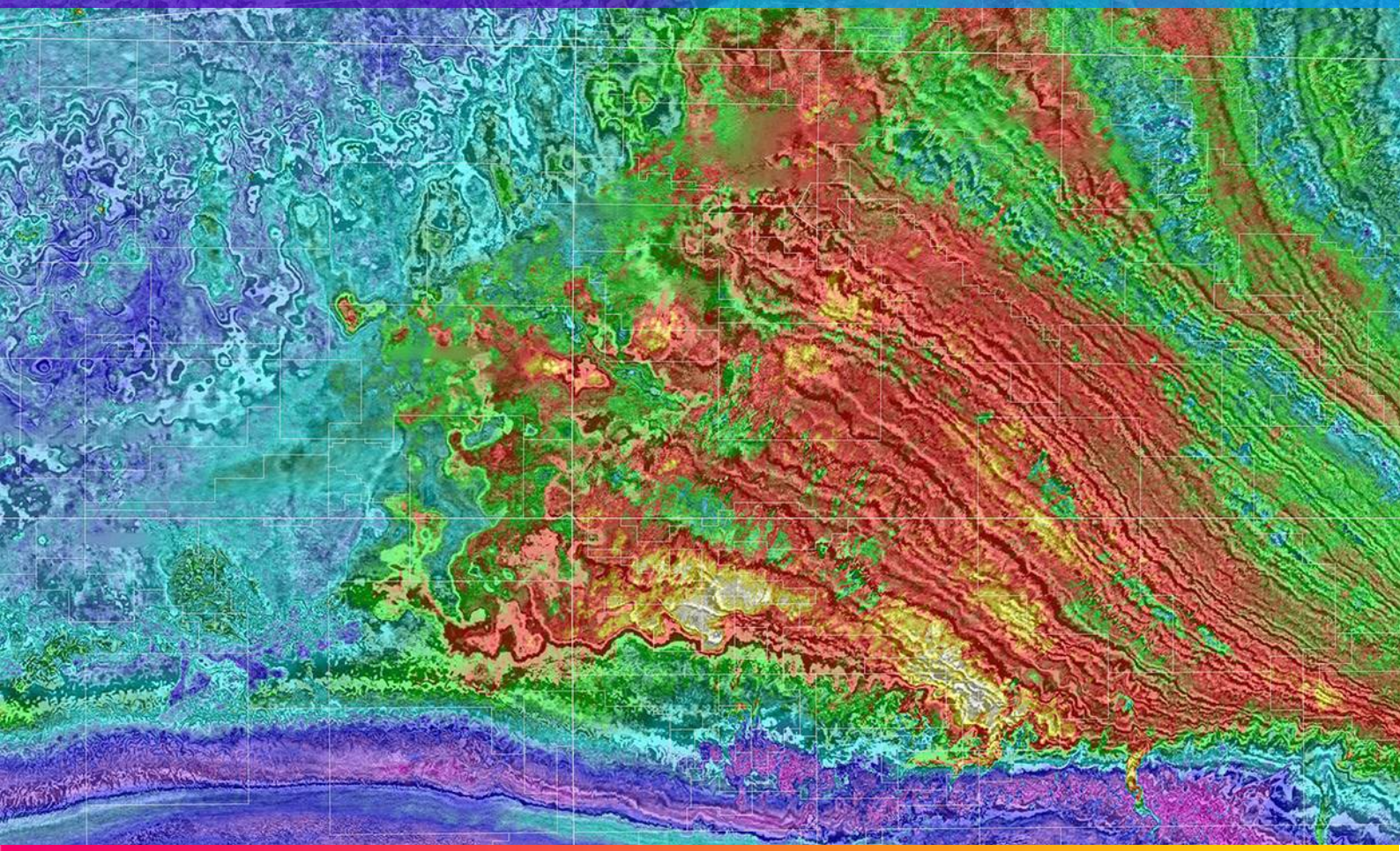


ENVIRONMENT PLAN

Sauropod 3D Marine Seismic Survey

cgg.com

SEE THINGS DIFFERENTLY

CGG

Document Status					
Version	***Purpose of document***	***Authored by***	***Reviewed by***	***Approved by***	***Review Date***
0.0	Final for submission	RPS	CGG	PR	31/08/2021
0.1	Update in response to public comment	RPS	CGG	PR	14/10/2021
0.2	Update in response to NOPSEMA comment	RPS	CGG	PR	23/12/2021
0.3	Update in response to NOPSEMA comment	RPS	CGG	PR	18/01/2022
1.0	Final for issue	RPS	CGG	PR	16/02/2022
1.1	Revised final for submission	RPS	CGG	PR	12/08/2022
1.2	Update in response to public comment	RPS	CGG	PR	27/10/2022
1.2.1	Update due to activity timing and consultation requirements	RPS	CGG	PR	21/08/2023
1.3	Final for submission	RPS	CGG	PR	04/09/2023
1.3.1	Update in response to NOPSEMA comment	RPS	CGG	PR	12/09/2023
2.0	Update in response to public comment	RPS	CGG	PR	24/10/2023
2.1	Update to Appendix C	RPS	CGG	PR	06/11/2023
2.2	Update in response to RFFWI	RPS	CGG	PR	05/02/2024
2.3	Update in response to NOPSEMA letter	RPS	CGG	PR	18/03/2024
2.3.1	Update to Appendix C	RPS	CGG	PR	02/04/2024
3.0	Resubmission of accepted EP – change to activity timing	RPS	CGG	PR	29/09/2025
3.1	Update in response to public comment	RPS	CGG	PR	26/11/2025

PREPARED BY:

MAKING COMPLEX EASY
A TETRA TECH COMPANY

Level 3, 500 Hay Street
Subiaco, WA 6008

T **+61 8 9211 1111**
W **rpsgroup.com**

Table of contents

Acronyms and Abbreviations 13
Environment Plan Summary 17
1 Introduction 18
1.1 Scope of this Environment Plan 18
1.2 Proponent 18
1.2.1 Titleholder and Nominated Liaison Person 18
2 Environmental Requirements 19
3 Description of the Activity 25
3.1 Survey Location 25
3.2 Schedule 25
3.3 Activity Details 26
3.3.1 Seismic Source Operation 28
3.3.2 Infill 28
3.3.3 Vessels 29
4 Description of the Existing Environment 30
4.1 Overview 30
4.1.1 Regional Context – the North-west Marine Region 30
4.2 Physical Environment 32
4.2.1 Climate 32
4.2.2 Oceanography 33
4.2.3 Bathymetry and Geomorphology 35
4.2.4 Sedimentology 37
4.3 Biological Environment 37
4.3.1 Plankton Communities 37
4.3.2 Benthic Habitats and Communities 38
4.3.3 Fish Assemblages 39
4.3.4 Commercially Targeted Fish Stocks 40
4.3.5 Threatened and Migratory Species 45
4.3.6 Marine Mammals 50
4.3.7 Sharks and Rays 56
4.3.8 Marine Reptiles 60
4.3.9 Marine Birds 63
4.3.10 Timing of Biological Sensitivities 67
4.4 Socio-Economic and Cultural Environment 67
4.4.1 Commonwealth Protected Areas 67
4.4.2 State Protected Areas 69
4.4.3 Key Ecological Features 70
4.4.4 Commercial Fisheries 72
4.4.5 Tourism and Recreation 80

4.4.6 Oil and Gas Activities 80
4.4.7 World and National Heritage Areas 81
4.4.8 First Nations Cultural Features and Heritage Values 81
4.4.9 Ramsar Wetlands 95
4.4.10 Marine Archaeology 96
4.4.11 Commercial Shipping 96
4.4.12 Defence Activities 96
5 Relevant Person Engagement 98
5.1 Consultation method 100
5.1.1 Consultation regulations, guidance and case law 100
5.1.2 Process to identify relevant persons 104
5.1.3 Provision of information 113
5.1.4 Sufficient time 115
5.1.5 Assessment and Management of Objections or Claims 115
5.1.6 Public comment 115
5.1.7 Ongoing consultation 116
5.2 Consultation results 118
5.2.1 Relevant persons for this EP 119
5.2.2 Provision of information and sufficient time 128
5.2.3 Merit assessment 129
5.2.4 Measures implemented in response to consultation 130
6 Environmental Risk Assessment Methodology 132
6.1 Introduction 132
6.2 Communication and consultation 132
6.3 Establishing the context 133
6.4 Impact and risk assessment 133
6.4.1 First Nations cultural features and heritage values 134
6.5 Hazards, impact and risk identification 134
6.6 Impact and risk analysis and evaluation 135
6.7 Impact and risk treatment 137
6.7.1 Decision context and assessment techniques 138
6.7.2 Hierarchy of Control Measures 139
6.8 Demonstration of ALARP 139
6.8.1 Practicability 140
6.8.2 Effectiveness 140
6.8.3 Cost Benefit Analysis 140
6.9 Residual Impact Ranking 140
6.10 Demonstration of Acceptability 141
6.11 Environmental Performance Outcomes and Standards 143
6.12 Monitoring and review 143

7 Environmental Risk Assessment – Planned Events 144
7.1 Noise emissions: Seismic source 144
7.1.1 Source of Impact/Risk 150
7.1.2 Seismic Sound Source 151
7.1.3 Acoustic Modelling 152
7.1.4 Sound Exposure Thresholds 152
7.1.5 Details of Impacts and Risks 153
7.1.6 Decision Context 191
7.1.7 Identification of Control Measures and Demonstration of ALARP 192
7.1.8 Demonstration of Acceptable Levels 196
7.1.9 Environmental Performance Outcomes, Standards and Measurement Criteria 200
7.2 Cumulative Impacts from Seismic Surveys 204
7.2.1 Source of Impact / Risk 204
7.2.2 Impact/Risk Evaluation 204
7.2.3 Decision Context 210
7.2.4 Identification of Control Measures and Demonstration of ALARP 211
7.2.5 Demonstration of Acceptable Levels 213
7.2.6 Defined acceptable levels of impact 214
7.2.7 Environmental Performance Outcomes, Standards and Measurement Criteria 216
7.3 Noise Emissions: Vessel, Helicopter and Mechanical Equipment 218
7.3.1 Details of Impacts and Risks 218
7.3.2 Impact/Risk Evaluation 218
7.3.3 Decision Context 219
7.3.4 Identification of Control Measures and Demonstration of ALARP 220
7.3.5 Demonstration of Acceptable Levels 221
7.3.6 Environmental Performance Outcomes, Standards and Measurement Criteria 222
7.4 Physical Presence: Disruption/Interference with Other Marine Users 223
7.4.1 Details of Impacts and Risks 223
7.4.2 Impact/Risk Evaluation 223
7.4.3 Decision Context 225
7.4.4 Identification of Control Measures and Demonstration of ALARP 226
7.4.5 Demonstration of Acceptable Levels 227
7.4.6 Environmental Performance Outcomes, Standards and Measurement Criteria 228
7.5 Discharge: Treated Sewage, Grey Water and Putrescible Waste 231
7.5.1 Details of Impacts and Risks 231
7.5.2 Impact/Risk Evaluation 231
7.5.3 Decision Context 231
7.5.4 Identification of Control Measures and Demonstration of ALARP 232
7.5.5 Demonstration of Acceptable Levels 233
7.5.6 Environmental Performance Outcomes, Standards and Measurement Criteria 233

7.6 Discharge: Drains, Deck and Bilge Water 234
7.6.1 Details of Impacts and Risks 234
7.6.2 Impact/Risk Evaluation 234
7.6.3 Decision Context 234
7.6.4 Identification of Control Measures and Demonstration of ALARP 235
7.6.5 Demonstration of Acceptable Levels 236
7.6.6 Environmental Performance Outcomes, Standards and Measurement Criteria 236
7.7 Artificial Light Emissions: Vessels 237
7.7.1 Details of Impacts and Risks 237
7.7.2 Impact/Risk Evaluation 237
7.7.3 Decision Context 238
7.7.4 Identification of Control Measures and Demonstration of ALARP 239
7.7.5 Demonstration of Acceptable Levels 240
7.7.6 Environmental Performance Outcomes, Standards and Measurement Criteria 240
7.8 Atmospheric Emissions: Vessels and Mechanical Equipment 241
7.8.1 Details of Impacts and Risks 241
7.8.2 Impact/Risk Evaluation 241
7.8.3 Decision Context 241
7.8.4 Identification of Control Measures and Demonstration of ALARP 242
7.8.5 Demonstration of Acceptable Levels 243
7.8.6 Environmental Performance Outcomes, Standards and Measurement Criteria 243
8 Environmental Risk Assessment – Unplanned Events 244
8.1 Hydrocarbon and Chemical Spills 244
8.1.1 Hydrocarbon and Chemical Properties 244
8.1.2 Credible Spill Scenarios 244
8.1.3 Spill Modelling Methodology 245
8.2 Hydrocarbon Spill – Vessel Collision 249
8.2.1 Details of Impacts and Risks 249
8.2.2 Impact/Risk Evaluation 250
8.2.3 Decision Context 260
8.2.4 Identification of Control Measures and Demonstration of ALARP 261
8.2.5 Demonstration of Acceptable Levels 262
8.2.6 Environmental Performance Outcomes, Standards and Measurement Criteria 262
8.3 Hydrocarbon Spill – Bunkering 264
8.3.1 Details of Impacts and Risks 264
8.3.2 Impact/Risk Evaluation 264
8.3.3 Decision Context 265
8.3.4 Identification of Control Measures and Demonstration of ALARP 266
8.3.5 Demonstration of Acceptable Levels 267
8.3.6 Environmental Performance Outcomes, Standards and Measurement Criteria 267

8.4 Chemical Spill: Single Point Failure 269
8.4.1 Details of Impacts and Risks 269
8.4.2 Impact/Risk Evaluation 269
8.4.3 Decision Context 269
8.4.4 Identification of Control Measures and Demonstration of ALARP 270
8.4.5 Demonstration of Acceptable Levels 270
8.4.6 Environmental Performance Outcomes, Standards and Measurement Criteria 271
8.5 Physical Presence: Entanglement / Collision with Marine Fauna 272
8.5.1 Details of Impacts and Risks 272
8.5.2 Impact/Risk Evaluation 272
8.5.3 Decision Context 274
8.5.4 Identification of Control Measures and Demonstration of ALARP 275
8.5.5 Demonstration of Acceptable Levels 276
8.5.6 Environmental Performance Outcomes, Standards and Measurement Criteria 277
8.6 Physical Presence: Loss of Equipment 279
8.6.1 Details of Impacts and Risks 279
8.6.2 Impact/Risk Evaluation 279
8.6.3 Decision Context 280
8.6.4 Identification of Control Measures and Demonstration of ALARP 281
8.6.5 Demonstration of Acceptable Levels 281
8.6.6 Environmental Performance Outcomes, Standards and Measurement Criteria 282
8.7 Discharge: Loss of Hazardous or Non-Hazardous Solid Waste 283
8.7.1 Details of Impacts and Risks 283
8.7.2 Impact/Risk Evaluation 283
8.7.3 Decision Context 284
8.7.4 Identification of Control Measures and Demonstration of ALARP 285
8.7.5 Demonstration of Acceptable Levels 285
8.7.6 Environmental Performance Outcomes, Standards and Measurement Criteria 286
8.8 Introduction of Invasive Marine Species: Ballast Water and Biofouling 287
8.8.1 Details of Impacts and Risks 287
8.8.2 Impact/Risk Evaluation 287
8.8.3 Decision Context 288
8.8.4 Identification of Control Measures and Demonstration of ALARP 289
8.8.5 Demonstration of Acceptable Levels 290
8.8.6 Environmental Performance Outcomes, Standards and Measurement Criteria 291
9 Implementation Strategy 292
9.1 Environmental Management System 292
9.2 Management of change 293
9.3 Environmental Performance Monitoring, Inspection, Audit and Reporting 293
9.3.1 Pre-survey inspection and audit 293

9.3.2 Monitoring, auditing and management of non-conformance 294
9.3.3 Review 294
9.3.4 Record Management 295
9.4 Organisation Structure 295
9.5 Training and competencies 300
9.5.1 Competency and Ongoing Awareness 300
9.6 Contractor and Supplier Management 301
9.7 Emergency Response 301
9.7.1 Emergency response initiation 302
9.7.2 Adverse weather procedures 303
9.8 Maintaining Environmental and Legislative Knowledge 303
9.8.1 Prior to Survey 303
9.9 EP Revision and Resubmission 304
9.10 OPEP 304
9.10.1 Drills and Training (OPEP/SOPEP) 305
9.10.2 Maintaining Currency 305
9.10.3 OSMP 305
9.11 Communication and Consultation 306
9.11.1 Internal Communications 306
9.12 Notifications and Reporting 306
9.12.1 External Routine Notification and Reporting Requirements 308
10 References 309

Figures

Figure 3-1 – Location of Sauropod 3D MSS 26
Figure 4-1 – Operational Area and EMBA for the Sauropod 3D MSS 30
Figure 4-2 – Marine Bioregions of Australia (Source: DSEWPaC 2012a) 31
Figure 4-3 – Provincial Bioregions (IMCRA v4.0) 32
Figure 4-4 – Surface Currents in Western Australian Waters. Source: DEWHA (2008a) 34
Figure 4-5 – Typical Ocean Current Circulation Pattern during Summer Months. Source: RPS (2019) 35
Figure 4-6 – Bathymetry within the Operational Area and Surrounds 36
Figure 4-7 – Geomorphic Features of the North West Shelf 37
Figure 4-8 – Management units for the scalefish resources in northern WA (Gaughan *et al.* 2018). The North Coast Fisheries Bioregion comprises the Pilbara and Kimberley management units 41
Figure 4-9 – Principal Spawning Ranges for Key Indicator Fish Species 45
Figure 4-10 – Humpback Whale BIAs 51
Figure 4-11 – Pygmy Blue Whale BIAs 52
Figure 4-12 – Whale Shark BIAs overlapping the Operational Area 56
Figure 4-13 – Flatback Turtle BIAs 60
Figure 4-14 – Habitat Critical to the Survival of Marine Turtles 60
Figure 4-15 – Commonwealth Marine Protected Areas 70
Figure 4-16 – Key Ecological Features 71
Figure 4-17 – Commonwealth Fisheries within the Operational Area and wider EMBA 75
Figure 4-18 – WA State Fisheries within the Operational Area 75
Figure 4-19 – Count of Fishing Vessels within Areas 2 and 3 of the Mackerel Managed Fishery for the period 2020 - 2024 (pooled sum of annual data within each Fishery Reporting Block) 78
Figure 4-20 –Count of Fishing Vessels within the Northern Demersal Scalefish Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Block) 78
Figure 4-21 – Count of Fishing Vessels within the Pilbara Fish Trawl (Interim) Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Blocks 79
Figure 4-22 – Count of Fishing Vessels within the Pilbara Trap Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Blocks; note that data only available for 60 x 60 nm reporting blocks) 79
Figure 4-23 Indigenous communities and townships along the coastal regions adjacent to the EMBA (ACHIS) 83
Figure 4-24 – RATSIB within the Operational Area and EMBA 84
Figure 4-25 Registered Aboriginal cultural heritage sites in the coastal margin adjacent to the EMBA (Source: ACHIS). 85
Figure 4-26 Lodged Aboriginal heritage sites in the coastal margin adjacent to the EMBA (Source: ACHIS). 85
Figure 4-27 Aboriginal cultural heritage surveys conducted along the coastal margin adjacent to the EMBA. 86
Figure 4-28 Native title claims and determinations in relation to the Operational Area and EMBA. Note that 'determined' areas are those where native title does exist, while 'claimed' areas are those where native title was determined not to exist. 87
Figure 4-29 Declared Indigenous Protected Areas in coastal and sea country areas adjacent to the EMBA 89
Figure 4-30 – Commercial Shipping Fairways 97
Figure 5-1 - Relevant person consultation process 100
Figure 6-1 – AS/NZS ISO 31000 – Risk Management Methodology 132
Figure 6-2 - Risk Related Decision Support Framework (OGUK 2014) 138
Figure 6-3 - Approach to Demonstrating ALARP and Acceptable Levels (Reg 13(5)(c)) 142
Figure 7-1 — Modelling Sites for Per-pulse Fields for Comparison Between the 3090 in^3 and 2820 in^3 Arrays 146
Figure 7-2 — Site 1: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in^3 and 2820 in^3 Arrays 147
Figure 7-3 — Site 2: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in^3 and 2820 in^3 Arrays 148
Figure 7-4 — Site 3: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in^3 and 2820 in^3 Arrays 149
Figure 7-5 Site 4: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 and 2820 in^3 Arrays 150
Figure 7-6 – Site 1: Maximum Particle Acceleration (top) and Velocity (bottom) at the Sea Floor as a Function of Horizontal Range from the Centre of the 3,090 in^3 Array Along the Broadband Directions 174
Figure 7-7 – Spatial Distribution of Catch per Unit Effort (CPUE) for the PFTIMF from 2004-2008 for Four Indicator Species, Including (a) Red emperor, (b) Rankin cod, (c) Blue-spotted emperor and (d) Goldband snapper (Gaughan *et al.* 2018). The Red and Black Dashed Polygons Indicate the Location of the Sauropod 3D MSS Acquisition Area and Operational Area Respectively 182
Figure 7-8 – Red emperor Spawning Biomass (Expressed as a Percentage of Unfished Levels) (Top) and Recruitment (Millions of Fish) (Bottom) (source: Department of Fisheries 2015). Levels After 2015 are Predictions Made in 2015 Based on Different Fishing and Stock Scenarios, and do not Represent Real Levels 183

Figure 7-9 – Goldband snapper Spawning Biomass (Expressed as a Percentage of Unfished Levels) (Top) and Recruitment (Thousands of Fish) (bottom) (Source: Department of Fisheries 2015). Levels After 2015 are Predictions Made in 2015 Based on Different Fishing and Stock Scenarios, and do not Represent Real Levels 183
Figure 7-10 - Previous Seismic Surveys Completed Within 150 km of the Sauropod 3D MSS in the last 5 years 206
Figure 8-1 – Weathering of MDO under Three Static Wind Conditions (5, 10 and 15 Knots). The Results are Based on a 280 m^3 Surface Release of MDO Over Six Hours, Tracked for 30 Days 249
Figure 8-2 – Zones of Potential Oil Exposure on the Sea Surface, In the Event of a 280 m^3 MDO Spill Within the Operational Area During the Transitional Season 251
Figure 8-3 – Zones of Potential Instantaneous Entrained Oil Exposure at 1-10 m Below the Sea Surface, in the Event of a 280 m^3 MDO Spill Within the Operational Area During the Summer Season 252
Figure 8-4 – Predicted Annualised EMBA for Entrained Hydrocarbons Above 100 ppb Resulting from a 280 m^3 MDO Spill Within the Operational Area 252
Figure 8-5 – Zones of Potential Instantaneous Dissolved Hydrocarbon Exposure at 0– 10 M Below the Sea Surface in the Event of a 280 m^3 Within the Operational Area During Winter 255
Figure 9-1 - Sauropod 3D MSS Organisation Structure 295

Tables

Table 1-1 – Details of SPA Application LWZLKT Titleholder and Nominated Liaison Person 18
Table 2-1 - Summary of Requirements Relevant to the Activity 20
Table 2-2 - Summary of Relevant International Agreements 24
Table 3-1 - Operational and Acquisition Area co-ordinates (GDA 94) 25
Table 3-2 – Key Details for the Sauropod 3D MSS 27
Table 4-1 – Predicted Monthly Average and Maximum Winds within the Operational Area (RPS 2019, Derived from CFSR Hindcast Model) 33
Table 4-2 – Key Indicator Species for Commercial Fisheries relevant to the Sauropod 3D MSS 43
Table 4-3 – Threatened and Migratory Marine Species Listed Potentially Occurring within the Operational Area and EMBA 46
Table 4-4 – Recovery Plans and Conservation Advice for EPBC Act-Listed Species Occurring Within the Operational Area and EMBA 48
Table 4-5 – Threatened and Migratory Species' BIAs within the Operational Area and EMBA 50
Table 4-6 – Threatened and Migratory Mammals Potentially Occurring Within the Operational Area and EMBA 53
Table 4-7 – Threatened and Migratory Sharks and Rays Potentially Occurring Within the Operational Area and EMBA 57
No coral reefs or shoals occur within the Operational Area and therefore sea snakes are expected to occur in low numbers.Table 4-8 – Threatened and Migratory Marine Reptiles Potentially Occurring Within the Operational Area and EMBA 61
Table 4-9 – Threatened and Migratory Seabirds Potentially Occurring Within the Operational Area And EMBA 64
Table 4-10 – Timing of Key Biological Sensitivities Relevant to the Operational Area and EMBA 67
Table 4-11 – Commonwealth and WA State Managed Fisheries 73
Table 4-12 – Oil and Gas Permits Relevant to the Operational Area (current 3/7/2025) 80
Table 4-13 – Extent of seismic activities in within 150 km of the survey area in the past 5 years 81
Table 4-14 Summary of Native Title Claims and Determinations which overlap or are coastally adjacent to the EMBA. 87
Table 4-15 List of Indigenous Protected Areas with summary of relevant cultural and ecological values and details of sea country extent. Note that these IPAs all fall outside of the Operational Area and EMBA. 90
Table 4-16 Summary of Commonwealth and State Marine Park management Plans overlapping the EMBA 91
Table 4-17 Summary of likely cultural values in the Operational Area and EMBA 93
Table 4-18 – Threats to land and sea country values and cultural sites described in Indigenous Protected Area Management Plans 94
Table 4-19 Recorded Shipwrecks Near the Operational Area and EMBA 96
Table 5-1 - Regulatory requirements regarding consultation 101
Table 5-2 - Consultation case law 103
Table 5-3 – Environment area values and sensitivities 104
Table 5-4 - Relevant person categories based on environmental values and sensitivities 105
Table 5-5 Relevant person categories based on identified impacts and risks of the proposed activity 106
Table 5-6 Research methods for identification of relevant persons - Regulation 25 (1)(d) 109
Table 5-7 - Information provided to Relevant Persons 113
Table 5-8 - Ongoing consultation requirements 117

Table 5-9 Assessment of Relevance 120
Table 5-10 Summary of Consultation with relevant persons during the 2025 consultation period resulting in changes to the EP. 131
Table 6-1 - Risk Management Terms 135
Table 6-2 - Definition of Consequence Terms 135
Table 6-3 – Definition of consequence 136
Table 6-4 – Definition of Likelihood 136
Table 6-5 - CGG Modified Risk Matrix 137
Table 6-6 – Hierarchy of Controls 139
Table 6-7 - Criteria for Defining Acceptable Levels of Impact 142
Table 7-1 – Environmental Impact Ranking Summary 144
Table 7-2 The Difference Between the Seismic Source Acoustic Parameters to be Used in the Sauropod 3D MSS and Those Used in the Impact Assessment. 145
Table 7-3 Far-field Source Level Specifications for the 3090 in^3 and 2820 in^3 Sources with a 6 m Tow Depth. Source Levels are for a Point-like Acoustic Source with Equivalent Far-field Acoustic Output in the Specified Direction. Sound Level Metrics are Per-pulse and Unweighted 145
Table 7-4 – Unweighted SPL, SEL_{24h}, and SPL_{pk} Thresholds for Acoustic Effects on Cetaceans 154
Table 7-5 Unweighted SPL and Updated SEL_{24h} and SPL_{pk} Thresholds for Acoustic Effects on Cetaceans 154
Table 7-6 – Maximum Predicted Horizontal Distances (R_{max}) To PTS (Injury), TTS and Behavioural Response Thresholds in Cetaceans, for All Modelled Scenarios 155
Table 7-7 – Maximum Predicted Horizontal Distances (R_{max}) To PTS (Injury), TTS and Behavioural Response Thresholds in Turtles, for All Modelled Scenarios 158
Table 7-8 – Sound Thresholds for Seismic Sound Exposure for Fish, Fish Eggs and Larvae, Adapted from Popper *et al.* (2014) 160
Table 7-9 – Maximum Predicted Distances (R_{max}) to Mortality/Potential Mortal Injury, Injury and TTS Thresholds for Fish, Fish Eggs and Larvae for Single-Pulse and SEL_{24h} Modelled Scenarios, For Both Water Column and at The Sea floor 166
Table 7-10 – Maximum Predicted Distances (R_{max}) to Effect Thresholds for Crustaceans at the Sea Floor 172
Table 7-11 – Maximum Predicted Distances (Rmax) to Mortality/PMI Thresholds in the Water Column for Fish Eggs and Larvae, and Zooplankton 177
Table 7-12 – Spatial Overlap with Spawning Areas of Key Indicator Fish Species in the Pilbara 180
Table 7-13 – Temporal Overlap with Spawning Periods of Key Indicator Fish Species 180
Table 7-14 – Combined Spatial – Temporal Overlap with Spawning Periods and Ranges of Key Indicator Fish Species 180
Table 7-15 – Stock Assessment of Key Indicator Fish Species in the Pilbara region 185
Table 7-16 – Spatial Overlap of the Acquisition Area with Fishing Effort for Relevant Commercial Fisheries 187
Table 7-17 – Previous Seismic Surveys Completed Within 150 km of the Sauropod 3D MSS in the last 5 years 205
Table 7-18 – Cumulative Spatial-Temporal Overlap of 2015 Seismic Surveys with Spawning Areas of Key Indicator Fish Species in the Pilbara 209
Table 7-19 – Spatial Overlap of the Operational Area with Fishing Effort for Relevant Commercial Fisheries 224
Table 8-1 – Environmental Impact and Risk Ranking Summary 244
Table 8-2 – Credible Hydrocarbon and Chemical Spill Scenarios 245
Table 8-3 – Spill Modelling Inputs 246
Table 8-4 – Location of the modelled spill Release Site 247
Table 8-5 – Hydrocarbon Exposure Thresholds 247
Table 8-6 – Physical Properties of MDO 248
Table 8-7 – Boiling Point Ranges of MDO 248
Table 8-8 – Summary of Spill Modelling Results for Surface Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations 250
Table 8-9 – Summary of Spill Modelling Results for Entrained Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations 253
Table 8-10 – Summary of Spill Modelling Results for Dissolved Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations 254
Table 9-1 – Roles and responsibilities 297
Table 9-2 - Notification requirements 307
Table 9-3 – External Routine Notification and Reporting Requirements 308

Appendices

Appendix A: CGG Environment Policy
Appendix B: Existing Environment Search Reports
Appendix C: Relevant Person Consultation
Appendix D: Underwater Sound Modelling
Appendix E: Seismic Array Comparison
Appendix F: Cetacean Species Verification Process
Appendix G: Hydrocarbon Spill Modelling
Appendix H: Oil Pollution Emergency Plan
Appendix I: Operational and Scientific Monitoring Plan

Acronyms and Abbreviations

Name	Description
$	Dollars (Australian dollars unless specified otherwise)
%	Per cent
°	Degrees
°C	Degrees Celsius
‘	Minutes
“	Seconds
ACHIS	Aboriginal Cultural Heritage Inquiry System
AGDD	Australian Government Department of Defence
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
ALARP	As low as reasonably practicable
AMMC	Australian Marine Mammal Centre
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
API	American Petroleum Institute gravity (A measure of how heavy or light a petroleum liquid in comparison to water)
ASBTIA	Australian Southern Bluefin Tuna Industry Association
ATSI	Aboriginal and Torres Strait Islander
BIA	Biologically important area
BoM	Bureau of Meteorology
BWMC	Ballast Water Management Certificate
BWMP	Ballast Water Management Plan
CCWA	Conservation council of Western Australia
CFA	Commonwealth Fisheries Association
COLREGS	International Regulations for Preventing Collisions at Sea 1972
cP	Centipoise (unit of viscosity)
CPUE	Catch Per Unit Effort
CSEP	Collaboration Seismic Environment Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture, Water and the Environment (formerly Department of Agriculture and Water Resources; superseded by DAFF and DCCEEW)
DAWR	Department of Agriculture and Water Resources (superseded by DAWE)
dB	Decibel
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation

Name	Description
DEH	Department of Environment and Heritage
DMIRS	Department of Mines, Industry Regulation and Safety (WA)
DoEE	Department of the Environment and Energy (superseded DAWE)
DoF	Department of Fisheries (WA)
DoT	Department of Transport (WA)
DPIRD	Department of Primary Industries and Regional Development (WA)
DPLH	Department of Planning, Lands and Heritage (WA)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
E	East
EEZ	Exclusive Economic Zone
EMBA	Environment that may be affected
ENVID	Environmental hazard identification
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental performance outcome
EPS	Environmental performance standard
ERA	Ecological risk assessment
ERM	Environmental Resources Management
ESD	Ecologically sustainable development
FNP	First Nations people
FRMA	*Fish Resources Management Act 1994*
GHG	Greenhouse gas
g/m^2	Grams per square meter (unit of surface or area density)
GMEM	Gippsland Marine Environmental Monitoring
HF	High frequency
hrs	Hours
Hz	Hertz
IAGC	International Association of Geophysical Contractors
ILUAs	Indigenous Land Use Agreements
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMS	Invasive marine species
IOGP	International Association of Oil and Gas Producers
IPAs	Indigenous Protected Areas
ISPP	International Sewage Pollution Prevention
IUCN	International Union for the Conservation of Nature
JASCO	JASCO Applied Sciences
KEF	Key Ecological Feature
KLC	Kimberley Land Council
km	Kilometre
km^2	Square kilometres

Name	Description
LF	Low frequency
m	Metre
m^2	Metres squared
m^3	Metres cubed
M	Million
m/s	Metres per second
MAMF	Marine Aquarium Managed Fishery
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
MDO	Marine diesel oil
MEPC	Marine Environment Protection Committee
MF	Medium frequency
MFO	Marine fauna observer
MGO	Marine gas oil
MMF	Mackerel Managed Fishery
MMO	Marine mammal observer
MOD	Maximum-over-depth
MPA	Marine Protected Area
MSS	Marine Seismic Survey
MUZ	Multiple Use Zone
N	North
NBPMF	Nickol Bay Prawn Managed Fishery
NDSMF	Northern Demersal Scalefish Managed Fishery
NEATS	National Electronic Approvals Tracking System
NERA	National Energy Resources Australia
NIAA	National Indigenous Australians Agency
nm	Nautical mile
NMSC	National Marine Safety Committee
NNTT	National Native Title Tribunal
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NWMR	North-west Marine Region
NWS	North West Shelf
NWSTF	North West Slope Trawl Fishery
OBN	Ocean bottom nodes
OIW	Oil in Water
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSMP	Operational and Scientific Monitoring Program
PFTIMF	Pilbara Fish Trawl Interim Managed Fishery
PK	Peak pressure levels

Name	Description
PLF	Pilbara Line Fishery
pm	Picometre
PMI	Potential mortality injury
PMST	Protected Matters Search Tool
POLREP	Oil Pollution Report
PPA	Pearl Producers Association
ppb	Parts per billion
PSU	Practical salinity unit
PTMF	Pilbara Trap Managed Fishery
PTS	Permanent threshold shift
RATSIB	Representative Aboriginal/Torres Strait Islander Body Area
RPS	RPS AAP Consulting Pty Ltd
RWDC	Restricted workday case
S	South
SBTF	Southern Bluefin Tuna Fishery
SEL	Sound exposure levels
SITREP	Situation Report
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SSMF	Specimen Shell Managed Fishery
TSSC	Threatened Species Scientific Committee
TSS	Temporary threshold shift
µg/l	Micrograms per litre
UNESCO	United Nations Educational, Scientific and Cultural Organization
µPa	Micropascals
UTM	Universal Transverse Mercator
UXO	Unexploded ordinance
VOC	Volatile organic compounds
W	West
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAM	Western Australian Museum
WASF	Western Australian North Coast Shark Fishery
WDCS	Whale and Dolphin Conservation Society
WSTF	Western Skipjack and Tuna Fishery
WTBF	Western Tuna Billfish Fishery
WWF	World Wildlife Fund for Nature
YMAC	Yamatji Marlpa Aboriginal Corporation
CGG	CGG Services (Australia) Pty Ltd
3D	Three dimensional

Environment Plan Summary

This EP summary has been prepared from material provided in this EP. The summary consists of the following as required by regulation 35(7) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS (E) Regulations):

EP Summary material requirement	Relevant section of EP containing EP Summary material
The location of the activity	Section 3.1
A description of the receiving environment	Section 4
A description of the activity	Section 3.3
Details of the environmental impacts and risks	Sections 7 and 8
The control measures for the activity	Sections 7 and 8
The arrangements for ongoing monitoring of the titleholders environmental performance	Section 9
Response arrangements in the oil pollution emergency plan	Section 9.10 and Appendix H:
Consultation already undertaken and plans for ongoing consultation	Section 5 and Appendix C:
Details of the titleholders nominated liaison person for the activity	Section 1.2.1

1 Introduction

1.1 Scope of this Environment Plan

CGG Services (Australia) Pty Ltd (CGG) is proposing to undertake the Sauropod 3D marine seismic survey (hereafter referred to as the Sauropod 3D MSS) in exploration permit area WA-527-P, which is located on the North West Shelf in the Roebuck Basin. An Environment Plan (EP) was previously accepted by NOPSEMA for this activity on the 10 April 2024, however CGG is now planning to conduct the survey in WA-527-P under a revised and updated EP (revised only for a change in year). The purpose of the Sauropod 3D MSS is to collect three-dimensional (3D) geophysical data about the underlying rock types to inform oil and gas exploration.

This EP has been prepared in accordance with the requirements of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and associated Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS (E) Regulations). It has also been prepared with reference to the Environment Plan Content Requirements Guidance Note (2020) produced by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.2 Proponent

CGG is a fully integrated geoscience company providing leading geological, geophysical and reservoir capabilities to its broad base of customers, primarily from the global oil and gas industry. CGG offers a range of products to assist oil companies to find oil and gas reserves offshore worldwide, including seismic and electromagnetic services, data acquisition, processing, reservoir analysis/interpretation and multi-client library data. CGG was founded in 1931 and has a workforce of over 6,000 staff in 70 locations worldwide.

CGG has extensive experience of conducting seismic surveys internationally and in Australia. The company has a well-developed and systematic approach to environmental management, including an Environment Policy (Appendix A:) that is applied successfully to operations around the world. CGG is a specialised seismic operator with a proven record of environmentally responsible operations in Australian waters.

1.2.1 Titleholder and Nominated Liaison Person

Permit titleholder and titleholder nominated liaison person details for Special Prospecting Authority (SPA) Application LWZLKT are provided in Table 1-1. If there is a change in the titleholder, the titleholder's nominated liaison person or a change in the contact details for the titleholder or liaison person, CGG will notify NOPSEMA and provide the updated details (as described in Section 9 of this EP).

Table 1-1 – Details of SPA Application LWZLKT Titleholder and Nominated Liaison Person

Titleholder Details	Liaison Person Details
CGG Services (Australia) Pty Ltd	Paul Rheinberg
Level 2, 1060 Hay Street	Business Development Manager
West Perth WA 6005	E: Paul.Rheinberg@viridiengroup.com
T: +61 8 9214 6200	T: +61 8 9214 6200
ACN: 081 777 755	

2 Environmental Requirements

The OPGGS Act provides the regulatory framework for all offshore petroleum exploration, production and greenhouse gas (GHG) activities in Commonwealth waters. The related OPGGS (E) Regulations require titleholders to undertake their petroleum activity in accordance with an EP accepted by NOPSEMA. This EP has been prepared to meet the requirements of the OPGGS (E) Regulations. This section provides information on the requirements that apply to the activity. Requirements include relevant laws, codes, standards, agreements, treaties, conventions or practices (in whole or part) that apply to the jurisdiction in which the activity will take place.

The Sauropod 3D MSS will take place within Commonwealth waters. Relevant requirements associated with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), related policies, guidelines, plans of management, recovery plans, threat abatement plans, and other relevant advice issued by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) are detailed in Section 4 in the applicable subsections, as part of the description of the existing environment.

Table 2-1 provides a summary of requirements that apply to the activity and are relevant to the activity's environmental management, while Table 2-2 summarises the international conventions and agreements of which Australia is a signatory that are relevant to the Sauropod 3D MSS.

Table 2-1 - Summary of Requirements Relevant to the Activity

Requirements	Scope (as Relevant to this EP)	Application to Sauropod 3D MSS	Administering Authority
Australian Maritime Safety Authority Act 1990	Facilitates international cooperation and mutual assistance in preparing and responding to major oil spill incidents and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies.	Under this Act, any hydrocarbon spill to the marine environment, resulting from the survey must be reported. In Commonwealth waters the Australian Maritime Safety Authority (AMSA) is the Statutory Agency for vessels and must be notified of all incidents involving a vessel. Hydrocarbon spill risks are detailed in Section 0	AMSA
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	This Act provides for the preservation and protection from injury or desecration areas and objects that are of significance to Aboriginal people, under which the Minister may make a declaration to protect such areas and objects. The Act also requires the discovery of Aboriginal remains to be reported to the Minister.	This Act would only apply to the activity if there was a discovery of First Nation remains. First Nation heritage sites are detailed in Section 4.4.8	DCCEEW
Australian Heritage Council Act 2003	This Act identifies areas of heritage value listed on the Register of the National Estate and sets up the Australian Heritage Council and its functions.	This Act would only apply to the activity if there was a discovery of First Nation remains. First Nation heritage sites are detailed in Section 4.4.8	Australian Heritage Council (AHC)
Aboriginal Heritage Act 1972	This Act provides for the protection of objects and places which are sacred or have significance to Aboriginal people. This Act is being replaced by the Aboriginal Cultural Heritage Act 2021 in stages from December 2021.	This Act would only apply to the activity if there was a discovery of First Nation remains. First Nation heritage sites are detailed in Section 4.4.8	DPLH
Aboriginal Cultural Heritage Act 2021	This Act provides a modern framework for the recognition, protection, conservation and preservation of Aboriginal cultural heritage while recognising the fundamental importance of Aboriginal cultural heritage to Aboriginal people. This Act is replacing the Aboriginal Heritage Act 1972 in stages from December 2021.	This Act would only apply to the activity if there was a discovery of First Nation remains. First Nation heritage sites are detailed in Section 4.4.8	DPLH
Biosecurity Act 2015	The objectives of this Act are: (a) to provide for managing the following: (i) biosecurity risks (ii) the risk of contagion of a listed human disease (iii) the risk of listed human diseases entering Australian territory or a part of Australian territory, or emerging, establishing themselves or spreading in Australian territory or a part of Australian territory (iv) risks related to ballast water (v) biosecurity emergencies and human biosecurity emergencies (b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the SPS Agreement and the Biodiversity Convention.	This Act applies to 'Australian territory' which is the airspace over and the coastal seas out to 12 nm from the coastline. Biosecurity risks associated with the survey are detailed in Section 8.8.	DAFF
Biosecurity Act 2015	Australian Ballast Water Management Requirements: Version 8 (DAWE 2020)	Provides guidance on how vessel operators should manage ballast water when operating within Australian seas in order to comply with the Biosecurity Act. Section 8.8 details these requirements.	DAFF
Biosecurity Regulation 2016	This regulation prescribes information relating to the exercise of powers by officials under the *Biosecurity Act* and sets out the necessary information and reporting requirements that those regulated by the *Biosecurity Act* are required to provide.	This regulation applies to 'Australian territory' which is the airspace over and the coastal seas out to 12 nm from the coastline. Biosecurity risks associated with the survey are detailed in Section 8.8	DAFF
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act aims to protect the environment, particularly matters of national environmental significance for which Australia has made international agreements. The EPBC Act streamlines national environmental assessment and approval processes and promotes ecologically sustainable development and conservation of biodiversity. It also provides for a cooperative approach to the management of natural, cultural, social and economic aspects of ecosystems, communities and resources. Section 3A of the Act defines the principles of ecological sustainable development. The following principles are principles of ecologically sustainable development: (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f)). Petroleum activities must be carried out in a manner consistent with the principles of ecological sustainable development set out in Section 3A of the EPBC Act. Determination of impact and risk Acceptability details that residual risks are ALARP, and the principles of ecologically sustainable development have been met (Section 5.1). Assessment of impacts and risks to Matters of National Environmental Significance (MNES) from the survey are described in Section 7 and 0.	DCCEEW

Requirements	Scope (as Relevant to this EP)	Application to Sauropod 3D MSS	Administering Authority
	(c) the principle of inter-generational equity--that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making (e) improved valuation, pricing and incentive mechanisms should be promoted.		
Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations)	Provides additional regulations regarding Matters of National Environmental Significance.	Part 8 of the Regulations details requirements for operating vessels and aircraft in relation to cetaceans. Section 7.3 details these requirements.	DCCEEW
EPBC Act Policy Statement 2.1 Interaction between offshore seismic exploration and whales	The aim of this Policy Statement is to: • provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations • provide a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours • provide guidance to both proponents of seismic surveys and operators conducting seismic surveys about their legal responsibilities under the EPBC Act (DEWHA, 2008c).	The policy statement provides guidance on undertaking seismic activities in Australian waters to limit potential impacts to whales. Section 7.1 and 7.1.9 details how the policy statement has been applied to this survey.	DCCEEW
Underwater Cultural Heritage Act 2018 Draft Underwater Cultural Heritage guidelines 2023	This Act protects historic wrecks (and associated relics) in Commonwealth waters that are more than 75 years old. Under this Act, historic shipwrecks are protected for their heritage values and maintained for recreational, scientific and educational purposes. These guidelines outline the requirements of the UWH Act so proponents can plan for and implement the necessary risk assessment and management strategies to protect UCH from any direct or indirect impacts and to manage any residual impacts to acceptable levels.	Anyone who finds the remains of a ship, or an article associated with a ship, needs to notify the relevant authorities, as soon as possible but ideally no later than after one week, and to give them information about what has been found and its location. Refer to Section 4.4.10 for information on historic shipwrecks in relation to the Sauropod 3D MSS.	DCCEEW
Navigation Act 2012	Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters. It gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory. The Act also has subordinate legislation contained in Regulations and Marine Orders.	Several Marine Orders are enacted under this Act relating to offshore petroleum activities, including: • Marine Order 21: Safety and emergency arrangements • Marine Order 27: Safety of navigation and radio equipment • Marine Order 30: Prevention of collisions • Marine Order 31: Vessel surveys and certification • Marine Order 58: Safe management of vessels. Section 7 and Section 0 detail where the applicable requirements apply to the survey.	AMSA
Offshore Petroleum and Greenhouse Gas Storage Act 2006 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023	Addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three nautical mile limit. Ensures that petroleum activities are undertaken in an ecologically sustainable manner and in accordance with an approved EP.	A titleholder must have an in-force EP prior to the commencement of any petroleum activity. This requirement is met by submission and acceptance of this EP. A significant modification, change or new stage of an existing activity that is not included in an in-force EP requires a revision of the EP to be submitted to NOPSEMA for acceptance. Titleholders are required to maintain financial assurance sufficient to give the titleholder carrying out the petroleum activity, the capacity to meet the costs, expenses and liabilities that may result in connection with carrying out the petroleum activity; doing any other thing for the purpose of the petroleum activity; or complying (or failing to comply) with a requirement under the OPGGS Act in relation to the petroleum activity. This requirement must be met by the titleholder before NOPSEMA can accept the EP.	NOPSEMA
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003 Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2004	An Act to impose levies relating to the regulation of offshore petroleum activities and greenhouse gas storage activities.	Requires that EP levies are imposed on EP submissions, including revisions, where the activities to which the EP relates are authorised by one or more Commonwealth titles. This requirement applies once the EP is accepted.	NOPSEMA

Requirements	Scope (as Relevant to this EP)	Application to Sauropod 3D MSS	Administering Authority
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Regulates ship-related operational activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc.	Provides for discharges and emissions from ships as per MARPOL Annex I, II, III, IV, V and VI. Several Marine Orders are enacted under this Act relevant to the activity, including: • Marine Order 91: Marine pollution prevention – oil • Marine Order 93: Marine pollution prevention – noxious liquid substances • Marine Order 94: Marine pollution prevention – packaged harmful substances • Marine Order 95: Marine pollution prevention – garbage • Marine Order 96: Marine pollution prevention – sewage • Marine Order 97: Marine pollution prevention – air pollution • Marine Order 98: Marine pollution prevention – anti-fouling systems. • Provides exemptions for the discharge of materials in response to marine pollution incidents. • Requires ships ≥400 gross tonnes to have pollution emergency plans. Section 7 details where the applicable requirements apply to the survey.	AMSA
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Is an offence to engage in negligent conduct that results in a harmful anti-fouling compound being applied to a ship. Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria.	If required, a ship must have a current anti-fouling certificate and must not use harmful antifouling compounds. Marine Order 98: Marine Pollution Prevention – anti-fouling systems is enacted under this Act. Section 0 details where the applicable requirements apply to the survey.	AMSA
International Association of Geophysical Contractors (IAGC) Environmental Manual for Worldwide Geophysical Operations (2013)	Provides the industry with useful information for conducting geophysical field operations in an environmentally sensitive manner.	Provide guidelines for best practice operations of seismic surveys to minimise environment impacts. Section 7 details applicable guidance.	IAGC
IAGC Mitigation Measures for Cetaceans during Geophysical Operations (February 2015)	Provides recommended mitigation measures for cetaceans during geophysical operations. IAGC recommends implementing the suggested controls (mentioned in the document) in the absence of regulations or guidelines.	Provide recommended mitigation measures for cetaceans during geophysical operations. Section 7 details applicable requirements.	IAGC
International Maritime Organisation (IMO) Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) 2011	Provide a globally consistent approach to the management of biofouling. They were adopted by the Marine Environment Protection Committee (MEPC) in July 2011 and were the result of three years of consultation between IMO Member States	Specific requirements are that vessels have a biofouling management plan and biofouling record book. Section 0 details these requirements.	IMO
WA Department of Fisheries (DoF) Guidance Statement on Undertaking Seismic Surveys in WA Waters	Identifies potential issues of concern associated with seismic surveys on fish and fish habitats, as defined under the *Fish Resources Management Act 1994* (FRMA). It is aimed at giving proponents direction on general standards and protocols designed to avoid or mitigate the potential impacts of seismic surveys on fish. It is expected that proponents will incorporate these standards and protocols when planning and implementing seismic surveys.	Provides guidance and mitigation strategies to avoid or minimise potential impacts of seismic surveys on fish. Section 7.1 and 7.1.9 details applicable requirements.	WA Department of Primary Industries and Regional Development (DPIRD)
National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (2017)	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine mega-fauna.	The strategy provides information and guidance on reducing vessel collisions with marine mega-fauna. Section 8.5 details applicable information and requirements.	DCCEEW
Update to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In Air Criteria for Onset of Auditory Injury and Temporary Threshold Shifts (2024).	Used for assessing the effects of underwater and in-air anthropogenic (human-made) sound on the hearing of marine mammal species, specifically it identifies the received levels and auditory weighting functions, or criteria, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute (<24 hours), incidental exposure to underwater or in-air anthropogenic sound sources based on updated information.	Provides a new set of sound exposure thresholds for the onset of PTS and TTS and new marine mammal hearing group terminology for consideration in Section 7.1.5.	US National Marine Fisheries Service

Requirements	Scope (as Relevant to this EP)	Application to Sauropod 3D MSS	Administering Authority
International Association of Oil and Gas Producers (IOGP) Recommended monitoring and mitigation measures for cetaceans during marine seismic survey geophysical operations (March 2017)	Provides recommendations on applying mitigation measures for cetaceans during geophysical operations. The measures outlined in this report are recommended for use during all marine seismic surveys that use compressed air source arrays, and are only intended for cetaceans (whales, dolphins and porpoises).	Provides recommended mitigation measures for cetaceans during a marine seismic survey, including exclusion zones, soft starts, seismic testing procedures, and recording Marine Fauna Observer (MFO) observations. Section 7.1 and 7.1.9 details applicable requirements.	IOGP

Table 2-2 - Summary of Relevant International Agreements

Agreement	Scope (as Relevant to this EP)	Relevance
1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972	Contributes to the international control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials. Under the 1996 Protocol, dumping is prohibited, except for materials on an approved list.	No dumping of any wastes or other matter from survey activities with the exception of those listed in Annex 1 of the Protocol (which will be discharged in line with MARPOL requirements).
Convention on Oil Pollution Preparedness, Response and Cooperation 1990 (OPRC 90)	This Convention establishes measures for dealing with marine oil pollution incidents nationally and in cooperation with other countries.	All vessels ≥400 gross tonnes will have a SOPEP in place (Section 8.1).
International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)	This Convention covers prevention of pollution of the marine environment by ships from operational or accidental causes. It includes regulations aimed at preventing and minimising pollution from ships (accidental and routine).	Pollution from the survey activities will be managed in accordance with MARPOL requirements, as described in Sections 7 and 8.
International Regulations for Preventing Collisions at Sea, 1972 (COLREGS)	The COLREGS outline internationally agreed rules for safe navigation, including 'give way' rules between vessels and other requirements for safe conduct including the requirement to keep a look out, travel at a safe speed, and how to operate vessels in narrow channels.	The survey will adhere to the requirements of COLREGS as implemented in Commonwealth waters through the *Navigation Act 2012* (refer to Table 2-1).
International Convention for the Safety of Life at Sea, 1974 (SOLAS)	This convention outlines the minimum safety standards in the construction, equipment and operation of merchant ships.	The survey will adhere to the requirements of SOLAS as implemented in Commonwealth waters through the *Navigation Act 2012* (refer to Table 2-1).
International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001	The Convention prohibits the use of harmful organotins in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.	The survey will adhere to the requirements of the convention as implemented through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*.

3 Description of the Activity

3.1 Survey Location

The Sauropod 3D MSS will take place within Commonwealth waters off the north-west Western Australian (WA) coast, within the Roebuck Basin in exploration permit area WA-527-P. The survey will be undertaken within an 'Acquisition Area', where seismic data acquisition will occur. The Acquisition Area will be located within a broader 'Operational Area', which includes additional space for vessel activities such as line turns, run-ins, run-outs, soft-start procedures and seismic source testing. The co-ordinates for the Operational and Acquisition Areas are provided in Table 3-1.

The Acquisition Area will be up to a maximum of approximately 3,500 km^2, with an Operational Area of approximately 6,000 km^2 (Figure 3-1). At its closest point, the Operational Area is approximately 120 km from the WA coast at Pardoo and 230 km from Broome. Water depths in the Operational and Acquisition Areas range from approximately 65 – 170 m and 75 – 165 m respectively.

The seismic source will be discharged at or below full capacity (power) within the Operational Area, for the purpose of run-outs, source testing and soft starts during run-ins. This discharge of the source will be sporadic, only occur for short periods of time, and will be limited to relatively short distances (e.g. 4–5 km) from the northern and southern boundaries of the Acquisition Area.

Table 3-1 - Operational and Acquisition Area co-ordinates (GDA 94)

Operational Area		**Acquisition Area**	
Latitude	Longitude	Latitude	Longitude
-17° 55' 47.93"	120° 3' 24.12"	-18° 1' 49.19"	119° 59' 24.25"
-18° 50' 45.74"	120° 4' 22.48"	-18° 44' 52.37"	120° 0' 8.93"
-18° 51' 15.77"	119° 31' 2.71"	-18° 45' 14.87"	119° 35' 4.56"
-17° 56' 16.4"	119° 30' 14.87"	-18° 2' 10.75"	119° 34' 26.08"

3.2 Schedule

The Sauropod 3D MSS is planned to occur within the window of early January to the end of May in either 2026 or 2027 with acquisition taking a maximum of 60 days including downtime and survey infill, streamer deployment and streamer recovery. Downtime allows for inclement weather, avoiding conflicts with other users and marine megafauna, and maintenance. The actual start date and year for the survey is subject to the availability of the survey vessels for conducting the survey, client data requirements, sea state conditions suitable for marine seismic acquisition, and granting of the required regulatory approvals and access authorities. Seismic data will be acquired over a 24-hour period, with shutdowns for routine and reactive maintenance, repairs, transit and line turns and fauna and stakeholder avoidance. The exact start and end dates will be communicated to stakeholders in accordance with notification requirements described in Section 9.11.

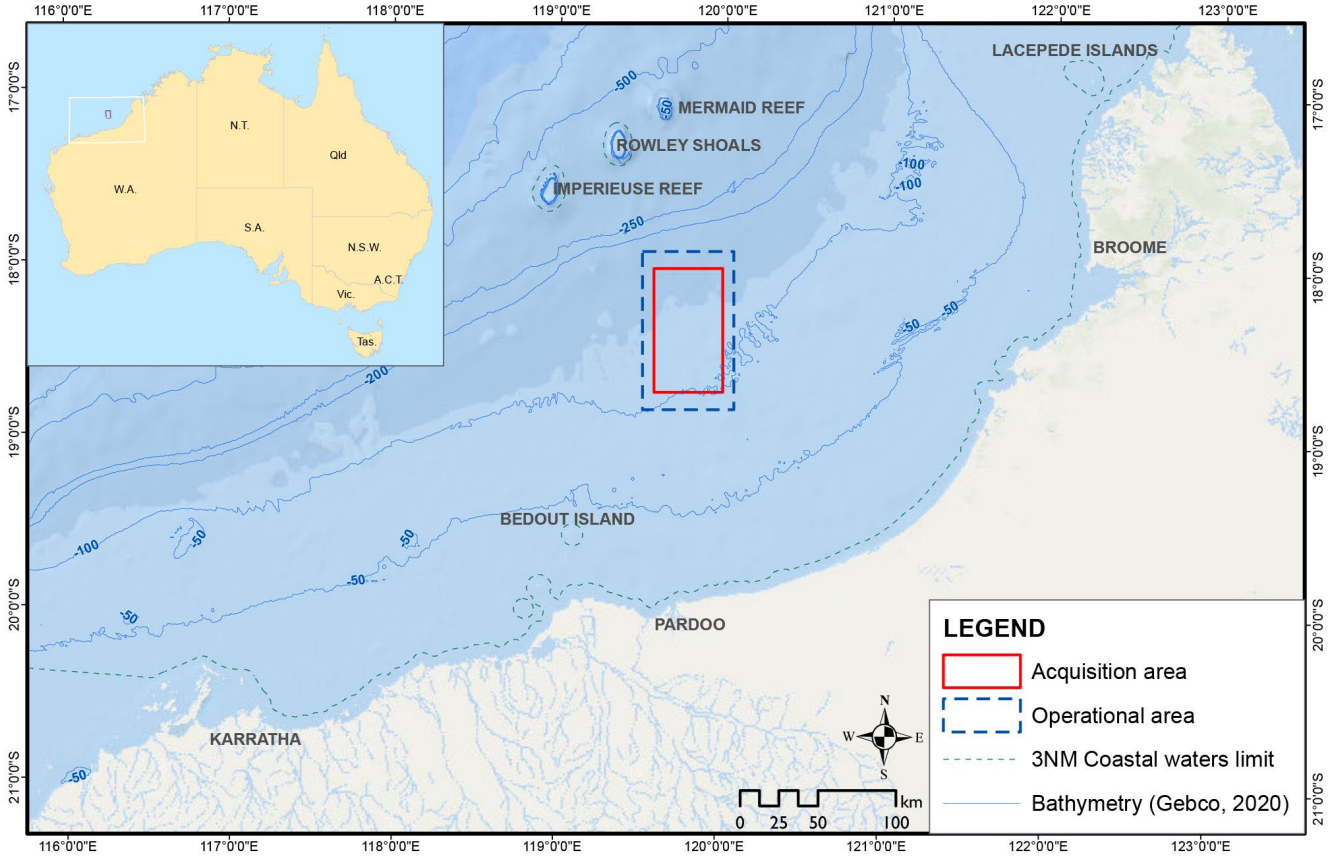


Figure 3-1 – Location of Sauropod 3D MSS

3.3 Activity Details

The core activity that forms the basis for this EP is the undertaking of the Sauropod 3D MSS. Associated activities in support of the survey are likely to include refuelling and resupply, use of support vessels as required, and crew changes within the Operational Area. Associated activities are described in this section as appropriate, with a focus on those considered relevant to the assessment of environmental impact and risk. Key details of the proposed seismic survey are summarised in Table 3-2 and described below.

The Sauropod 3D MSS will be undertaken by a seismic survey vessel towing an underwater seismic source and a series of up to 12 streamers behind it. The seismic source will consist of an array of airguns of varying volumes, distributed in three separate arrays that will be discharged alternately. The airguns emit high pressure pulses of sound, with the primary energy directed downwards into the subsurface (not horizontally away from the source). The streamers contain underwater microphones (known as hydrophones) which record the sound waves reflected off the seabed and underlying rock formations. These data are later processed to provide information about the structure and composition of geological formations below the seabed.

The survey vessel will tow the seismic source at 5–10 m beneath the sea surface, with a total discharge volume of up to 2,820 cubic inches (in^3). The total volume size of the airgun array has been chosen based on the range of water depths within the survey area and depth of the target within the subsurface to ensure adequate seismic imaging.

The hydrophone streamers will extend approximately 7.05 km behind the vessel and be spaced 112.5 m apart. The streamers will be towed at a depth of approximately 18 m below the surface. Tail buoys will be used to maintain position in the water and clearly indicate the streamer ends. As tail buoys are self-inflating, they will return to the surface if they go beyond a certain water depth. In addition, the tail buoys will be fitted with turtle guards, lights and radar reflectors. Depth monitoring and control devices positioned along the streamers will be used to maintain the preferred tow depth.

Table 3-2 – Key Details for the Sauropod 3D MSS

Parameter	Sauropod 3D MSS
Survey Area	
Permit area	WA-527-P
Acquisition Area	Approximately 3,500 km^2
Operational Area	Approximately 6,000 km^2
Adjustment Area	(Used in reference to compensation claims by commercial fishers): the area extending 10 km around the perimeter of the area in which the seismic source can be active that defines the limits of fisheries loss of catch and displacement claims (NERA 2021).
Activity Area	(Used in reference to relevant person consultation): the area within which the activity will occur (the Operational Area) plus a buffer within which a change to ambient environmental conditions may occur due to planned activities.
Planning Area	(Used in reference to relevant person consultation): the broader area that might be affected by an unplanned hydrocarbon spill. Also referred to as the EMBA for the purpose of impact assessment.
Seismic Activity	
Survey window	1 January – 31 May 2026 And / Or 1 January – 31 May 2027
Duration of survey	60 days
Length of sail lines	83 km
Time to traverse a sail line	~10 hours
Orientation of sail lines	North–south
Distance between sail lines	675 m – 716 m
Seismic vessel sail line speed	~4.5 knots
Seismic source discharge interval	Approximately every 12.5 m (approximately every 5.4 seconds) along survey lines
Seismic Source	
Type	Airgun / three arrays, which will be discharged alternately
Size	Max 2,820 in^3
Pressure	2,000 psi
Source levels (at 0–2,000 Hz)	223.0-228.2 dB re 1 µPa2m^2s (SEL) 244.8-255.0 dB re 1 µPa m (PK)
Sound source tow depth	5–10 m
Streamers	
Number	12
Streamer length	8,000 m
Distance from seismic vessel bow to tail buoy	8,750 m
Distance between streamers	112.5 m
Streamer tow depth	18 m

Parameter	Sauropod 3D MSS
Vessels	
Seismic vessel	One vessel - specific vessel yet to be determined
Support vessels	Two support vessels (one supply and one chase) – specific vessels yet to be determined
Refuelling	Refuelling at sea will occur approximately every 2–4 weeks (depending on the specific vessel and contractor)
Crew changes	Via helicopter or support vessel every 4–6 weeks.

3.3.1 Seismic Source Operation

When acquiring data, the vessel will travel along a series of pre-determined lines within the Acquisition Area at approximately 4.5 knots (8 km/hour), discharging the seismic source at 12.5 m intervals (approximately every 5.4 seconds).

The Sauropod 3D MSS is a typical 3D survey using methods and procedures similar to others conducted in Australian waters. No unique or unusual equipment or operations are proposed. The survey will be conducted 24 hours a day. Survey and equipment parameters are provided in Table 3-2.

The seismic survey vessel will typically acquire the data along a series of adjacent and parallel lines in a “racetrack”-like pattern. At the end of the first line in a racetrack sequence, the vessel will turn in a wide arc to position for another parallel line in the opposite direction, offset several kilometres from the previous line. The vessel will then turn again to position to return in the opposite direction along the third parallel line in the sequence, offset approximately 675 – 716 m from the first line. This pattern is repeated across the Acquisition Area until the required coverage is completed. The vessel will sail lines that are typically in a north–south orientation. Each sail line is approximately 83 km long and will take approximately ten hours to acquire. The time required to complete each sail line is dependent on vessel speed and currents.

Full-fold seismic data acquisition involving operation of the seismic source at full volume will occur within the Acquisition Area, although the seismic source will also be operated outside of the Acquisition Area during line run-outs, source testing, soft starts during run-ins, maintenance and testing.

During line run-outs, the seismic source will typically be operated at full volume for the equivalent of half a streamer length (approximately 4 km) before the source is shut down and the survey vessel commences the next line turn. Following completion of the line turn, the vessel will complete a run-in towards the Acquisition Area, which involves sailing in a straight line to allow the streamers to straighten prior to commencing acquisition. During these run-ins, soft-start procedures occur for a minimum of 30 minutes (approximately 4 km), which begins with the operation of the single smallest source element in the array and gradual ramp-up to include additional source elements until the seismic source is operated at full volume for the commencement of the acquisition line at the Acquisition Area boundary.

The seismic source may also be operated for short durations in a controlled manner elsewhere in the Operational Area, for the purpose of source maintenance and testing. These activities are infrequent and typically involve short intermittent controlled discharges of individual source elements (i.e. single gun/cluster or single source array) for durations in the order of a short number of testing shots. Since this testing only involves a single gun or a small cluster of guns, the noise propagated from the source during this activity must logically be less than the whole array. Therefore, any impacts from noise emissions will not be greater than that predicted in the impact assessment.

Operation of the seismic source in all cases will be in accordance with control measures and performance standards specified in this EP.

3.3.2 Infill

When acquiring 3D marine seismic data, surface currents may shift the streamers away from their nominal positions. This shift, called feathering, can lead to holes in the data coverage. Holes in data coverage can also occur when the airgun array is turned off due to technical or logistical reasons (e.g., technical problems or marine fauna interactions). These holes are typically filled by steering the vessel closer to the previous sail-line or by acquiring additional sail-lines along the holes. These extra sail-lines are known as infill. Infill can be a large part of the time and cost for a marine seismic survey. Without infill activity, seismic surveys would be incomplete, the data compromised and contract requirements not fulfilled.

It is not possible to estimate what the amount of feather (and resulting coverage) will be. Typically, pre-plot sail lines will be completed and the infills are left to the end of a survey once the seismic data have been partially processed and all infill locations identified.

With proper infill management, unnecessary infill lines may be reduced or avoided. The on-board navigator steers the seismic vessel for coverage to minimise the amount of infill. Additionally, steerable streamers and fan-mode techniques for the streamer spread are used to minimise infill requirements.

3.3.3 Vessels

3.3.3.1 Seismic Vessel

A purpose-built survey vessel will be used for the Sauropod 3D MSS and will carry up to approximately 70 people. The specific vessel for the survey has yet to be determined.

3.3.3.2 Support Vessels

Two support vessels will be engaged for the Sauropod 3D MSS. These comprise:

- One chase vessel accompanying the seismic vessel to assist with managing potential interactions with other marine users
- One supply vessel responsible for resupply, refuelling, and other support functions.

Refuelling and resupply at sea by a supply vessel is expected to occur approximately every 2–4 weeks during the survey (depending on the specific vessel and contractor). At-sea refuelling of the seismic vessel will only take place during daylight hours and within strict weather limit guidelines. Refer to Section 8.3 for details of control measures to be implemented during refuelling.

Crew changes are expected to be undertaken by a supply vessel or helicopter approximately every 4–6 weeks.

4 Description of the Existing Environment

4.1 Overview

This section describes the environmental and socio-economic values and sensitivities within the existing environment of the Operational Area and wider environment that may be affected (EMBA) by the proposed activity (see Figure 4-1). The EMBA is a conservative approximation of the furthest extent that could be affected in any credible impact scenario. In this case, the EMBA represents an unplanned release of marine diesel oil (MDO). The EMBA was derived from oil spill modelling for an instantaneous release of 280 m^3 at the north-west corner of the Operational Area. It is important to note that the EMBA covers a much larger area than the area that is likely to be affected during any one single spill event. The modelling was run for a variety of weather and metocean conditions (300 simulations in total), and the resulting EMBA for the north-west corner of the Operational Area was extrapolated to the three other corners. Other nearby sensitivities that were considered potentially relevant to the EP are also described in this section. The information contained in this section has been used to inform the assessment of impacts and risks in Section 7 and Section 8. For further detail on the modelling refer to Section 8.1.

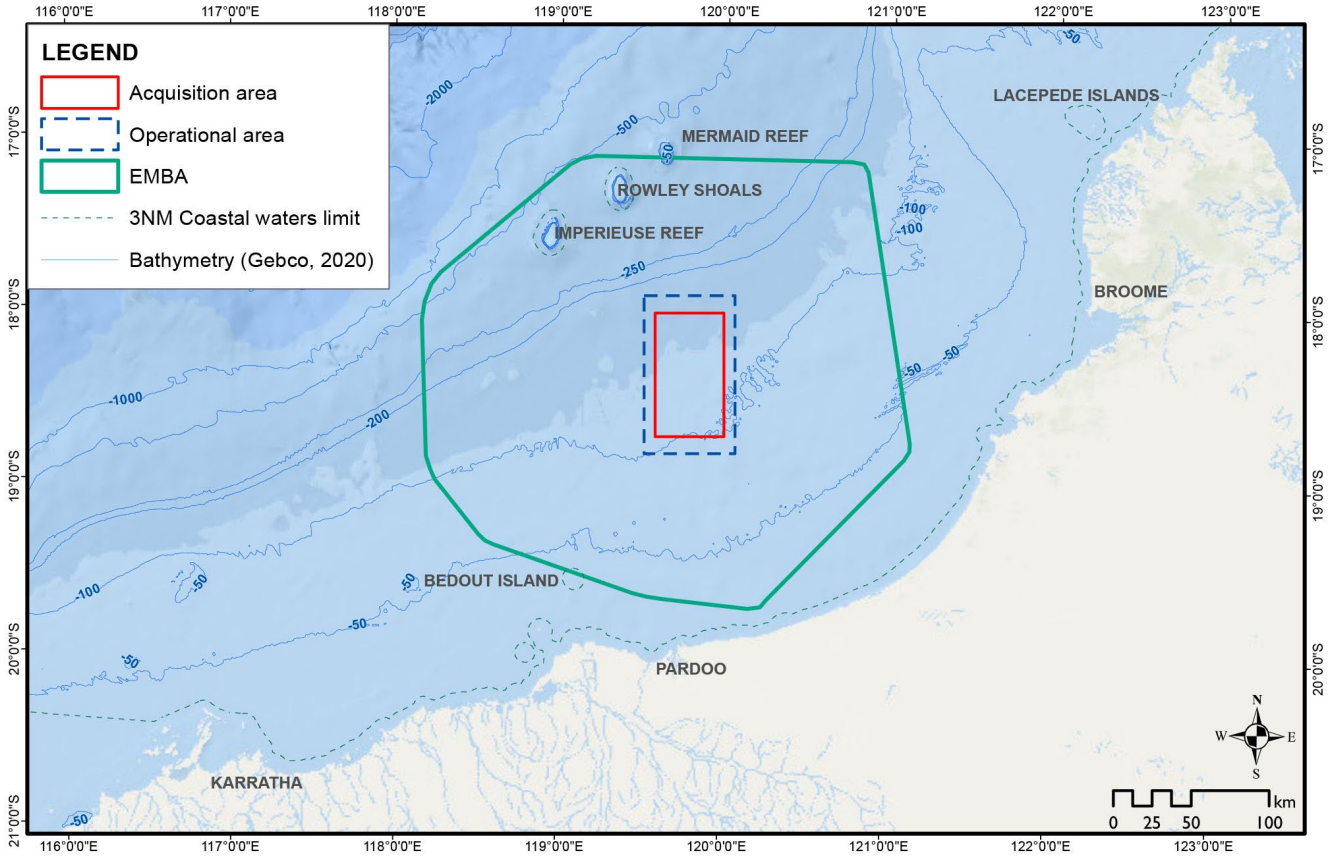


Figure 4-1 – Operational Area and EMBA for the Sauropod 3D MSS

4.1.1 Regional Context – the North-west Marine Region

The Operational Area is located in the centre of the North West Shelf (NWS), an area of significant environmental, economic and cultural value. In 2008, the former Department of the Environment, Water, Heritage and the Arts (now the DCCEEW) introduced marine bioregional planning. Under these plans, the Australian marine environment was categorised into six broad marine bioregions (Figure 4-2). Marine Bioregional Plans describe the marine environment and conservation values of each marine region, set out broad biodiversity objectives, identify regional priorities and outline strategies and actions to address these priorities (DoEE n.d.). The Operational Area is located within the North-west Marine Region (NWMR).

The NWMR comprises Commonwealth waters from the Western Australia–Northern Territory border to Kalbarri, south of Shark Bay. The NWMR is characterised by the following aspects (DEWHA 2008a):

- Containing a large portion of continental shelf and continental slope
- Highly variable tidal regions and very high cyclone incidence
- Shallow-water tropical marine ecosystems, which are home to globally significant populations of internationally threatened species
- Containing threatened and migratory species listed under the EPBC Act, including cetaceans, Dugong, marine reptiles, seabirds and migratory shorebirds, seahorses and pipefish, sharks and sawfishes
- Containing biologically important areas (BIAs), where protected species display biologically important behaviour such as breeding, foraging, resting or migration.

Within the NWMR, marine habitats are further categorised into eight provincial bioregions. The Operational Area is located within the North West Shelf Province, and the EMBA overlaps with part of the North-west Transition (Figure 4-3). These two provincial bioregions are described below.

4.1.1.1 North West Shelf Province

The Operational Area is located within the North West Shelf Province, a bioregion that covers 238,759 km^2 of waters on the continental shelf in depths of up to 200 m. The North West Shelf Province is described as a dynamic oceanographic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides (DEWHA 2008a). Waters are generally warm, and currents are primarily driven by the Indonesian Throughflow (ITF). Diverse pelagic and demersal fish communities occupy the bioregion and are thought to be closely associated with depth ranges. The region facilitates seasonal migrations of iconic megafauna such as the blue whale, humpback whale and whale shark. Coastal areas provide important breeding sites for a variety of seabirds, including Eighty Mile Beach and the Lacepede Islands. The region is commercially important to both the petroleum industry and commercial fishing industry.

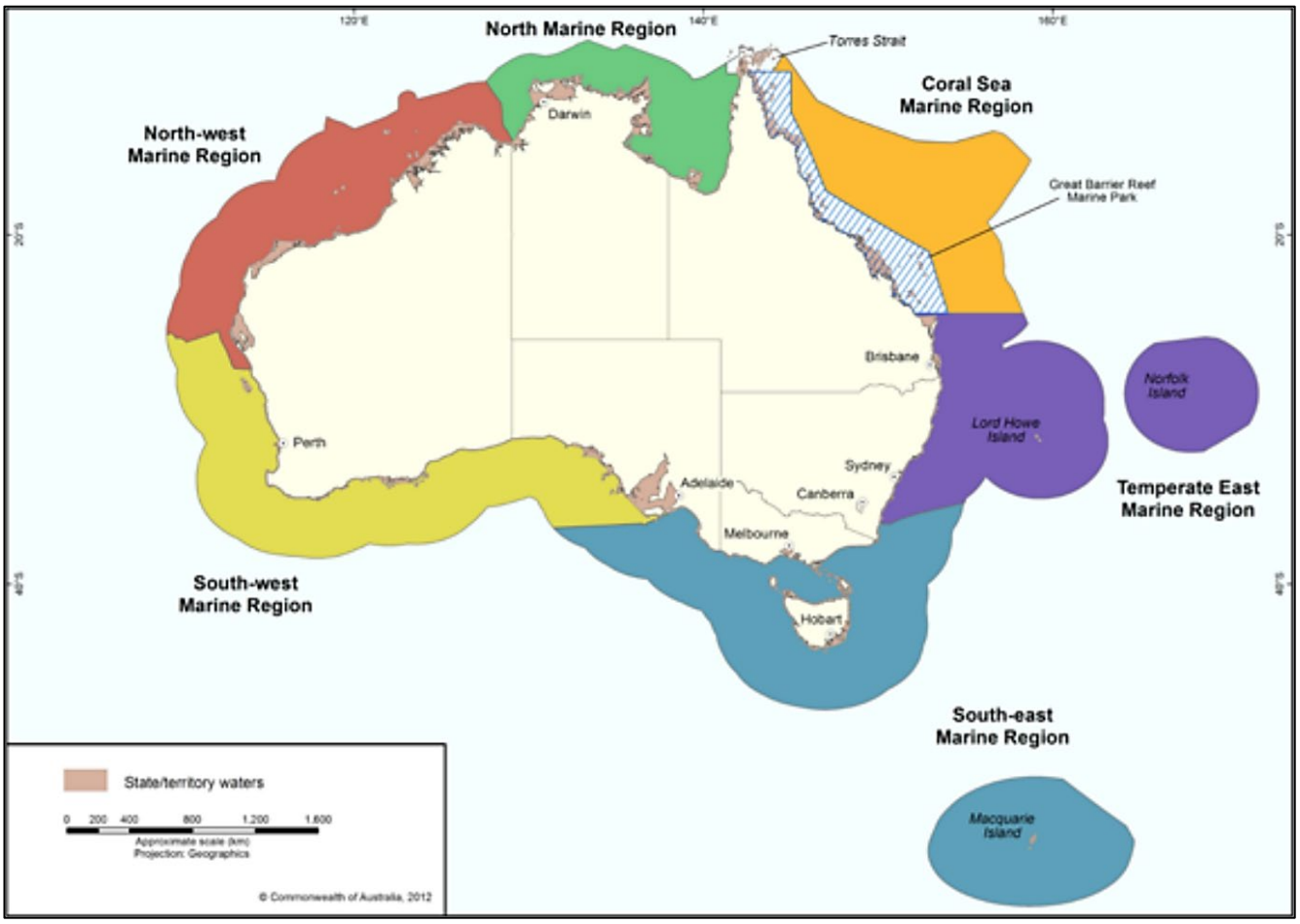


Figure 4-2 – Marine Bioregions of Australia (Source: DSEWPaC 2012a)

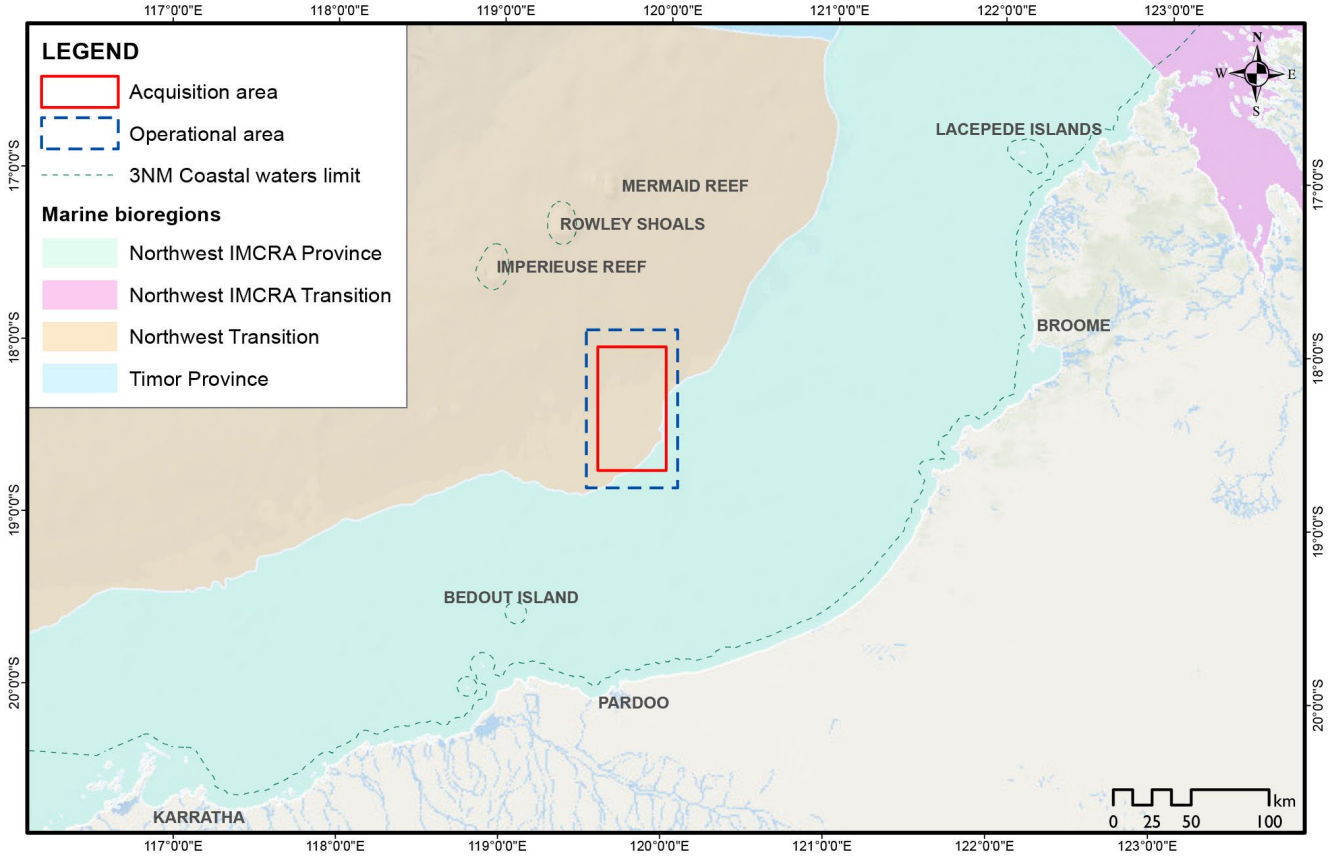


Figure 4-3 – Provincial Bioregions (IMCRA v4.0)

4.1.1.2 North-west Transition

The EMBA overlaps with part of the North-west Transition, a bioregion that covers 184,424 km^2 and includes shelf break and continental slope and the majority of the Argo Abyssal Plain, covering depths up to 5,980 m. The Rowley Shoals are a key topographic feature of the bioregion (see Sections 4.3.2.1 and 4.4.2.1). The continental slope portion of the bioregion is thought to support fish communities with high levels of species diversity and endemism; however, little is known about the benthic biological communities in the deeper parts of the bioregion (DEWHA 2008a). A range of pelagic migratory species including billfish, sharks, tuna and cetaceans occur within the bioregion, particularly in association with the Rowley Shoals.

4.2 Physical Environment

4.2.1 Climate

4.2.1.1 Seasonal Patterns

The climate of the NWMR is dry tropical, exhibiting a hot summer season from October to April and a milder winter season between May and September (BoM 2021a). There are often distinct transition periods between the summer and winter regimes, which are characterised by periods of relatively low winds (Pearce *et al.* 2003).

4.2.1.2 Air Temperature and Rainfall

Air temperatures in the region, as measured at the Rowley Shoals platform (approximately 107 km from the Operational Area), indicate maximum average temperatures during summer of 30.4 °C and minimum temperatures of 23.6 °C in winter (BoM 2021b).

The region experiences a tropical monsoon climate, with distinct wet (October to April) and dry (May to September) seasons (Pearce *et al.* 2003). Rainfall in the region (measured at Wallal Downs Station) typically occurs during the wet season (summer), with highest falls observed during late summer (BoM 2021c), and often associated with the passage of tropical low-pressure systems and cyclones (Pearce *et al.* 2003). Rainfall outside this period is typically low.

4.2.1.3 Wind

Winds vary seasonally, with a tendency for winds from the south-west quadrant during summer and the south-east quadrant in winter. The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. During winter months, the relative position of the high-pressure cells moves further north, leading to prevailing south-easterly winds blowing from the mainland (Pearce *et al.* 2003). Winds typically weaken and are more variable during the transitional period between the summer and winter regimes, generally between April and August (Table 4-1).

Table 4-1 – Predicted Monthly Average and Maximum Winds within the Operational Area (RPS 2019, Derived from CFSR Hindcast Model)

Month	Average Wind (knots)	Maximum Wind (knots)	General Direction (from)
January	11	35	W
February	11	47	W
March	9	58	Variable
April	8	27	Variable
May	13	32	ESE
June	13	30	ESE
July	13	29	ESE
August	11	29	ESE
September	11	31	Variable
October	10	25	WSW
November	10	27	WSW
December	11	36	W
Minimum	8	25	-
Maximum	13	58	-

4.2.1.4 Tropical Cyclones

Tropical cyclones are a relatively frequent event for the region, with the Pilbara coast experiencing more cyclonic activity than any other region of the Australian mainland coast (BoM 2021d). Tropical cyclone activity can occur between November and April and is most frequent in the region during January to March, with an annual average of approximately one storm per month. Cyclones are less frequent in the months of November, December and April but historically the worst storms have occurred in April.

4.2.2 Oceanography

4.2.2.1 Tides

Tides in the region of the NWS are semi-diurnal and have a pronounced spring-neap cycle, with tidal currents flooding towards the south-east and ebbing towards then north-west (Pearce *et al.* 2003). Within the North West Shelf Province, tidal activity is considered a significant factor for the oceanography. Tides in this part of the bioregion are large and tend to increase in magnitude from south to north (from an amplitude of one metre at Exmouth to over three metres at Broome). In shallower waters, the tides contribute to the vertical mixing of the surface water layer and sediments. It should be noted that in the shallower coastal waters there is a high evaporation rate, which results in slower offshore movement of denser, more saline waters across the North West Shelf. This dense, more saline water is typically found as a bottom layer of coastal water out as far as the 200 m depth contour.

4.2.2.2 Waves

Internal tides are typically generated around the shelf break and appear to contribute to the biological productivity of the region. When the internal waves break, it causes mixing of more nutrient-rich water with the photic zone, and therefore enhancing biological productivity.

Furthermore, the region is known to have seasonal cyclonic events, which are key drivers in the bioregion. Tropical cyclone activity can occur between November and April and is most frequent in the region during January to March, with an annual average of approximately one storm per month. Cyclones are less frequent in the months of November, December and April but historically the worst storms have occurred in April. During cyclone season, wave action in the bioregion is increased.

4.2.2.3 Temperature

The offshore oceanic sea water characteristics of the NWS exhibit seasonal and water depth variation in temperature and salinity, being greatly influenced by major currents in the region. Surface waters are relatively warm year-round due to the tropical water supplied by the Indonesian Throughflow and the Leeuwin Current, with temperatures reaching 30 °C in summer and dropping to 22 °C in winter (Pearce *et al.* 2003). This is reflected in data available from NOAA, where the average annual surface temperature water in the EMBA and Operational Area is approximately 27 °C (NOAA 2021a).

4.2.2.4 Currents

The oceanography of this bioregion is generated by the movement of surface currents from the waters of the Indonesian Throughflow (Figure 4-4). The Throughflow waters are circulated from the North-west Marine region through the South Equatorial and Eastern Gyral currents. Within the North West Shelf Province water circulation is highly seasonal. During winter, the Throughflow's southern flow is at its strongest and tends to dominate the water column. On the other hand, during summer, the Throughflow is weaker and strong winds from the south-west cause intermittent reversal of the currents, which generates upwellings of colder and deeper water. Typical ocean current circulation patterns during summer months (the main proposed timing of the Sauropod 3D MSS) are shown in Figure 4-5.

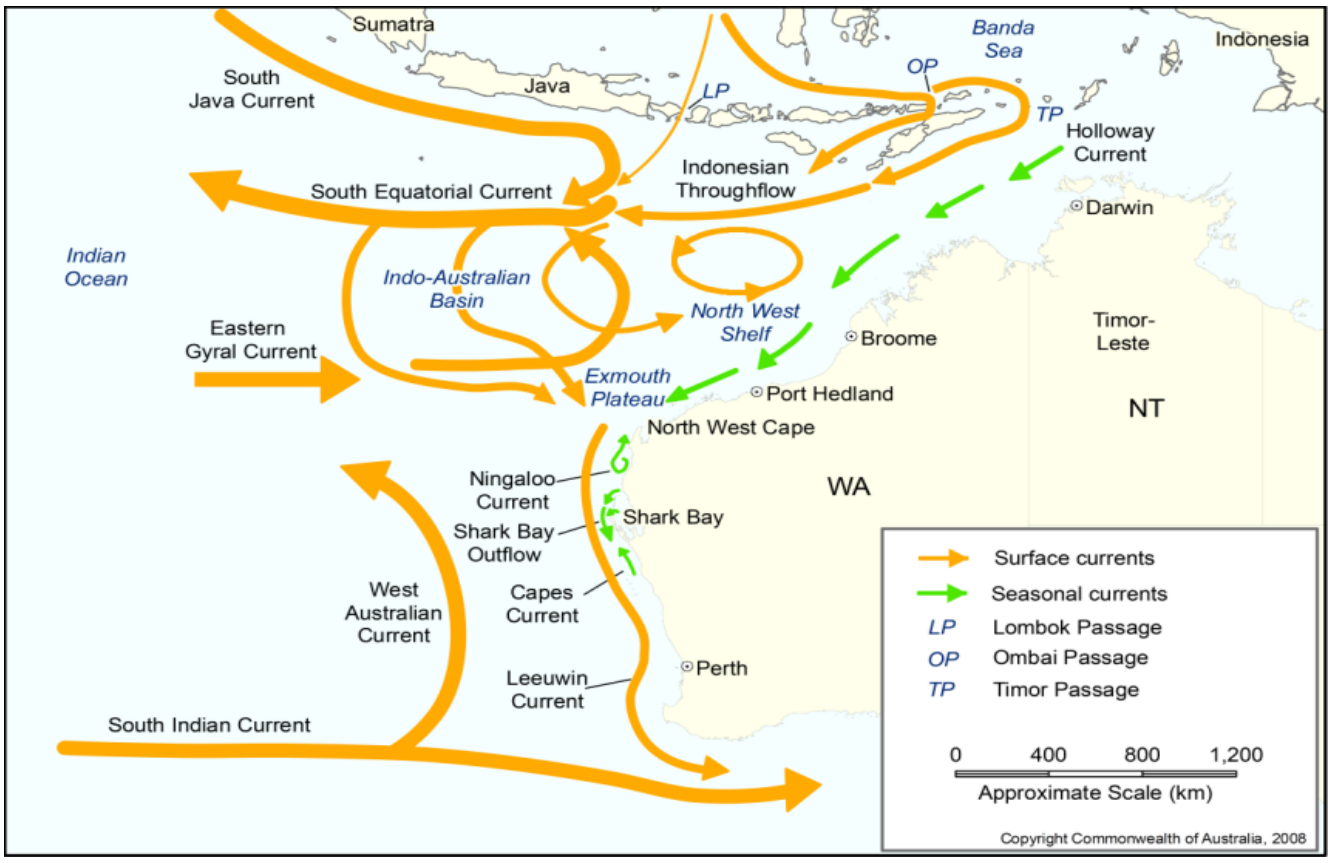


Figure 4-4 – Surface Currents in Western Australian Waters. Source: DEWHA (2008a)

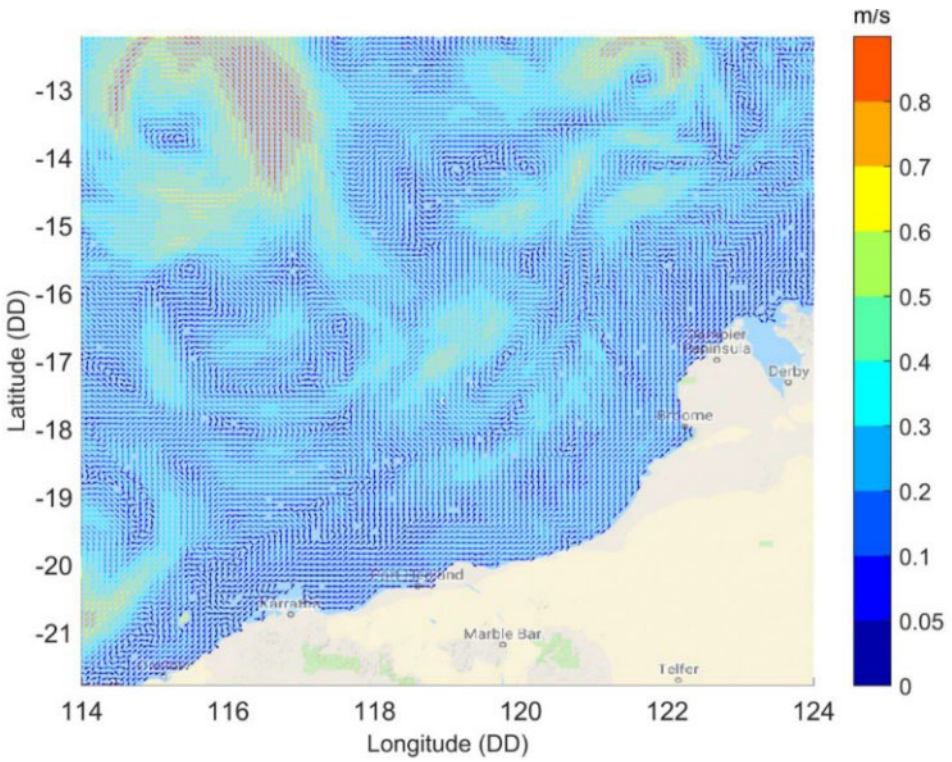


Figure 4-5 – Typical Ocean Current Circulation Pattern during Summer Months. Source: RPS (2019)

4.2.2.5 Salinity

Variation in surface salinity along the NWS throughout the year is minimal (between 35.2 and 35.7 PSU), with slight increases occurring during the summer months due to intense coastal evaporation (Pearce *et al.* 2003; James *et al.* 2004). This small increase in salinity during summer is then countered by the arrival of the lower salinity waters of the Leeuwin Current and Indonesian Throughflow in autumn and winter (James *et al.* 2004). This is also reflected in more recent publicly available data from the NOAA (2021b), where annual surface salinity levels are ~35 PSU.

4.2.2.6 Water Quality

Water quality in the NWMR is regulated by the ITF, a low-salinity water mass that plays a key role in initiating the Leeuwin Current (DSEWPaC 2012a). It brings warm, low-nutrient, low-salinity water from the western Pacific Ocean through the Indonesian archipelago to the Indian Ocean. It is the primary driver of the oceanographic and ecological processes in the region (DEWHA 2008a). South of the NWMR, the Leeuwin Current continues to bring warm, low-nutrient, low-salinity water further south. Eddies formed by the Leeuwin Current transport nutrients and plankton communities offshore (DEWHA 2008a). During summer, the Leeuwin Current typically weakens, and the Ningaloo Current develops, facilitating upwellings of cold, nutrient-rich waters up onto the NWS (DSEWPaC 2012a). Other areas of localised upwelling in the NWMR include the Wallaby Saddle and Exmouth Plateau, where these seabed topographical features force the surrounding deeper, cooler, nutrient-rich waters up into the photic zone (DSEWPaC 2012a).

Turbidity is primarily influenced by sediment transport by oceanic swells and primary productivity (Semeniuk *et al.* 1982; Pearce *et al.* 2003). Upwelling of nutrient-rich waters may increase phytoplankton productivity in the photic zone, which may increase local turbidity (Semeniuk *et al.* 1982; Wilson *et al.*, 2003). In nearshore areas, turbidity is highly variable due to storm run-off, wind generated waves and large tidal ranges (Pearce *et al.* 2003). Periodic events, such as major sediment transport associated with tropical cyclones, may influence turbidity on a regional scale (Brewer *et al.* 2007).

4.2.3 Bathymetry and Geomorphology

The Operational Area is located in waters approximately 65 -170 m deep on the continental shelf. The bathymetry within the Operational Area is predominately characterised by relatively flat seabed. The water depth is approximately 65 m in the south-eastern corner of the Operational Area and increases to 150 m in the north-west corner of the Operational Area (

Figure 4-6).

In the wider EMBA, the North West Shelf (NWS) Province encompasses more than 60% of the continental shelf in the NWMR (Baker *et al.* 2008), gradually sloping from the coastline to the shelf break at the edge of the region and includes water depths of 0–200 m. Approximately half the province is in water depths of 50–100 m (DEWHA 2008a). The NWS Province includes a number of sea floor features such as submerged banks and shoals, and valley features that are thought to be morphologically distinct from other features of these types in different regions of the NWMR (DEWHA 2008a) (Figure 4-7).

Several steps and terraces caused by Holocene sea level changes are present in the NWMR with the most prominent of these features occurring as an escarpment along the North West Shelf and Sahul Shelf at a depth of 125 m. This escarpment is related to an ancient sub-aerially exposed land surface and coastline (beach and dune deposits), known as the ancient coastline. The ancient coastline at the 125 m depth contour is designated as a Key Ecological Feature (KEF) and overlaps at the middle portion of the Operational Area (Section 4.4.3, Figure 4-16).

Previous movements in sea level have had a significant influence on the geology of the region of the Operational Area. Between 21,000 and 19,000 years ago the sea level was approximately 120 to 125 m lower than present day (Lewis *et al.* 2013). Therefore, the processes responsible for the formations present in the region include sub-aerial exposure of sediment and processes associated with land and coastal environments. Across the NWS region, the occurrence of an undulating cemented surface, expressed at the seabed as a series of ridges interspersed with sediment ponds infilling hollows and troughs, is related to an ancient sub-aerially exposed land surface and coastline (beach and dune deposits). Other coastal features including sand bars and river outlets are also present in this region, complicating the geology and geological sequence adjacent (seaward) to the area of ridges. A complex geological feature in close proximity to the Operational Area and located within the EMBA is the Rowley Shoals, which contains the Mermaid Reef KEF (Section 4.4.3, Figure 4-7).

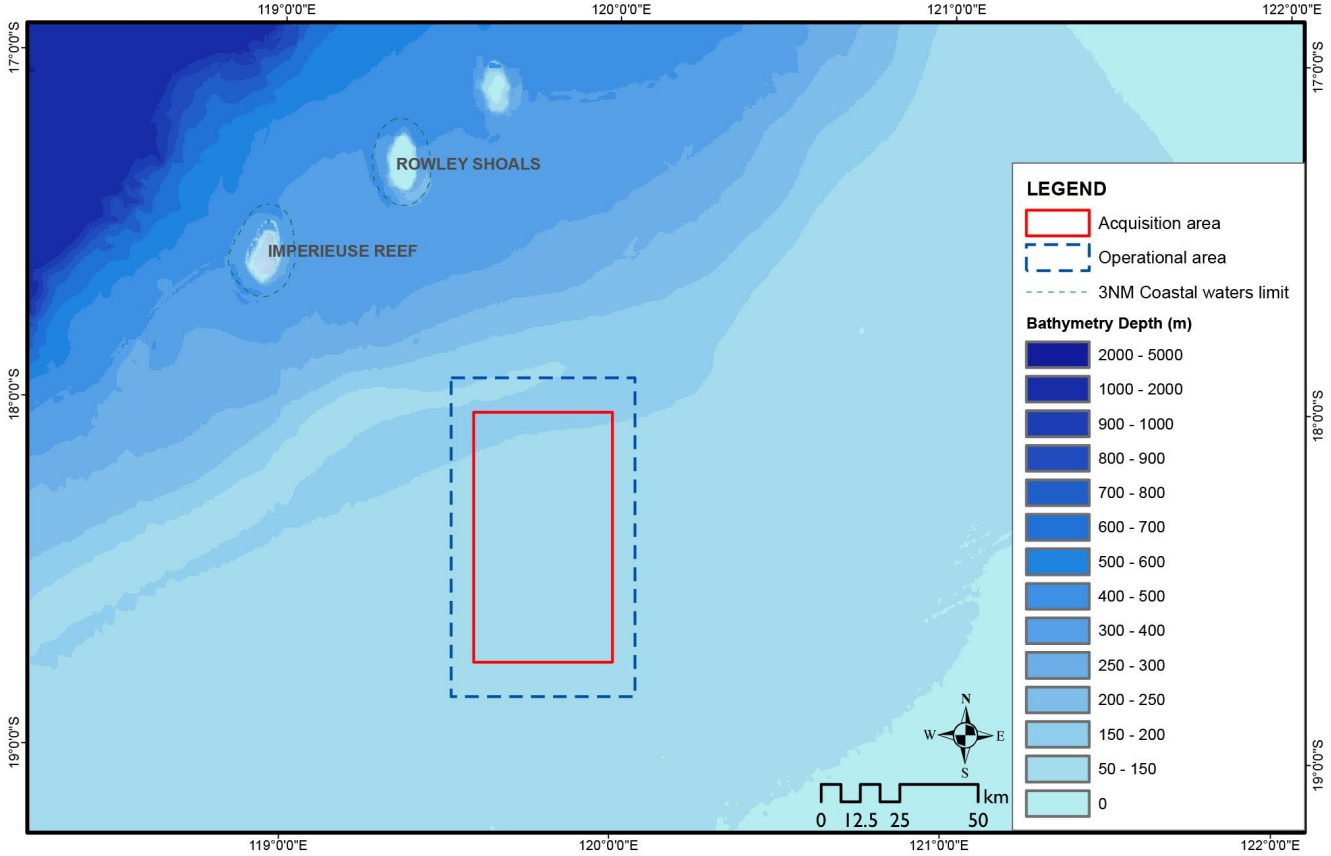


Figure 4-6 – Bathymetry within the Operational Area and Surrounds

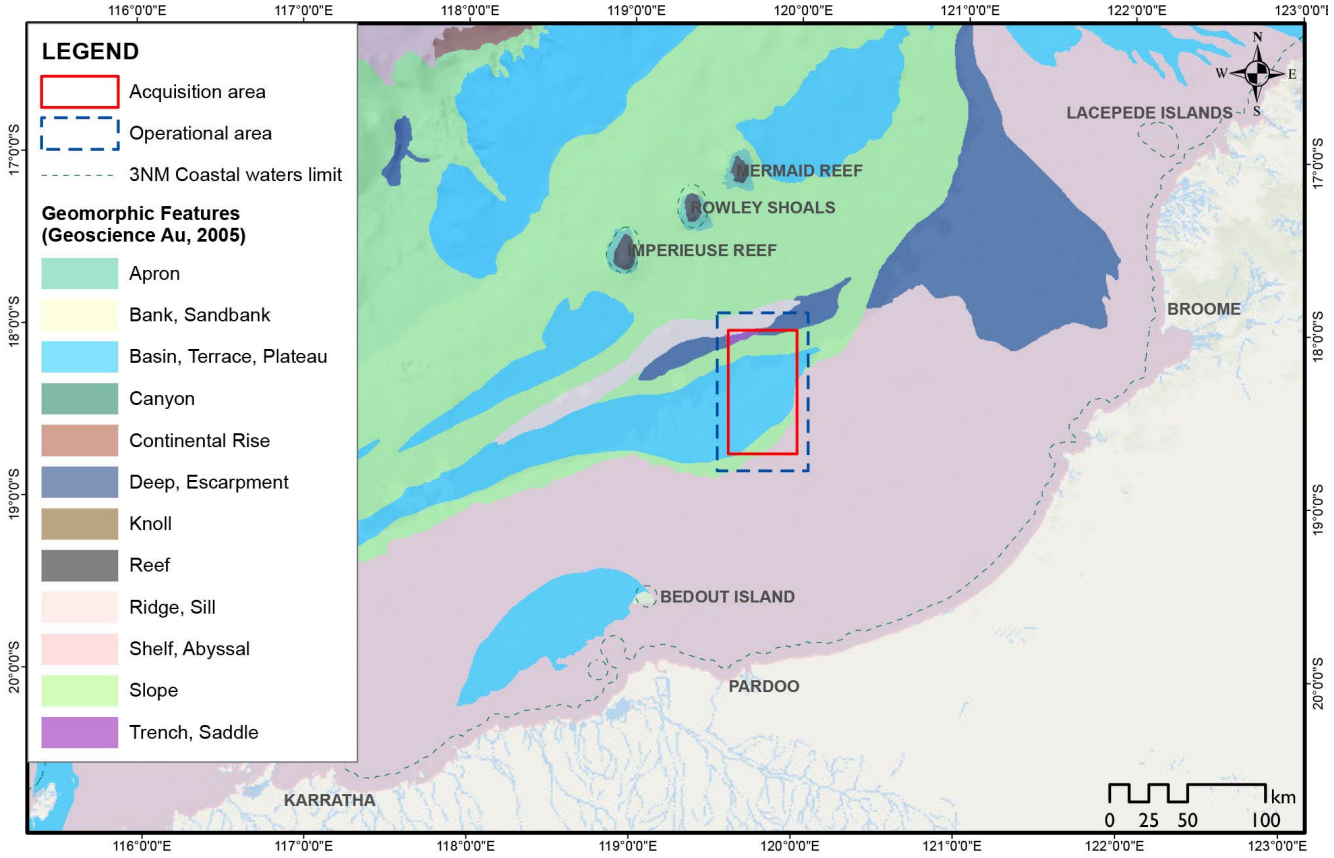


Figure 4-7 – Geomorphic Features of the North West Shelf

4.2.4 Sedimentology

Sediment differentiation in the North West Shelf Province occurs on a north–south gradient and is thought to differ from the rest of the NWMR (DEWHA 2008a). Sediment in the region is broadly characterised by calcareous gravel, sand and silt (CSIRO 2015). South of Broome, sediment is relatively homogenous and dominated by sand, typically only containing a small amount of gravel. Sediment becomes highly variable north of Broome, with sand being dominant in some areas and gravel dominant in others (DEWHA 2008a). Within 100 km of the coast and 100 km of the shelf break, there is the slight presence of mud in the sediment. Sediments within the Operational Area are expected to be relatively homogenous and dominated by calcareous gravel, sand and silt (DEWHA 2008a; CSIRO 2015).

4.3 Biological Environment

4.3.1 Plankton Communities

Plankton consists of microscopic organisms typically divided into phytoplankton (algae) and zooplankton (fauna including larvae). Plankton play a major role in the trophic system with phytoplankton being a primary producer and zooplankton being a primary consumer. Phytoplankton rapidly multiply in response to bursts of nutrient availability and are subsequently consumed by zooplankton that in turn are consumed by other fauna species.

Spatial distribution of phytoplankton and zooplankton is irregular, both vertically and horizontally and temporally. Sporadic/short-lived and potentially localised episodes of nutrient upwelling can occur as a result of internal waves (the rising and sinking of sea water layers of different densities) at the shelf break, wind-driven currents, or cyclonic activity, which influence higher plankton concentrations.

Plankton within the Operational Area are expected to reflect the conditions of the wider upper continental slope. Surface waters of the NWS have low nutrient availability, with phytoplankton occurring in higher concentrations near areas where upwelling of deeper, nutrient-rich water occurs (Thomson 2015). The most common plankton in the offshore waters of the NWS are diatoms, single-cell algae with cell walls made of silica. Recent sampling by the UWA Oceans Institute (Thomson

2015) across the NWMR found that large summer blooms of diatoms occur in Pilbara offshore waters west of Broome. These blooms occur at the junction of stratified cool and warm water mass at depths of at least 45 m. High concentration of diatoms (Chlorophyll concentration of 1.39–2.10 µg/l) were recorded to occur in an area between 40 and 120 km east of the Operational Area.

4.3.2 Benthic Habitats and Communities

The distribution of benthic communities in the NWMR depends on the water depth, the substrate and sediment characteristics and availability of food. The sediments within the Operational Area are expected to be broadly characterised by calcareous gravel, sand and silt. This type of substrate is known to support relatively little seabed structure or sessile epibenthos.

The Operational Area is expected to be sparsely covered by sessile filter-feeding organisms (e.g. gorgonians, sponges, ascidians and bryozoans) and mobile invertebrates such as echinoderms, prawns and detritus-feeding crabs (Brewer *et al.* 2007; DEWHA 2008a). Heyward *et al.* (1997) also noted that benthic macro-invertebrate infauna and epifauna such as worms, crustaceans, molluscs, gastropods, sea urchins, starfish, sea cucumbers, etc. typically occur in low numbers in water depths greater than 50 m in the NWMR. Macro-invertebrates that are present in these habitats comprise mainly polychaete worms, small crustaceans, amphipods and isopods such as shrimps and lice. Other invertebrates that may occur in these habitats include occasional sea cucumbers, sea urchins, molluscs, hydroids and sponges, and other worm species.

In the Keraudren MSS Operational Area the study collected 17 transects of towed video footage covering a total length of 21.9 km of seabed over a three-day period. The key findings of the study as presented within the Santos Keraudren Seismic Survey EP Summary, were as follows:

- Thirteen main habitat types were defined, representing flat and gently sloping seabeds comprising mainly sand/gravel and rock with sediment veneer.
- No ‘potato habitat’ (ascidians and sponges on hard substrate) was identified in the 17 transects.
- Variants of potential ‘garden habitat’ (containing hydroids, sponges, octocorals, soft corals, ascidians and crinoids) comprised approximately 50% of the area surveyed and the habitat where the two pearl oysters were found, comprised 16.4% of the area surveyed.

The epibenthos recorded in this depth range is summarised as follows:

- Common epibiota included sponges, hydroids, whip corals, soft corals, crinoids, echinoderms (starfish, basket stars and sea cucumbers), gorgonians and ascidians.
- Densities and growth forms of epibiota (e.g. hydroids and sponges) were often a characteristic of specific habitat types. For example, habitats characterised by low abundance, short, turf-like forms were often characterised by mobile sand habitats with patches/troughs of more consolidated gravel/rock prone indicating periodic inundation by sand waves.
- Most transects comprised several different habitat types with high abundance, diverse assemblages in patches interspersed by lower abundance/diversity sand or sandy gravel habitats.
- Most common substrate type was consolidated sandy gravel with shell fragments, which was stabilised by patchy, very low-lying hydroid/bryozoan turf (40–75% cover). Large epibiota was generally evenly distributed as shorter forms at relatively low abundance (5% cover) or occurred as denser patches of larger growth forms on consolidated gravel in depressions or troughs (up to 24% cover).
- Another common habitat observed was large sand waves (with gently sloping relief) and very low abundance of epibiota (1%) or no conspicuous epibiota.
- Of particular note was a mesophytic gorgonian forest with high densities of large epibiota on relatively flat emergent bedrock with sand/gravel veneer. Gorgonians were estimated at between 1 to 1.8 m high, with shorter colonies also present.

It is expected that the Operational Area and wider EMBA would support similar epibenthos as those found in the Santos study due to shared bioregions and comparable benthic habitat, sediments, and geomorphic features. As there are no known banks, shoals or shallow areas within the Operational Area, the Operational Area is unlikely to support diverse benthic assemblages, such as hard and soft corals, gorgonians, encrusting sponges, seagrass and macroalgae.

There are a number of banks and shoals located within the EMBA that may support diverse benthic assemblages. These banks and shoals are discussed further below.

4.3.2.1 Rowley Shoals

The Rowley Shoals are located within the EMBA for the Sauropod 3D MSS and comprise three reef systems distanced 30–40 km apart. These are Clerke Reef, Imperieuse Reef and Mermaid Reef, located approximately 65, 60 and 80 km from the Operational Area respectively. The marine reef fauna of the Rowley Shoals is considered to be exceptionally rich and diverse, including species typical of the oceanic coral reef communities of the Indo-West Pacific (DEC 2007).

The major habitats of the Rowley Shoals include intertidal and subtidal reefs that support a diverse range of benthic communities. Surveys carried out by the Western Australian Museum (WAM), identified 184 species of corals (primarily Indo-West Pacific species), 264 species of molluscs, 82 species of echinoderms and 389 species of finfish were also identified (DEC 2007).

Over 200 species of hermatypic (hard) corals have been recorded at the shoals over a range of depths (Veron 1986; Veron 1993; McKinney 2009). Sparse seagrass is found within the subtidal coral reef communities and although they are not a major habitat type, they are still an important component of these habitats (Berry 1986; Walker and Prince 1987). Invertebrate species (excluding corals) at the Rowley Shoals include sponges, cnidarians (jellyfish, anemones), worms, bryozoans (sea mosses), crustaceans (crabs, lobsters, etc.), molluscs (cuttlefish, baler shells, giant clams, etc.), echinoderms (starfish, sea urchins) and sea squirts (Veron 1986).

4.3.2.2 Ancient coastline at 125 m Depth Contour

The ancient coastline at 125 m depth contour is a series of steps and terraces that form an escarpment along the NWS. The ancient coastline at 125 m depth contour is defined as a KEF as it is a unique sea floor feature with ecological properties of regional significance. The hard substrate may contribute to higher diversity and enhanced species richness relative to the soft sediment habitat, and may include sponges, crinoids, molluscs, echinoderms and other benthic invertebrates (DSEWPaC 2012). The topographic complexity of these escarpments may also provide a relatively nutrient-rich environment for sessile communities (DSEWPaC 2012). The ancient coastline at 125 m depth contour KEF is further described in Section 4.3.3 and Section 4.4.3.1.

4.3.3 Fish Assemblages

Fish communities in this region are diverse and are closely related to different depth ranges (DEWHA, 2008a). Fish species of the inner shelf include lizardfish, goatfish, trevally, angelfish and tuskfish. In waters with a depth between 100–200 m, goatfish, deep lizardfish, ponyfish, deep threadfin bream, adult trevally, billfish and tuna are usually present (DEWHA 2008a).

The Protected Matters Database search (Appendix B:) identified 31 pipefish species, six seahorse species, and three pipehorse species that may occur in the EMBA. Pipefish are a listed marine species, however, are not listed as threatened or migratory under the EPBC Act. The Species group report card – bony fishes (DSEWPAC 2012b), which supplements and supports the NWMR bioregional plan, states that almost all syngnathids (pipefish, seahorses and pipehorses) live in nearshore and inner shelf habitats, usually in shallow, coastal waters, among seagrasses, mangroves, coral reefs, macroalgae dominated reefs, and sand or rubble habitats. Temperate water species predominately inhabit seagrasses and macroalgae, while tropical species are primarily found among coral reefs. The water depths of the Operational Area range from 65 m–170 m. Only seven species of the 40 syngnathids species identified as potentially occurring within the EMBA have been recorded in water depths greater than 65 m (DoEE 2019a; Bray and Thompson 2019; Austin and Pollom 2019; Froese and Pauly 2019). Therefore, the majority of the identified species are not expected to occur across the flat, soft substrates that predominate the Operational Area and EMBA.

4.3.3.1 Ancient coastline at the 125 m Depth Contour

The ancient coastline at the 125 m depth contour KEF is thought to provide areas of hard substrate that may contribute to higher biological diversity. Little published information is currently available, but the hard substrate may provide suitable habitat for a variety of demersal fish species, which may exhibit some level of site fidelity. The Operational Area partially overlaps with approximately 9% of the KEF.

Santos WA commissioned a study in 2018, to describe the fishes associated with the ancient coastline KEF within and adjacent to the Acquisition Area of the Keraudren Seismic Survey. The Keraudren Seismic Survey Acquisition Area is located approximately 20 km from the Sauropod Operational Area and shares similar environmental characteristics. The SBRUVS technique (stereo baited remote underwater video system) was utilised for the survey. The key findings of the study as presented within the Santos Keraudren Seismic Survey EP Summary, were as follows:

- A total of 638 fish from 48 species and 18 families
- A number of commercially important species were observed including red emperor (one individual), goldband snapper (35 individuals), and saddletail snapper (one individual)
- Four most ubiquitous species were threadfin bream (observed in 97% deployments), lunartail puffer (observed in 95% deployments), longnose trevally (observed in 76% deployments) and giant trevally (observed in 60% deployments)
- Four most abundant species were longnose trevally (153 individuals), threadfin bream (103 individuals), lunartail puffer (78 individuals) and goldband snapper (35 individuals)
- No consistent structurally complex seabed feature was evident that 'site-attached' fish would normally be associated with.

It is expected that the Sauropod Operational Area would support similar fish assemblages as those identified in the Santos study due to shared bioregions and comparable benthic habitat, sediments, and geomorphic features.

4.3.4 Commercially Targeted Fish Stocks

The NWMR provides fishing grounds for several commercial fisheries, which target a variety of demersal and pelagic fish species. The Department of Primary Industries and Regional Development (DPIRD) provided information on the spawning and distribution of fish species that are used to provide an indication of fish stocks targeted by fisheries relevant to the Operational Area. These species are known as key indicator species and are relevant to the management of commercial fish stocks. Indicator species are selected from the suite of commercially targeted finfish (based on their inherent vulnerability, management importance and overall risk to sustainability) for assessing the status of the overall resource.

The three demersal indicator species for the Pilbara region are red emperor (*Lutjanus sebae*), rankin cod (*Epinephelus multinotatus*), and bluespotted emperor (*Lethrinus punctulatus*). The status of ruby snapper (*Etelis* sp) is also used as an indicator species for the offshore demersal scalefish resources targeted by the Pilbara Line Fishery (Newman *et al.* 2024). Goldband snapper (*Pristipomoides multidens*) is an indicator species for the Kimberley region (which has limited overlap with the Sauropod 3D MSS Operational Area) although the species also occurs throughout the Pilbara region and comprises a significant proportion of the commercial catch, therefore, it is considered in this EP. Spanish mackerel (*Scomberomorus commerson*) is the principal target species and single indicator species for the Mackerel Managed Fishery.

As described for each individual key indicator fish species in the Australian Fisheries Research and Development Corporation (FRDC) Status of Australian Fish Stocks (SAFS) reports (Roelofs et al. 2024) and in DPIRD's stock structure summary (Gaughan *et al.* 2018), fish stock structures are considered in terms of both their genetic stocks and fishery management units. The genetic stocks refer to the geographic areas where genetic homogeneity is maintained by the dispersal of pelagic eggs and larvae within and between regions (Newman *et al.* 2000; Department of Fisheries 2004). The level of mixing from egg and larval dispersal is influenced by the spatial-temporal patterns of spawning relative to the prevailing oceanographic currents, the duration of the spawning period and the periodicity of spawning. For example, a species that spawns over a large portion of the continental shelf for a protracted period will very likely have a high level of egg and larval dispersal resulting in a wide spatial stock extent (Gaughan *et al.* 2018). This is the case with all of the key indicator fish species in northern Western Australia, which spawn throughout their ranges and on multiple occasions during protracted spawning periods (Gaughan *et al.* 2018).

There is considerable bidirectional mixing of pelagic eggs and larvae in both directions along the Northwest Shelf, therefore, for species that are relatively evenly distributed throughout their range and with spawning seasons that extend over several months, there is a high propensity for alongshore mixing over large distances (Gaughan *et al.* 2018). The eggs and larvae released by spawning adult demersal fish in the region may disperse for several days or weeks and may travel for hundreds of kilometres or more before settling on the seabed (Newman *et al.* 2000; Mackie *et al.* 2009, 2010; Marriott *et al.* 2012; Berry *et al.* 2012; Gaughan *et al.* 2018). The genetic stocks, therefore, represent the area where the exchange of larvae and subsequent recruitment of juvenile fish to the stocks occurs over many years (Martin *et al.* 2014; Gaughan *et al.* 2018).

Note that fish stocks may also be considered in terms of smaller, more discrete 'management units', which are adopted by fisheries management authorities for the purposes of fisheries management. The management units consider the genetic stock and larval settlement, but also take into account the smaller ranges and localised movements of adult and juvenile fish, as well as the extent of the fisheries that target the stocks. Consequently, the fisheries management units are typically smaller than the extent of the genetic stocks. This provides a more conservative approach to managing the resource (Gaughan *et al.* 2018). The North Coast Fisheries Bioregion of WA defined by DPIRD is divided into two management units, the Pilbara and the Kimberley management units (Figure 4-8), which also inform the FRDC (Roelofs et al. 2024) stock

assessments. The fishery management unit boundaries are the same as the Pilbara and Kimberley region fisheries. The location of the boundary for the two management units, which determines the break in spatial extent of the fisheries stock assessments, is an artificial construct, which reflects both a practical spatial division of the genetic stock and the historical development of the fisheries in the Pilbara and Kimberley regions (Gaughan *et al.* 2018). All WA-managed commercial fisheries in the North Coast Fisheries Bioregion (Pilbara and Kimberley management units) are assessed as having sustainable (adequate) stock levels – the exceptions being the Pilbara Trawl (Interim) Managed Fishery and the Pilbara Demersal Trap Managed Fishery in which the fishing mortality of key indicator species is above Harvest Strategy tolerance ranges (Newman et al. 2024).

Table 4-2 summarises the indicator fish species that are relevant to the Operational Area, the spatial extent of their biological stocks, and their reproductive biology, based on information provided by DPIRD (2019) and other published literature on the fisheries and fish species. Figure 4-9 presents the principal spawning ranges of the key indicator fish species based on Pilbara fisheries management units and the principal water depths provided by DPIRD (2019). Both the biological stock ranges and the fishery management units are discussed in the impact and risk assessments in Section 7.

Whilst the WA Pearl Oyster Fishery does not fish within the Operational Area (refer Section 4.4.4), habitat similar to that described for the target species silver-lipped pearl oyster (*Pinctada maxima)* broodstock may occur within the Operational Area and EMBA (DoF, 2016). Whilst aggregations of the silver-lipped pearl oyster are generally found in water depths of less than 40 m, two pearl oysters were found in a benthic study for the Santos Keraudren Seismic Survey in water depths of 40-60 m which is expected to be the limit of their depth range. The study area overlaps the extreme eastern portion of Sauropod Operational Area. Both individuals were observed growing vertically attached to consolidated rock substrates, with a relatively thick veneer of shelly/gravelly sand. Although it is expected that the Sauropod 3D MSS Operational Area and wider EMBA would support similar epibenthos as those found in the Santos study due to shared bioregions and comparable benthic habitat, sediments, and geomorphic features, a sparse distribution of silver-lipped pearl oyster broodstock is expected to occur within the area due to the water depths.

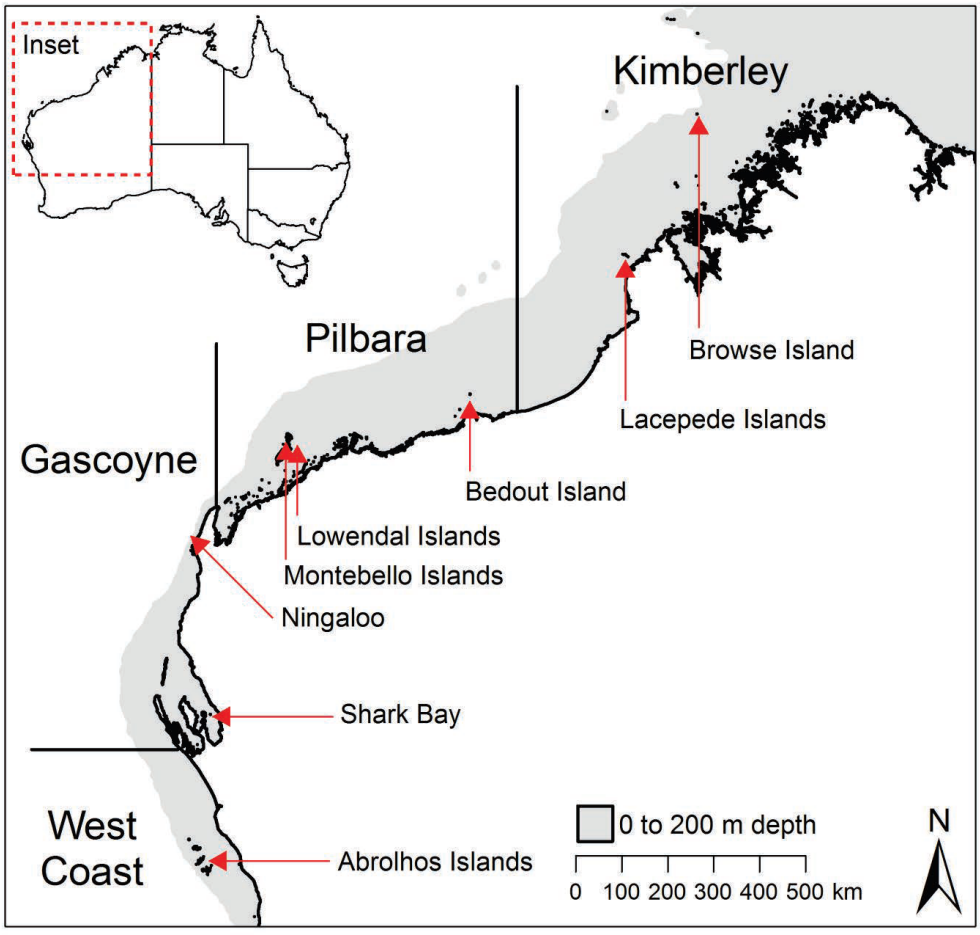


Figure 4-8 – Management units for the scalefish resources in northern WA (Gaughan *et al.* 2018). The North Coast Fisheries Bioregion comprises the Pilbara and Kimberley management units

4.3.4.1 Southern bluefin tuna (*Thunnus maccoyii*)

Southern bluefin tuna (SBT) is listed as Conservation Dependent under the EPBC Act and targeted by the Commonwealth Southern Bluefin Tuna Fishery and by recreational fishers in southern marine waters of Australia, although little if any fishing for SBT occurs in WA waters (eg Section 4.4.4). Individuals are highly migratory. Spawning occurs in tropical waters during spring and summer, and the only known spawning ground is in the north-eastern Indian Ocean between Java and northern Australia. The southern most portion of this spawning ground lies within Australia's Exclusive Economic Zone. After spawning females move south into cooler waters. Within a few months of hatching juvenile SBT probably use the Leeuwin current to help them migrate to the Great Australian Bight where they stay through summer and move away during winter. Young fish migrate seasonally between the south coast of Australia and the central Indian Ocean. Adults from three years or older are often found in the region of 40–45° S known as the "West Wind Drift". After five years of age SBT are seldom found in near shore surface areas, and their distribution extends over the southern circumpolar area throughout the Pacific, Indian and Atlantic Oceans. The species or species habitat occurs from northern WA southwards and across southern Australia and as far north as southern QLD (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=69402#:~:text=The%20Southern%20Bluefin%20Tuna%20is%20found%20in%20the%20south%2Dwest,Pacific%20Ocean%20(IUCN%202010; accessed 18th June 2025). Adult and juvenile SBT may therefore be present within the Operational Area after spawning although they are likely to be dispersed and transient as they undertake their current-assisted southern migration.

Table 4-2 – Key Indicator Species for Commercial Fisheries relevant to the Sauropod 3D MSS

Species	Distribution and Habitat	Biological Stock Range	Principal Depth Range	Reproduction and Recruitment	Spawning Season	Relevance to EP
Goldband snapper (*Pristipomoides multidens*)	Goldband snapper occur around offshore reefs, shoals, and areas of hard flat bottom with occasional benthos or vertical relief. Juveniles typically occur on uniform sedimentary habitat with no relief (Newman *et al.* 2008). Goldband snapper are widely distributed throughout northern Australia, from the Gascoyne region of WA to SE Queensland (Newman *et al.* 2008, 2018a; Saunders *et al.* 2018).	Australian populations of Goldband snapper are likely to form a single biological stock and there is gene flow among Goldband snapper from the Northern Territory (Timor Sea and Arafura Sea) and between the Western Australian management units (Kimberley, Pilbara and Gascoyne) (Saunders *et al.* 2018).	80-150 m (Jackson, et al. 2020).	Goldband snapper are highly fecund, serial, broadcast spawners and they can produce several million eggs per season (Newman *et al.* 2008). They spawn throughout their range (DPIRD 2019c). Goldband snapper can spawn approximately every three days / every week during the spawning period (Santos 2020). Juveniles remain in offshore waters with the adult spawning biomass but are found in association with different habitat (Newman *et al.* 2008). Fish are estimated to reach maturity after approximately 4.6 years (Saunders *et al.* 2018). Stock status: Adequate (Newman *et al.* 2023).	October – May (extended peak spawning period) (DPIRD 2019).	Given the known distribution and habitat depths, Goldband snapper are likely to occur and may spawn within the Operational Area. The proposed acquisition window overlaps with five months of the Goldband snapper's eight month spawning period.
Rankin cod (*Epinephelus multinotatus*)	Rankin cod are a demersal species distributed in continental shelf waters throughout tropical and sub-tropical northern Australia, from Shark Bay in WA to the NT (Newman *et al.* 2020a). They are generally found in warm coastal waters in association with drop-offs and deep rocky reefs. Juveniles are generally found in inshore coral reefs (Newman *et al.* 2008).	There is low genetic variation and extensive connectivity among populations over large distances (at least 1,400 km) (Gaughan *et al.* 2018). There is no evidence of discrete breeding populations of Rankin cod in Western Australia, indicating that there is a single biological stock between Shark Bay and the Kimberley (Gaughan *et al.* 2018; Newman *et al.* 2020a)	10-150 m (DPIRD 2019).	Rankin cod are highly fecund, serial, broadcast spawners that release eggs over a protracted spawning period (8-10 months of the year) and appear to spawn across much of the continental shelf of the Pilbara region (Gaughan *et al.* 2018). They spawn throughout their range (DPIRD 2019). Juveniles generally occur inshore from the adults in deeper waters, indicating there may be some movement of juveniles offshore with increasing age (Newman *et al.* 2008). Fish are estimated to reach maturity after approximately 2 years (Newman *et al.* 2020a). Stock status: Acceptable (Newman *et al.* 2023).	The species spawns for 8-10 months of the year in the Pilbara region (Gaughan *et al.* 2018). DPIRD (2019c) advise that the main spawning season is June – December and March (peaks August – October).	Given the known distribution and habitat depths, Rankin cod are likely to occur and may spawn within the Operational Area. The proposed acquisition window avoids the three-month peak spawning period from August – October.
Red emperor (*Lutjanus sebae*)	Red emperor occur from the central west coast of WA to southern Queensland (Newman *et al.* 2020b). Red emperor are widely distributed across the continental shelf and associated with reefs, lagoons, epibenthic communities, limestone sand flats and gravel patches (Newman *et al.* 2008).	The reproductive biology of Red emperor results in a very broad distribution of eggs and larvae, which results in genetic connectivity over a wide geographic range (Gaughan *et al.* 2018). There is extensive connectivity and gene flow among populations across northern Australia (Queensland to Shark Bay in WA), indicating a single genetic stock (Newman *et al.* 2020b). There is no evidence of discrete breeding populations between regions in WA (Gaughan *et al.*2018).	10-180 m (DPIRD 2019).	Red emperor are highly fecund, serial, broadcast spawners. Females release many batches of eggs over an extended spawning period. (Newman *et al.* 2008; Gaughan *et al.*2018). They spawn throughout their range (DPIRD 2019c). Juvenile fish are more common in nearshore waters and move offshore and recruit to the stock as they mature (Newman *et al.* 2008; van Herwerden *et al.* 2009). Fish are estimated to reach maturity after approximately 4 – 6 years (Newman *et al.* 2018). Stock status: Acceptable (Newman *et al.* 2023).	The species spawns for 10-12 months of the year on the north coast of WA (Gaughan *et al.* 2018). DPIRD (2019) advises that the main spawning season is September – June (with bimodal peaks September – November and January – March).	Given the known distribution and habitat depths, Red emperor are likely to occur and may spawn within the Operational Area. The proposed acquisition window overlaps with four months of the Red emperor's main 10 month spawning period, including one of the bimodal peaks.
Blue-spotted emperor (*Lethrinus punctulatus*)	The blue-spotted emperor are distributed primarily from around Geraldton and the Abrolhos Islands in WA to Darwin in the NT (Newman *et al.* 2020c). Greatest abundances are noted in the western Pilbara region (Newman *et al.* 2020c; Gaughan *et al.* 2018). The species is often found in association with shallow reef, sand and mud areas (Newman *et al.* 2008).	There is extensive connectivity among populations of Blue-spotted emperor over large distances, and there is considered to be a single biological stock in WA and potentially as far as the Northern Territory (Newman *et al.* 2020c).	5-110 m (DPIRD 2019).	Blue-spotted emperor are highly fecund, serial, broadcast spawners that release eggs over a protracted spawning period (11 months of the year) (Gaughan *et al.* 2018). They spawn throughout their range (DPIRD 2019). Fish are estimated to reach maturity after approximately 18 months (Newman *et al.* 2020c; Gaughan *et al.* 2018). Stock status: Acceptable (Newman *et al.* 2023).	The species spawns for 11 months of the year (Gaughan *et al.* 2018). DPIRD (2019) advises that the main spawning season is July – March (extended peak spawning period).	Given the known distribution and habitat depths, Blue-spotted emperor are likely to occur and may spawn within the Operational Area. However, the water depths at which the species occurs is largely outside the water depths of the Operational Area and so overlap is limited (refer to Figure 4-9). The proposed acquisition window overlaps with three months of the Blue-spotted emperor's nine month spawning period.

Species	Distribution and Habitat	Biological Stock Range	Principal Depth Range	Reproduction and Recruitment	Spawning Season	Relevance to EP
Ruby snapper (*Etelis* carbunculus)	Ruby snapper occur across the Indo-West pacific region. In Australia, ruby snapper are recorded from Geraldton, WA to north-eastern Queensland (Australian Museum 2019; Bray 2020).	The extent of the biological stock of Ruby snapper is uncertain.	150 -480 m (DPIRD 2019).	Ruby snapper spawn throughout their range (DPIRD 2019). Like other snappers, they are understood to be highly fecund, serial, broadcast spawners (Newman *et al.* 2008). Stock status: Sustainable - acceptable (Newman *et al.* 2023).	December-April (peak spawning period January-March) (DPIRD 2019).	Ruby snapper are likely to occur and may spawn within the Operational Area. However, the water depths at which the species occurs are largely outside the water depths of the Operational Area and so overlap is limited (refer to Figure 4-9). The proposed acquisition window overlaps with the Ruby snapper's spawning period.
Other demersal species (non-indicator species)	Variable (DPIRD 2019c).	Variable (DPIRD 2019c).	Variable (DPIRD 2019).	Spawn throughout their range (DPIRD 2019c). Stock status: Sustainable - acceptable (Newman *et al.* 2023). The proposed acquisition window overlaps with the likely spawning periods of these species.	Most likely to exhibit a peak spawning period from October-May (DPIRD 2019).	Other demersal fish species may spawn in the Operational Area.
Spanish mackerel (*Scomberomorus commerson*)	Spanish mackerel are a pelagic species that are widely distributed throughout Indo-West Pacific waters. In Australia, Spanish mackerel are found from approximately Geraldton in WA to Northern NSW (Langstreth *et al.* 2018). Adult movements in Australian waters occur over ranges up to 100 km (Mackie *et al.* 2010).	Spanish mackerel in northern Australia form three distinct genetic stocks: an east coast stock, a Torres Strait stock, and a single stock across the north and west coasts of Australia (Northern Territory and WA) (Langstreth *et al.* 2018). Consequently, the whole of the WA Mackerel Managed Fishery (spanning the Kimberley, Pilbara and Gascoyne regions) is defined as a single stock (Langstreth *et al.* 2018).	1 – 50 m (DPIRD 2019).	Form spawning schools around inshore reefs in north coast bioregion (Mackie *et al.* 2010; Lewis and Jones 2018). Spanish mackerel spawning occurs in coastal waters. They are serial spawners and alongshore dispersal of eggs maintains genetic homogeneity (Mackie *et al.* 2010). Females are capable of producing a batch of hundreds of thousands of eggs every 1-3 days during the spawning season, though a spawning frequency of 1.9 to 5.9 days has also been reported (McPherson 1993; Mackie *et al.* 2010). Larvae are commonly associated with reef lagoonal areas before juveniles move to estuary and foreshore nursery and feeding grounds where they tend to remain for the first year of life (McPherson 1993; Begg *et al.* 2006; Mackie *et al.* 2010). Fish are estimated to reach maturity after approximately 2 years (Langstreth *et al.* 2018). Stock status: Acceptable (Newman et al. 2023).	September – December (peak spawning) (DPIRD 2019).	Given the known distribution and habitat depths, the species may occur in the Operational Area but is highly unlikely to spawn in the Operational Area (refer to Figure 4-9). The proposed acquisition window does not overlap with the Spanish mackerel's four month spawning period.
Silver-lipped pearl oyster (*Pinctada maxima*)	Pearl oysters are a benthic species that are widely distributed throughout the Indo-West Pacific Region. In Western Australia they are found northward from Shark Bay, however the majority of the population occurs in the North-West Cape adjacent to Eighty Mile Beach (DoF 2016).	Pearl oysters in Western Australia are fished in four distinct zones from Exmouth to Kununurra.	Generally pearl oysters occur in water depths of 8-40 m (DoF 2016), however there is evidence to suggest they can occur in depths up to 60 m (Santos Keraudren Extension 3D MSS 2020 report).	Males mature at 3-4 years of age at 100-120 mm, and about half have changed to female by the time they reach 170 mm. Females are highly fecund, producing millions of eggs, however less than 1% of those fertilised survive the free-living larval stages (DoF, 2016). Stock status: Sustainable (Roelofs et al. 2024)	Synchronous spawning generally occurs from September to May each year, however the primary spawning period occurs in October-December (DoF 2016).	Pearl oysters are likely to occur within the Operational Area, however in depths greater than 40 m they are likely to occur in very low abundance. The proposed acquisition window overlaps five months of the pearl oysters nine month extended spawning period.



Figure 4-9 – Principal Spawning Ranges for Key Indicator Fish Species

4.3.5 Threatened and Migratory Species

The EPBC Act Protected Matters Search Tool (PMST) was used to identify listed species under the EPBC Act that may occur within the Operational Area and EMBA (report for a search conducted 26/06/2025 provided in Appendix B:). The results of the search inform the assessment of planned events in Section 7 as well as unplanned events in Section 8. It should be noted that the EPBC Protected Matters database is a general database that conservatively identifies areas in which protected species have the potential to occur.

A total of 78 EPBC Act listed species were identified as potentially occurring within the Operational Area. Of those listed, 19 are considered threatened marine species and 35 are migratory species under the EPBC Act (Table 4-3).

An additional 34 EPBC Act listed species were identified as potentially occurring within the wider EMBA. Of these, seven are considered threatened marine species and 13 are migratory species under the EPBC Act (Table 4-3).

Three migratory terrestrial species were identified in the PMST search as occurring within the EMBA, including the barn swallow (*Hirundo rustica*), grey wagtail (*Motacilla cinerea*) and yellow wagtail (*Motacilla flava*). These have been excluded from further assessment due to the lack of a credible impact scenario.

The full list of species identified in the PMST search is provided in the EPBC Act PMST report (Appendix B:).

Table 4-3 – Threatened and Migratory Marine Species Listed Potentially Occurring within the Operational Area and EMBA

Scientific Name	Common Name	Threatened	Migratory	Relevance to EP	
				Operational Area	EMBA
Marine Mammals					
Balaenoptera borealis	Sei whale	Vulnerable	✓	✓	✓
Balaenoptera musculus	Blue whale	Endangered	✓	✓	✓
Balaenoptera physalus	Fin whale	Vulnerable	✓	✓	✓
Balaenoptera edeni	Bryde's whale	N/A	✓	✓	✓
Megaptera novaeangliae	Humpback whale	N/A	✓	✓	✓
Orcinus orca	Killer whale	N/A	✓	✓	✓
Physeter macrocephalus	Sperm whale	N/A	✓	✓	✓
Tursiops aduncus	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	N/A	✓	✓	✓
Dugong dugon	Dugong	N/A	✓	X	✓
Orcaella heinsohni	Australian snubfin dolphin	Vulnerable	✓	X	✓
Sousa sahulensis	Australian humpback dolphin	Vulnerable	✓	X	✓
Marine Reptiles					
Caretta caretta	Loggerhead turtle	Endangered	✓	✓	✓
Chelonia mydas	Green turtle	Vulnerable	✓	✓	✓
Dermochelys coriacea	Leatherback turtle	Endangered	✓	✓	✓
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	✓	✓	✓
Natator depressus	Flatback turtle	Vulnerable	✓	✓	✓
Aipysurus apraefrontalis	Short-nosed sea snake	Critically Endangered	X	X	✓
Aipysurus foliosquama	Leaf-scaled sea snake	Critically Endangered	X	X	✓
Crocodylus porosus	Salt-water crocodile	N/A	✓	X	✓
Sharks and Rays					
Anoxypristis cuspidata	Narrow sawfish	N/A	✓	✓	✓
Carcharodon carcharias	Great white shark	Vulnerable	✓	✓	✓
Isurus oxyrinchus	Shortfin mako shark	N/A	✓	✓	✓
Manta alfredi	Reef manta ray	N/A	✓	✓	✓
Manta birostris	Giant manta ray	N/A	✓	✓	✓
Pristis pristis	Freshwater sawfish	Vulnerable	✓	✓	✓
Pristis zijsron	Green sawfish	Vulnerable	✓	✓	✓
Rhincodon typus	Whale shark	Vulnerable	✓	✓	✓
Carcharhinus longimanus	Oceanic whitetip shark	N/A	✓	✓	✓
Isurus paucus	Longfin mako	N/A	✓	✓	✓
Pristis clavata	Dwarf sawfish	Vulnerable	✓	X	✓
Sphyrna lewini	Scalloped hammerhead	Conservation Dependent	X	✓	✓
Carcharias taurus	Grey nurse shark	N/A	✓	✓	✓

Scientific Name	Common Name	Threatened	Migratory	Relevance to EP	
				Operational Area	EMBA
Avifauna					
Numenius madagascariensis	Eastern curlew	Critically Endangered	✓	✓	✓
Calidris canutus	Red knot	Vulnerable	✓	✓	✓
Phaethon lepturus fulvus	Christmas Island white-tailed tropicbird	Endangered	X	✓	✓
Papasula abboti	Abbott's booby	Endangered	X	✓	✓
Fregata minor	Great frigatebird	N/A	✓	✓	✓
Actitis hypoleucos	Common sandpiper	N/A	✓	✓	✓
Anous stolidus	Common noddy	N/A	✓	✓	✓
Calidris acuminata	Sharp-tailed sandpiper	Vulnerable	✓	✓	✓
Calidris melanotos	Pectoral sandpiper	N/A	✓	✓	✓
Calonectris leucomelas	Streaked shearwater	N/A	✓	✓	✓
Fregata ariel	Lesser frigatebird	N/A	✓	✓	✓
Pandion haliaetus	Osprey	N/A	✓	✓	✓
Phaethon lepturus	White-tailed tropicbird	N/A	✓	✓	✓
Calidris ferruginea	Curlew sandpiper	Critically Endangered	✓	X	✓
Phaethon rubricauda westralis	Red-tailed tropicbird	Endangered	X	✓	✓
Sternula albifrons	Little tern	Vulnerable	✓	X	✓
Sula leucogaster	Brown booby	N/A	✓	X	✓
Sterna dougallii	Roseate tern	N/A	✓	X	✓

4.3.5.1 Listed Threatened Species Recovery Plans and Conservation Advice

Species Recovery Plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities (DoEE, n.d.). Recovery plans are enacted under the EPBC Act and remain in force until the species is removed from the threatened list. Conservation advice provides guidance on immediate recovery and threat abatement activities that can be undertaken to ensure the conservation of a listed species or ecological community (DoEE, n.d.).

Table 4-4 lists the applicable recovery plans and/or conservation advice for EPBC Act-listed species within the Operational Area and EMBA, as identified by the PMST search. Any relevant requirements applicable to the activity will be considered as part of the Environmental Risk Assessment (Section 7 and Section 8).

Table 4-4 – Recovery Plans and Conservation Advice for EPBC Act-Listed Species Occurring Within the Operational Area and EMBA

Species	Recovery Plan / Conservation Advice	Key Threats Identified in the Plan/ Advice	Actions Relevant to the Sauropod 3D MSS	Environmental Risk Assessment Section
All vertebrate fauna	Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018).	Marine-based sources of debris.	Contribute to long-term prevention of marine debris, through waste management and resource recovery. Limit the amount of single use plastic material lost to the environment in Australia.	Section 8.7
Mammals				
Sei whale	Conservation advice *Balaenoptera borealis* Sei whale (TSSC, 2015a).	Anthropogenic noise and acoustic disturbance. Vessel strike.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Blue whale	Conservation management plan for the Blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (DoEE, 2015a).	Noise interference. Vessel disturbance.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Fin whale	Conservation advice *Balaenoptera physalus* Fin whale (TSSC, 2015b).	Anthropogenic noise and acoustic disturbance. Vessel strike.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Humpback whale	There is no approved Conservation Advice for this species.	Noise Interference (including seismic surveys). Vessel disturbance and strike.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Australian snubfin dolphin	Conservation Advice for *Orcaella heinsohni (*Australian snubfin dolphin*)* (DCCEEW, 2025)	Anthropogenic noise and acoustic disturbance. Vessel disturbance and strike.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Australian humpback dolphin	Conservation Advice for *Sousa sahulensis (*Australian humpback dolphin*)* (DCCEEW, 2025)	Anthropogenic noise and acoustic disturbance. Vessel disturbance and strike.	Assessing and addressing anthropogenic noise. Minimising vessel collisions.	Section 7.1, Section 7.2 Section 8.5
Reptiles				
Loggerhead turtle	Recovery plan for marine turtles in Australia (DoEE, 2017)	Threats to the WA stock include: Light pollution. Vessel disturbance (strike) – rated as 'almost certain' likelihood of occurrence, minor consequence. Noise interference (acute) – rated as a 'likely' likelihood of occurrence, minor consequence. An "almost certain" rating means the event is expected to occur every year. A "minor" rating means that individuals are affected, but there is no effect at stock level.	Minimise light pollution No specific actions for vessel disturbance are identified by the plan. The Australian Government has developed a National Strategy for Mitigating Vessel Strike of Marine Mega-fauna (2017) to provide guidance on reducing the risk of vessel collisions and the impacts they may have on marine fauna. A precautionary approach to acute noise exposure should be applied to seismic surveys.	Section 7.7 Section 8.5 Section 7.1, Section 7.2
Hawksbill turtle	Recovery plan for marine turtles in Australia (DoEE, 2017)	Threats to the WA stock include: Light pollution. Vessel disturbance – rated as 'almost certain' likelihood of occurrence, minor consequence. Noise interference (acute) – rated as a 'possible' likelihood of occurrence, minor consequence.	Minimise light pollution No specific actions for vessel disturbance are identified by the plan. The Australian Government has developed a National Strategy for Mitigating Vessel Strike of Marine Mega-fauna (2017) to provide guidance on reducing the risk of vessel collisions and the impacts they may have on marine fauna. A precautionary approach to acute noise exposure should be applied to seismic surveys.	Section 7.7 Section 8.5 Section 7.1, Section 7.2
Green turtle	Recovery plan for marine turtles in Australia (DoEE, 2017)	Threats to the WA stock include: Light pollution. Vessel disturbance (strike) – rated as a 'likely'* likelihood of occurrence, minor consequence.	Minimise light pollution No specific actions for vessel disturbance are identified by the plan. The Australian Government has developed a National Strategy for Mitigating Vessel Strike of Marine Mega-fauna	Section 7.7 Section 8.5 Section 7.1, Section 7.2

Species	Recovery Plan / Conservation Advice	Key Threats Identified in the Plan/ Advice	Actions Relevant to the Sauropod 3D MSS	Environmental Risk Assessment Section
		Noise interference (acute and chronic) – rated as 'unknown' likelihood of occurrence, minor consequence. *A "likely" rating means the event is expected to occur at least once every five years.	(2017) to provide guidance on reducing the risk of vessel collisions and the impacts they may have on marine fauna. A precautionary approach to acute noise exposure should be applied to seismic surveys.	
Flatback turtle	Recovery plan for marine turtles in Australia (DoEE 2017)	Threats to the Pilbara stock include: Light pollution. Vessel disturbance (strike) – rated as an 'almost certain' likelihood of occurrence, minor consequence. Noise interference (acute) – rated as a 'likely' likelihood of occurrence, minor consequence.	Minimise light pollution No specific actions for vessel disturbance are identified by the plan. The Australian Government has developed a National Strategy for Mitigating Vessel Strike of Marine Mega-fauna (2017) to provide guidance on reducing the risk of vessel collisions and the impacts they may have on marine fauna. A precautionary approach to acute noise exposure should be applied to seismic surveys.	Section 7.7 Section 8.5 Section 7.1, Section 7.2, 7.2
Leatherback turtle	Recovery plan for marine turtles in Australia (DoEE 2017) Approved conservation advice for *Dermochelys coriacea* (Leatherback turtle) (DEWHA 2008b)	Vessel disturbance	Minimising vessel collisions.	Section 8.5
Short-nosed sea snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed sea snake) (DSEWPaC 2011)	No threats identified that are applicable to this EP.	N/A	N/A
Leaf-scaled sea snake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPaC, 2011)	No threats identified that are applicable to this EP.	N/A	N/A
				N/A
Sharks and rays				
Great white shark	Recovery plan for the Great white shark (*Carcharodon carcharias*) (DSEWPaC 2013)	No threats identified that are applicable to this EP.	N/A	N/A
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014)	No threats identified that are applicable to this EP.	N/A	N/A
Dwarf sawfish	Approved Conservation Advice for *Pristis lavate* (Dwarf sawfish) (TSSC 2009), Sawfish and River Shark Multispecies Recovery Plan (DoE 2015b)	No threats identified that are applicable to this EP. No threats identified that are applicable to this EP.	N/A	N/A
Green sawfish	Approved Conservation Advice for Green sawfish (TSSC 2008), Sawfish and River Shark Multispecies Recovery Plan (DoE 2015b)	No threats identified that are applicable to this EP. No threats identified that are applicable to this EP.	N/A	N/A
Whale shark	Conservation advice *Rhincodon typus* Whale shark (TSSC 2015d)	Vessel disturbance	Minimising vessel collisions.	Section 8.5
Freshwater sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014) Sawfish and River Shark Multispecies Recovery Plan (DoE 2015b)	No threats identified that are applicable to this EP. No threats identified that are applicable to this EP.	N/A	
Seabirds				
Red knot	Conservation advice *Calidris canutus* red knot (DCCEEW, 2024)	Acute Pollution (oil pollution).	Manage disturbance at important sites when Red knots are present.	Section 7.1, Section 7.2, Section 7.7, Section 8.5
Curlew sandpiper	Conservation advice *Calidris ferruginea* curlew sandpiper (DCCEEW, 2023)	Acute Pollution (oil pollution).	Manage disturbance at important sites when Curlew sandpipers are present.	Section 7.1, Section 7.2, Section 7.7, Section 8.5
Far Eastern curlew	Conservation advice *Numenius madagascariensis* eastern curlew (DCCEEW, 2023)	Acute Pollution (oil pollution).	Manage disturbance at important sites when Eastern curlews are present.	Section 7.1, Section 7.2, Section 7.7, Section 8.5
Common sandpiper, Red knot, Pectoral sandpiper, Sharp-tailed sandpiper, Greater sand plover	Wildlife Conservation Plan for Migratory Shorebirds (DCCEEW, 2024)	Acute Pollution (oil pollution).	Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes.	Section 7.1, Section 7.2, Section 7.7, Section 8.5
Abbott's booby	Conservation Advice *Papasula abbotti* Abbott's booby (TSSC 2020)	No threats identified that are applicable to this EP.	N/A	N/A

4.3.5.2 Biologically Important Areas

Biologically Important Areas (BIAs) are regions where a particular species is known or likely to display important behaviours such as breeding, foraging, nesting or migration (DoEE n.d.). BIAs have no legal status; however, they provide information to help inform regulatory and management decisions. Table 4-5 identifies the BIAs associated with threatened and migratory species potentially occurring within the Operational Area and EMBA, as identified during the PMST search (Appendix B:). Further information on BIAs is provided in the individual species descriptions below (Section 4.3.6 and Section 4.3.9).

Table 4-5 – Threatened and Migratory Species' BIAs within the Operational Area and EMBA

Species	BIA	Location	Distance from Operational Area
Humpback whale	Migration	North-west WA coast	15 km
Pygmy Blue Whale	Migration	WA waters	72 km
Whale shark	Foraging	NWS 200 m isobath	Overlaps
Dwarf sawfish	Foraging, nursing and pupping	Eighty Mile Beach	90 km
Freshwater sawfish	Foraging and pupping	Eighty Mile Beach	90 km
Green sawfish	Nursing and pupping	Eighty Mile Beach	90 km
Flatback turtle	Internesting	Eighty Mile Beach	20 km
	Internesting*	Eighty Mile Beach	60 km
Lesser frigatebird	Breeding	Bedout Island	Overlaps
White-tailed tropicbird	Breeding and foraging	North-West and Rowley Shoals	Overlaps
Wedge-tailed shearwater	Breeding	Port Hedland	150 km
Little tern	Breeding and resting	Rowley Shoals	23 km
Lesser crested tern	Breeding	Bedout Island	60 km
Roseate tern	Breeding and resting	Bedout Island	60 km
Brown booby	Breeding	Pilbara coast	40 km

* Habitat critical to the survival of a marine turtle species (DoEE 2017).

4.3.6 Marine Mammals

Several species of marine mammals are known to occur in the region and have wide distributions that are associated with feeding and migration patterns linked to reproductive cycles. There are 27 marine mammal species known to occur regularly in the NWMR, including 16 whale species and at least 11 species of dolphin (DEWHA 2008a).

Five threatened and migratory and eleven migratory marine mammal species were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in the EMBA.

Cetacean species, such as the Pygmy Blue Whale and Humpback whale, are known to transit between Southern Ocean feeding grounds and tropical water breeding grounds. However, some cetacean species (e.g., spotted bottlenose dolphin) are thought to be resident in the region throughout the year (DEWHA 2008a).

Dugongs are also present in the region, preferring shallow waters along the coast and around shoals where seagrass habitats are available (DEWHA 2008a). The Operational Area is highly unlikely to support Dugong populations, due to the open ocean location, water depths and lack of suitable habitat.

A description of the identified threatened and/or migratory marine mammals is provided in Table 4-6 including their distribution, migratory movements, preferred habitat and likely presence within the Operational Area and EMBA.

Two species have biologically important areas within the Operational Area and wider EMBA, as follows:

- The Humpback whale migration, breeding and calving BIAs extend along the length of the coast of WA, to its northernmost extent offshore of the Kimberley region. The migration BIA is located approximately 15 km south of the Operational Area. The breeding, nursing and calving BIA is located 255 km east of the Operational Area and outside the wider EMBA (Figure 4-10).
- The Pygmy Blue Whale migration BIA passes along the shelf edge at depths between 500 m and 1,000 m. The migration BIA is located 72 km to the north of the Operational Area (Figure 4-11).

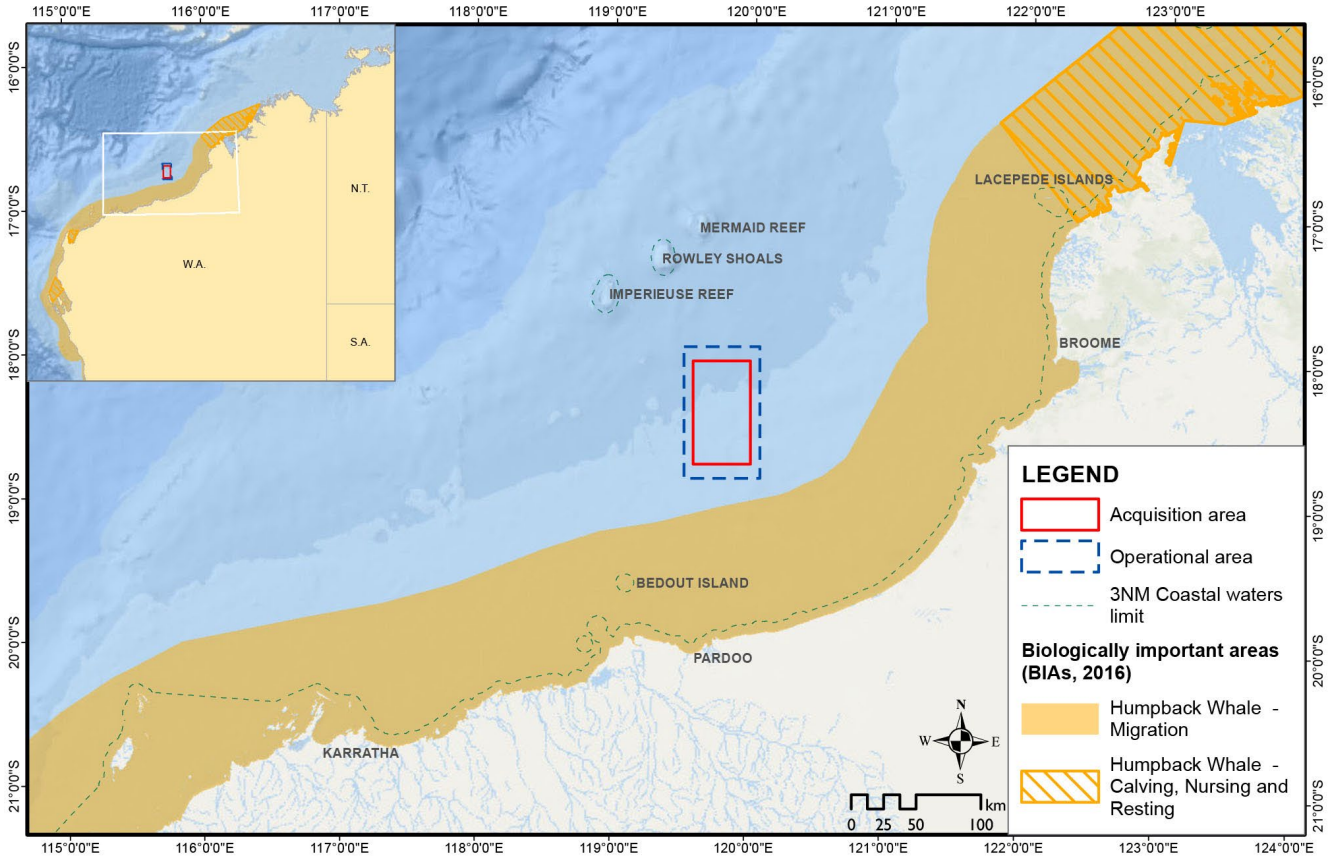


Figure 4-10 – Humpback Whale BIAs

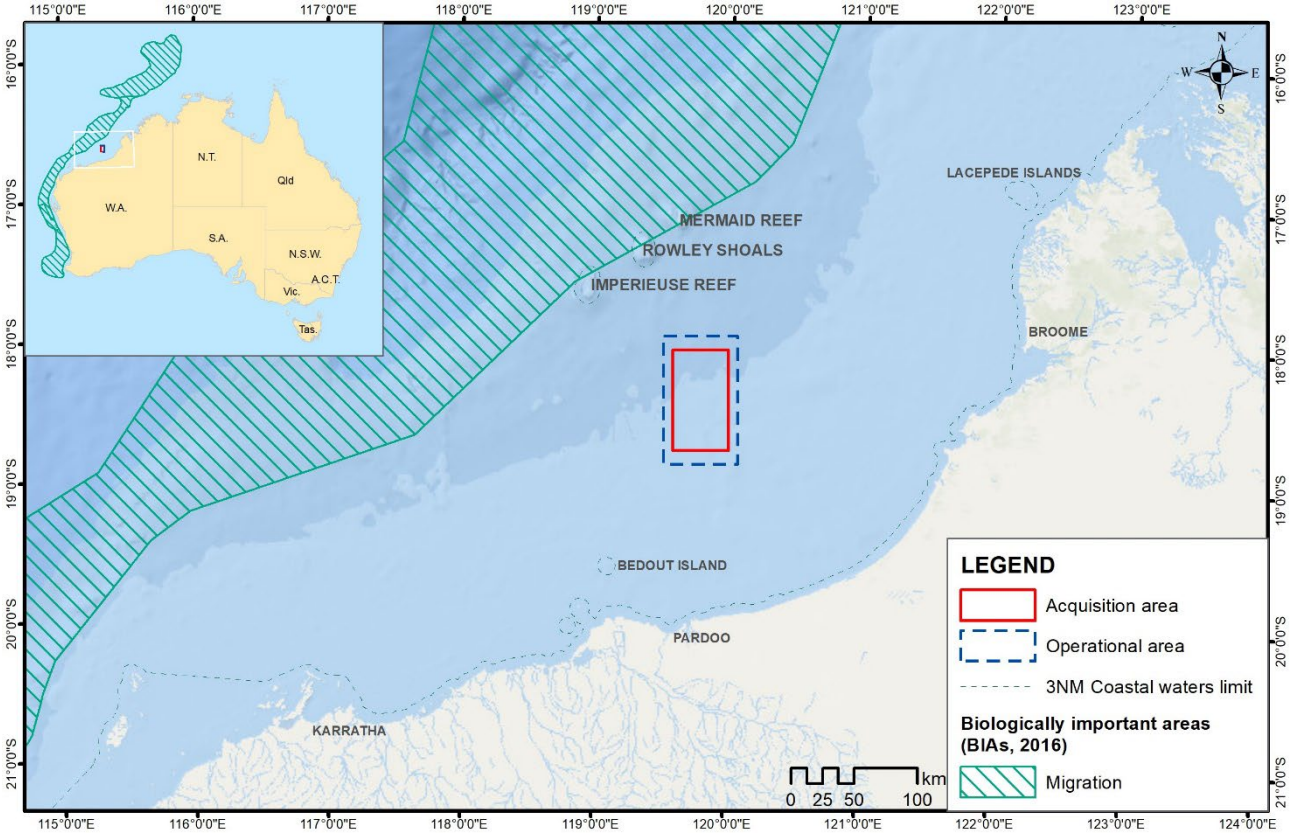


Figure 4-11 – Pygmy Blue Whale BIAs

Table 4-6 – Threatened and Migratory Mammals Potentially Occurring Within the Operational Area and EMBA

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
Mammals Potentially Occurring Within the Operational Area			
Blue whale	Two subspecies of blue whale are found in the southern hemisphere: The Pygmy Blue Whale (*Balaenoptera musculus brevicauda*) and the Antarctic blue whale (*B. m. intermedia*). During the southern hemisphere summer, Antarctic blue whales are usually found south of 60ºS, while Pygmy Blue Whales are usually found north of 55ºS (DoEE 2019). Therefore, Antarctic blue whales are highly unlikely to be present within or nearby the Operational Area. The Pygmy Blue Whale has a worldwide oceanic distribution and are regularly sighted in Australian waters. Whilst the species prefer deep waters, whale sightings in Australia are usually related to migration purposes or opportunistic feeding. The Pygmy Blue Whale has BIAs for migration and foraging along the WA coastline. The EMBA overlaps with the migration BIA. Satellite tracking of Pygmy Blue Whales undergoing their northern migration indicates whales generally follow known migration paths, transiting offshore from Carnarvon and north of the Rowley Shoals (Double *et al.* 2012, 2014; Thums, *et al.* 2022).	The annual northbound migration past Exmouth and north-western Australia has been detected between April and August, with the return southbound migration from October to the end of December, peaking in November and early December (McCauley and Jenner 2010; McCauley and Duncan 2011; Double *et al.* 2012; Double *et al.* 2014; Thums *et al.* 2022).	The species' migration BIA is located approximately 72 km north of the Operational Area. Due to this and the absence of known foraging, resting and calving habitat, presence within the Operational Area and EMBA is likely to be infrequent and consist of transitory individuals during migration months. Individuals may be present in the northern region of the wider EMBA during seasonal migrations. Acquisition of the survey may overlap the commencement of the northbound migration (April-August) but avoids the southbound migration period for Pygmy Blue Whales in the region (October to December).
Humpback whale	Humpback whales occur globally and throughout Australian waters with their distribution being influenced by migratory pathways and aggregation areas for resting, breeding and calving (DoEE 2019). There are two genetically distinct populations of Humpback whales in Australia (i.e. west coast and east coast) (DoEE 2019). Major breeding areas have been identified for the western Australian population in the Kimberley region and in particularly between Lacepede Islands and Camden Sound (Jenner *et al.* 2001). Camden Sound is the northern most limit for the majority of west coast whales and is considered to be an important breeding area (Jenner *et al.* 2001). The west coast population of the Humpback whale is thought to be increasing in size by about 9% per year (DoEE 2019); estimates conducted suggest that in 2008 the population migrating up the WA coast was at 21,750 individuals (Hedley *et al.* 2011). Humpback whale songs change in composition among age groups, but most energy is consistently between 200 – 500 Hz (Salgado Kent *et al.* 2012).	Humpback whales undergo an annual migration from the summer feeding grounds in Antarctica to the breeding and calving grounds in Camden Sound (approximately 540 km from the Operational Area) occurs between late May/June and October (DoEE 2019). During migration, individuals travel alone or in temporary aggregations of generally non-related individuals. The numbers of Humpback whales at Camden Sound peak between June and September each year (DoEE 2019). The migration corridor tends to be within the 200 m isobath (Jenner *et al.* 2001). Individuals are likely to be present in the southern region of the wider EMBA during seasonal migrations.	The Operational Area is located 15 km north of the migration BIA, with breeding known to occur within the area. However, due to the species' breeding and calving BIA being located approximately 250 km north-east of the Operational Area, the presence of the species within the Operational Area is likely to be infrequent and consist of transitory individuals.
Bryde's whale	Bryde's whales are distributed throughout oceanic and inshore, tropical and warm temperate waters, between 40˚N and 40˚S year-round. They have been recorded off all states of Australia, with the exception of the Northern Territory (DoEE 2019). The inshore form of the Bryde's whale is typically limited to the 200 m depth contour and breeds and calves year-round, whilst the offshore form is found in deeper waters (500 to 1,000 m) and breeds and calves over several months during winter (Best *et al.* 1984; Kato 2002). The nearest known area of aggregation is Ningaloo Reef (over 740 km away) (DoEE 2019). Aerial surveys carried out in 2009, between mainland Australia and Scott Reef (approximately 465 km north-east of the Operational Area) recorded Bryde's whales in low numbers (RPS 2010). Between September 2006 and June 2009 sea noise loggers deployed within Scott Reef also recorded Bryde's whales' calls year-round (McCauley 2011; RPS 2010). No specific feeding or breeding grounds have been discovered off Australia.	Inshore coastal forms appear to breed and give birth throughout the year, while the offshore form appears to have a protracted breeding and calving season over several months during winter. There is currently no evidence of large-scale movements of the inshore form of the Bryde's whale. However, the offshore form may migrate seasonally, heading towards warmer tropical waters during the winter months. It should be noted that there is limited data on migration, mating, breeding and calving patterns for Bryde's whales.	No specific feeding or breeding grounds have been discovered off Australia and given the distance to the closest known aggregation area at Ningaloo Reef (approximately 740 km away), the presence of the species within the Operational Area and wider EMBA is likely to be infrequent.
Fin whale	Fin whales occur from polar to tropical waters, but rarely in inshore waters (DoEE 2019). Fin whales are widely distributed in both hemispheres between latitudes 20–75° S (Mackintosh 1966). This species is common in temperate waters, the Arctic Ocean and Southern Ocean. Fin whales feed intensively in high latitudes and may feed to some extent, depending upon prey availability and locality, in lower latitudes. Fin whales feed on planktonic crustacea, some fish and cephalopods (crustaceans). Fin whales are killed by ship strike more than any other whale, which may be due to surface feeding (DoEE 2019). The Australian Antarctic waters are important feeding grounds for Fin whales. Sightings of Fin whales feeding in the Bonney Upwelling area indicate that this area is also a potentially important feeding ground. There is no known mating or calving areas for Fin whales in Australian waters.	There is insufficient data to prescribe migration times and routes for Fin whales, however recent sightings in Australian waters include summer and autumn months. Fin whale calls have been detected in Antarctic waters from February to July (DoEE 2019).	Given the wide-ranging nature of this species, lack of nearby important habitat and a preference for deeper offshore waters, the presence of the species within the Operational Area and wider EMBA is likely to be limited.

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
Sei whale	Sei whales are considered a cosmopolitan species, ranging from polar to tropical waters, but tend to be found more offshore than other species of large whales. They show well defined migratory movements between polar, temperate and tropical waters (Mackintosh 1965). Migratory movements are essentially north–south with little longitudinal dispersion. Sei whales have been infrequently recorded in Australian waters (Bannister *et al.* 1996). The similarity in appearance of sei whales and Bryde's whales has resulted in confusion about distributional limits and frequency of occurrence. This species is known to breed in tropical and subtropical waters, while Australian Antarctic waters are important feeding grounds for Sei whales, as are temperate, cool waters (Horwood 1987).	The movements and distributions of Sei whales in Australian waters are unpredictable and not well documented. Information suggests that Sei whales have the same general pattern of migration as most other baleen whales, although it is timed a little later and they do not go to such high latitudes (Gambell 1968).	Given the wide-ranging nature of this species, lack of nearby important habitat and a preference for deeper offshore waters, the presence of the species within the Operational Area and wider EMBA is likely to be limited.
Killer whale	The Killer whale is found in all of the world's oceans, from the Arctic and Antarctic regions to tropical seas (Ford *et al.* 2005). The species has been recorded in all the coastal waters of Australia, with concentrations reported in Tasmania, and common sightings in South Australia and Victoria (DoEE 2019). The preferred habitat of the species includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters. They may be more common in cold, deep waters, but off Australia, Killer whales are most often seen along the continental slope and on the shelf, particularly near seal colonies. Killer whales have regularly been observed within the Australian territorial waters along the ice edge in summer. No areas of significance and no determined migration routes have been identified for this species within waters off WA (DoEE 2019).	Killer whales are known to make seasonal movements and follow regular migratory routes. Mating is known to occur all year round, whilst the calving season spans several months.	Given the wide-ranging nature of this species, lack of nearby important habitat and a preference for coastal waters, the presence of the species within the Operational Area is unlikely. Presence within the wider EMBA is also likely to be limited.
Sperm whale	Sperm whales are abundant from polar waters to the equator and typically found in deep temperate and tropical offshore waters (greater than 600 m) or closer to the shore in water depths greater than 200 m (DoEE 2019). Sperm whales tend to be found where the seabed rises steeply from great depth and are probably associated with concentrations of major food in areas of upwelling (Bannister *et al.* 1996). There is limited information on their distribution in Australian waters, although they have been recorded off the coast of all Australian states, where they occur in groups of up to 50 individuals (DoEE 2019). Sperm whales have been recorded from all Australian states. Sperm whales have previously been recorded both acoustically and during aerial surveys, on the North West Shelf, suggesting that they occasionally occur in the deep, oceanic waters of the region (RPS 2010).	Sperm whales are seasonal breeders, but the mating season is prolonged, extending from late winter through to early summer. In the Southern Hemisphere, conceptions occur from July to March, peaking in September and December. Calves may be born in tropical and temperate waters and are mainly born between November and March.	Given the wide-ranging nature of this species, lack of nearby important habitat and a preference for deeper offshore waters, the presence of the species within the Operational Area and wider EMBA is likely to be limited.
Spotted bottlenose dolphin (Arafura/ Timor Sea populations)	The Spotted bottlenose dolphin occurs in tropical and subtropical coastal and shallow offshore waters of the Indian Ocean, Indo-Pacific region and the western Pacific Ocean (DoEE 2019). In Australia, the species is generally found in inshore areas such as bays and estuaries, nearshore waters, open coast environments and shallow offshore waters. The species is typically found close to shore, within approximately 1 km from the nearest land or oceanic islands, or in water depths of less than 30 m (Reeves *et al.* 2003). The closest calving BIA is located at Roebuck Bay, approximately 150 km from the Operational Area. The population present at Roebuck Bay is likely to be resident due to rich and consistent prey available.	Calving peaks occur in spring and summer or spring and autumn. Knowledge of the species seasonal migration and breeding is largely unknown; however, it is inferred that only the Arafura-Timor Sea population is migratory.	Given the species preference for shallow water and close proximity to shore, the presence of the species within the Operational Area is likely to be limited. The species may occasionally be present in the shallower southern region of the wider EMBA.
Mammals potentially occurring within the EMBA			
Dugong	Dugongs are also known to occur along the coast throughout the Kimberley to the Western Australia–Northern Territory border; however, population estimates for these areas are not available (DSEWPaC 2012). Dugongs inhabit protected shallow coastal areas, such as wide shallow bays and mangrove channels. Some of the coastal waters in the region support significant populations of Dugongs, including Shark Bay, which has an estimated population of around 10,000 individuals (DSEWPaC 2012). Specific areas supporting Dugongs in Western Australia include: Shark Bay; Ningaloo and Exmouth Gulf; the Pilbara coast (Exmouth Gulf to De Grey River) (Marsh *et al.* 2002); and Eighty Mile Beach and Kimberley Coast Region, including Roebuck Bay (Brown *et al.* 2014). Dugongs feed primarily on seagrass in shallow waters less than 10 m deep and mostly above 3 m depth (Burbidge *et al.* 2014). A survey carried out in northern Australia between 1994 and 2001 using time-depth recorders deployed on 15 Dugongs logged a total of 39,507 dives. The survey identified that Dugongs spend the majority of their time in water depths of less than 3 m (Chilvers *et al.*2004). The closest foraging BIA is located south of the Operational Area, along the Dampier Peninsula (approximately 650 km away).	The patterns of Dugong movement in Western Australia are not well understood, it is thought that Dugongs move in response to seagrass and water temperature. Dugongs are generally seasonal breeders, and the seasonality of breeding is more marked in the sub-tropics (mostly spring, early summer calving) than in the tropics.	The PMST search identified the species as potentially occurring within the EMBA, and not within the Operational Area. The closest foraging BIA for this species is 150 km away (Roebuck Bay) from the Operational Area. Due to the absence of suitable habitat and preference for shallow waters, presence of the species within the EMBA is likely to be limited.
Australian snubfin dolphin	The Australian snubfin dolphin (*Orcaella heinsohni*) inhabits shallow coastal, estuarine, and tidal river waters primarily in northern Australia, including Queensland, Northern Territory, and northwestern Australia (DCCEEW, 2025). Its distribution spans remote northern coastlines from Western Australia through to Queensland, typically in waters less than 20 meters deep near freshwater outflows, though individuals have been recorded up to 23 km offshore (Bouchet et al., 2021). The species favours complex, sheltered habitats such as bays, mangroves, and estuaries that support diverse prey, facilitating feeding, socialising, and year-round breeding (Palmer et al., 2014). Populations are relatively fragmented and localised but are continuous with those in Papua New Guinea, distinct from Asian populations (DCCEEW 2025).	Australian snubfin dolphins exhibit relatively localised movements without extensive seasonal migrations (DCCEEW, 2025), with breeding and calving peaking around the transition from the dry to wet season (approximately June to October) in northern Australia, though timing varies regionally. Despite a lack of defined migratory patterns, studies reveal significant connectivity and temporary movements between sites such as Darwin Harbour, Bynoe Harbour, and Shoal Bay, NT (Brooks et al. 2017), indicating some movement flexibility.	The PMST search identified Australian snubfin dolphins as potentially occurring within the EMBA and not within the Operational Area. There are no known BIAs for this species located within the EMBA. Due to their preference for sheltered habitats such as bays, mangroves, and estuaries, presence of the species within the EMBA is likely to be limited.

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
Australian humpback dolphin	The Australian humpback dolphin (*Sousa sahulensis*) is found in small, fragmented populations along the tropical and subtropical coastal waters of the Sahul Shelf, spanning northern Australia to southern New Guinea (DCCEEW 2025; Jefferson & Rosenbaum, 2014). In Australia, its range extends from Shark Bay, Western Australia, to the Queensland/New South Wales border, with strong site fidelity in shallow, often turbid nearshore waters up to 20 km from the coast, including embayments, estuaries, and mangrove-lined channels (DCCEEW 2025; Raudino et al., 2018; Hanf et al., 2022). Typically inhabiting depths of 5–15 m, the species is associated with coastal, estuarine, and tidal river waters, although they have been recorded up to 60 km offshore near Barrow Island, the Montebello Islands, and the western Lowendal Islands (Raudino et al., 2018). Populations are small, spatially structured, and generally number fewer than 150 mature individuals per subpopulation, with the largest population likely under 1,000 individuals (DCCEEW 2025). Key concentrations are noted near North West Cape, Exmouth Gulf, Darwin Harbour, and Cape York (DCCEEW 2025).	Australian humpback dolphins exhibit relatively localised movements without extensive seasonal migrations. Seasonal shifts in distribution may occur on a local scale, often linked to reproductive behaviour or prey availability. Despite a lack of defined migratory patterns, there is evidence of movement or connectivity between nearby local sites such as Darwin Harbour, Bynoe Harbour, and Shoal Bay, NT (Brooks et al. 2017), indicating some movement flexibility.	The PMST search identified Australian humpback dolphins as potentially occurring within the EMBA and not within the Operational Area. There are no known BIAs for this species located within the EMBA. Due to their preference for sheltered habitats such as bays, mangroves, and estuaries, presence of the species within the EMBA is likely to be limited.

4.3.7 Sharks and Rays

The NWMR supports high species richness of shark, sawfish and rays stemming from the diversity of marine environments. There are approximately 500 shark and sawfish species globally, with 94 species found within the NWMR (i.e. 19% of the world's shark species) (DEWHA 2008).

One threatened, five threatened and migratory, and seven migratory shark and ray species were identified in the PMST search as potentially occurring in the Operational Area and EMBA (Table 4-3).

A description of the identified threatened and/or migratory sharks, sawfish and rays is provided in Table 4-7 including their distribution, migratory movements, preferred habitat and likely presence within the Operational Area and EMBA.

One BIA for the shark and ray species described in Table 4-3 has been identified within the Operational Area, while another three were identified within the wider EMBA. The Whale shark foraging BIA extends northwards from Ningaloo along the 200 m isobath. The Operational Area overlaps with the BIA (Figure 4-12). The EMBA overlaps the foraging, nursing and pupping BIAs for Dwarf sawfish and the nursing and pupping BIAs for Freshwater sawfish and Green sawfish.

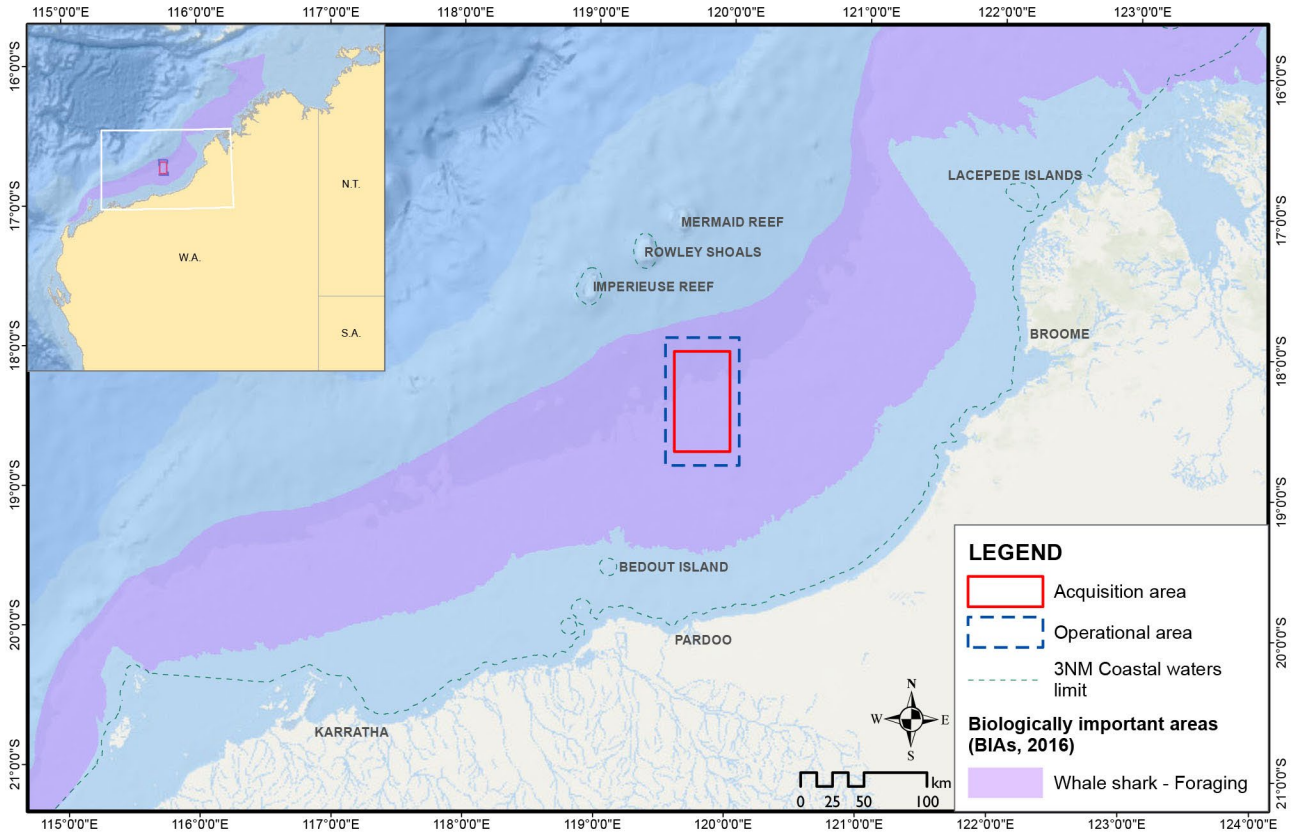


Figure 4-12 – Whale Shark BIAs overlapping the Operational Area

Table 4-7 – Threatened and Migratory Sharks and Rays Potentially Occurring Within the Operational Area and EMBA

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
Sharks and rays potentially occurring within the Operational Area			
Whale shark	The whale shark occurs in both tropical and temperate waters with a typically oceanic and cosmopolitan distribution (Colman 1997). They are most commonly recorded in WA, the Northern Territory and Queensland, although they have been sighted occasionally in New South Wales and Victoria. According to the DoEE's Conservation Advice on whale sharks, the species is known to aggregate at Christmas Island (approximately 1,700 km away) between December and January and at Ningaloo Reef (approximately 740 km away) between March and July to feed on krill and baitfish associated with coral spawning events (DoEE 2019). After this period, Whale sharks disperse from Ningaloo and are understood to forage in continental shelf waters during spring. The population participating in the Ningaloo aggregation is estimated to comprise between 300 and 500 individuals, although the total population size in the region is unknown (Meekan *et al.* 2006; Bradshaw *et al.* 2007). The Operational Area overlaps with the Whale shark foraging BIA (Figure 4-12), which extends northwards from Ningaloo along the 200 m isobath.	Whale sharks are regarded as highly migratory – although these 'migration patterns' are poorly understood. Individuals tagged at Ningaloo Reef have been shown to migrate north, north-east or north-west towards Indonesian waters (Sleeman *et al.* 2010; Wilson *et al.* 2006; Reynolds *et al.* 2017). Tagged Whale shark data includes records of Whale sharks departing from Ningaloo in spring and travelling north-west, following the 200 m isobath on the edge of the continental shelf. This route has been designated by the DoEE as a BIA for whale shark foraging between July and November, which extends from Ningaloo Reef to waters in the Timor Sea.	Given the recorded migratory routes in the region, individual whale sharks may be encountered in the Operational Area and wider EMBA. However, given that the proposed timing of the survey does not coincide with the July to November migration period when Whale sharks are most likely to utilise the BIA, whale sharks are expected to occur in low numbers.
Great white shark	Great white sharks have been recorded from central Queensland around the south coast to north-west WA, with movements occurring between the mainland coast and the 100 m depth contour (DoEE 2019). Great white sharks are frequently recorded in waters around Fur seal and Sea lion colonies such as the islands off the lower west coast of Western Australia (DoEE 2019).	Great white sharks are known to undertake migrations along the WA coast, with some individuals travelling as far north as North West Cape during spring, before returning south for summer (DoEE 2019).	Due to their preference for cold temperate waters and feeding grounds in waters around seal colonies further south, the presence of the species within the Operational Area and wider EMBA is likely to be limited.
Shortfin mako shark	The shortfin mako is found in tropical and warm-temperate seas in water depths up to 500 m (Cailliet *et al.* 2009). The species is rarely found in waters cooler than 16 °C and is occasionally found close inshore where the continental shelf is narrow (Cailliet *et al.* 2009). The species is widespread in Australian waters, having been recorded in offshore waters all around the continent's coastline with exception of the Arafura Sea, the Gulf of Carpentaria and Torres Strait.	Shortfin makos are also highly migratory and travel large distances.	Given the species distribution in deep offshore waters, the presence of the species within the Operational Area and wider EMBA is expected to be low.
Longfin mako	Longfin makos inhabit oceanic and pelagic habits, typically in tropical regions. They are a highly mobile species and have a wide-ranging distribution (DSEWPaC 2012) but are rarely encountered. Longfin mako usually occur to depths of 760 m but have been reported to 1,752 m (Rigby *et al.* 2019; Ebert *et al.* 2013, Hueter *et al.* 2016, Weigmann 2016). In Australian waters, the species is found from Geraldton, in WA, and north to Port Stephens in New South Wales (Last and Stevens 2009). Given the species wide-distribution and preference for deeper waters, the presence of the species within the EMBA is expected to be low.	There is insufficient data to prescribe distribution behaviours, migration times and routes and seasonal patterns.	Given the species distribution in deep offshore waters, the presence of the species within the Operational Area and wider EMBA is expected to be low.
Narrow sawfish (previously known as the knifetooth sawfish)	The exact distribution of the species is uncertain, but it is highly likely that its full range extends from Indo-Australian Archipelago to Japan and South Korea. The Narrow sawfish is a benthic-pelagic species that inhabits estuarine, inshore and offshore waters to at least 40 m depth (Last and Stevens 2009). Inshore and estuarine waters are critical habitats for juveniles and pupping females, whilst adults predominantly occur offshore (Peverell 2005).	There is insufficient data to prescribe distribution behaviours, migration times and routes and seasonal patterns.	Given the species distribution, and preference for coastal/estuarine areas, the presence of the species within the Operational Area is expected to be limited. The species may occasionally be present in the shallower southern region of the wider EMBA.
Reef manta ray (coastal manta ray)	The Reef manta ray is found around the northern coast of Australia between south western Australia, and Central New South Wales (DoEE 2019). This species is often resident in or along productive near-shore environments, such as island groups, atolls or continental coastlines. This species tends to inhabit warm tropical or sub-tropical waters. The species is commonly sighted inshore, however is also found around offshore coral reefs, rocky reefs and seamounts (Marshall *et al.* 2018).	Movement patterns are likely site-specific and correlated with cycles in productivity. Individuals have been documented to make seasonal migrations of several hundred kilometres as well as daily migrations of almost 70 km (IUCN 2019).	Given the species is generally associated with nearshore environments, the presence of the species within the Operational Area is expected to be limited. The species may be present in higher numbers around Rowley Shoals and in the shallower southern region of the wider EMBA.
Giant manta ray	The Giant manta ray lives in tropical, marine waters worldwide, and occasionally in temperate seas between latitudes 30°N and 35°S. In Australia, the species is recorded from south-western WA, around the tropical north to the southern coast of New South Wales. Individuals have been recorded to travel up to 70 km over one day (van Duinkerken 2010).	The year-round population of Giant manta rays present at Ningaloo Reef extends to Exmouth from mid-May through to mid-September.	Given the species wide-distribution, the presence of the species within the Operational Area is expected to be low. The species may be present in higher numbers around Rowley Shoals and in the shallower southern region of the wider EMBA.

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
Freshwater sawfish (also known as largetooth sawfish)	The Largetooth sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, Western Australia, to the western side of Cape York Peninsula, Queensland (Allen 2000; DoEE 2019). It is a marine/estuarine species that spends its first three–four years in freshwater (DoEE 2019). The preferred habitat of this species is mud bottoms of river embayments and estuaries, but they are also found well upstream. The species mainly feeds on fishes and benthic invertebrates. The Fitzroy River has been identified as a likely important nursery site for the Largetooth sawfish (located 380 km from the Operational Area and outside the EMBA) (Whitty *et al.* 2008). The Freshwater sawfish pupping and foraging BIAs are located along Eighty Mile Beach and Roebuck Bay and overlap the EMBA. Pupping is known to occur from the months of January to May at Eighty Mile Beach. The closest BIA is located 90 km from the Operational Area	A study on the movement patterns of other sawfish species, P. lavate and P. zijsron, showed that the species had a high fidelity to an area, with movements restricted to only a few square kilometres within the coastal fringe, and influenced by tides (Stevens *et al.* 2008).	Given the species preferred estuarine habitat, and the location of the pupping and foraging BIAs, the presence of the species within the Operational Area is expected to be low. The species may be present in the shallower southern region of the wider EMBA.
Green sawfish	In Australian waters, Green sawfish have historically been recorded in the coastal waters off Broome, Western Australia, around northern Australia and down the east coast as far as Jervis Bay, NSW (Stevens *et al.* 2005). The Green sawfish has been recorded in inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches (Peverell *et al.* 2004). They have also been recorded in very shallow water (1 m) to offshore trawl grounds in over 70 m of water (Stevens *et al.* 2005). Green sawfish are found in Indonesian waters and it is possible that individuals may migrate between Australia and Indonesia. It is probable that the Australian population can be considered geographically separate (Stevens *et al.* 2005). The Sahul Shelf system is known to support populations of Green sawfish (Donovan *et al.* 2008). The Green sawfish nursing and pupping BIAs are located along Eighty Mile Beach and Roebuck Bay and overlap the EMBA. The closest BIA is located 90 km from the Operational Area.	Sawfish are known to return seasonally to inshore coastal waters adjacent to the northern Australian region to breed and pup. Little is known about reproduction in Green sawfish. It is unknown whether there is migration into Australian waters of Green sawfish adults or juveniles from populations outside Australia. Green sawfish are found in Indonesian waters and it is possible that individuals may migrate between Australia and Indonesia, however it is probable that the Australian population can be considered geographically separate (Stevens *et al.* 2005).	Given the species preferred estuarine habitat and the location of the pupping and foraging BIAs, the presence of the species within the Operational Area is expected to be low. The species may be present in the shallower southern region of the wider EMBA.
Oceanic whitetip shark	The Oceanic whitetip has a global distribution, occurring in both tropical and subtropical waters, with a temperature range of 18–28°C but preferring >20°C (Rigby *et al* 2019b; Howey-Jordan *et al* 2013). The species is usually found offshore in the open sea with a preference for surface waters (< 200 m) but have been reported in depths of 1,082 m (Rigby, 2019b).	Across its range the Oceanic whitetip shark is highly migratory, however, there is limited information on the movement patterns and migration paths of this species (Young and Carlson 2020).	The PMST search identified that the species or species habitat may occur within the Operational Area and EMBA. Given the species' wide-distribution, the presence of the species within the Operational Area is expected to be low.
Grey nurse shark	Grey nurse sharks inhabit inshore waters and have a wide but patchy tropical and temperate distribution in the Indo-West Pacific. There are two distinct subpopulations in Australia on the east and west coasts. The west coast population inhabits coastal and continental shelf waters from southwest Western Australia (Albany) up to the North West Shelf (DoE, 2014). Grey nurse sharks tend to be found in groups at specific locations, known as aggregation sites (Otway et al., 2003). Grey nurse sharks undertake large-scale movements to potentially capitalise on seasonal prey aggregations, with individuals migrating 1,294 km along the WA coast from SW WA to Ningaloo, and 1,500 km on the east coast (Dwyer et al., 2023; Jakobs et al., 2019).	The movement pattern of the west coast populations of grey nurse sharks is relatively unknown. Juveniles are known to migrate for new territory; however, seasonal migration patterns have not been observed (Last & Stevens 2009). The eastern populations have complex seasonal patterns, indicating western populations may also. Grey nurse sharks have been known to undertake large-scale movements to potentially capitalise on seasonal prey aggregations, with individuals migrating 1,294 km along the WA coast from SW WA to Ningaloo, and 1,500 km on the east coast (Dwyer et al., 2023; Jakobs et al., 2019).	The PMST search identified this species as potentially occurring within the Operational Area and EMBA. Given their wide-distribution and preference for inshore waters, presence of this species within the Operational Area and EMBA is likely to be limited.
Scalloped hammerhead shark	The scalloped hammerhead is a coastal and semi-oceanic species with a circumglobal distribution in coastal warm-temperate and tropical seas. In Australia, the species is recorded around the northern coastline from approximately Sydney, New South Wales to Geographe Bay, Western Australia (Last & Stevens 2009). The species inhabits continental and insular shelves and adjacent deep water from the surface and intertidal areas to at least 275 m depth. Their preferred habitats include continental shelves, around islands, and in areas with steep underwater drop-offs. They frequent both shallow coastal waters and deeper offshore zones and are known to use nursery grounds in estuaries and embayments.	In northern Australia, juvenile scalloped hammerheads inhabit shallow inshore waters, especially during the wet season, while adult males occupy deeper offshore areas or remain coastal. Pregnant females are rarely seen locally, likely migrating to Indonesia and Papua New Guinea to give birth, with northern Australia serving as crucial nursery habitat. These sharks exhibit sex- and age-based habitat segregation and some migratory behaviour, contributing to a broader Indo-Pacific population connectivity centered on seasonal pupping in coastal nursery grounds.	The PMST search identified that the species or species habitat may occur within the Operational Area and EMBA. Given the species' wide-distribution, the presence of the species within the Operational Area is expected to be low.
Dwarf sawfish	The Dwarf sawfish is found in Australian coastal waters extending north from Cairns around the Cape York Peninsula in Queensland to the Pilbara coast (DoEE 2019).	Dwarf sawfish may move into marine waters after the wet season and during the wet season enter estuarine or fresh waters to breed.	The PMST search identified the species as potentially occurring within the EMBA, and not within the Operational Area.

Common Name	Habitat and Distribution	Seasonality	Relevance to EP
	Dwarf sawfish typically inhabit shallow (2 to 3 m) silty coastal waters and estuarine habitats, occupying relatively restricted areas and moving only small distances (Stevens *et al.*, 2008). The majority of capture locations for the species in WA waters have occurred within King Sound and the lower reaches of the major rivers that enter the sound, including the Fitzroy, Mary and Robinson rivers (Morgan *et al.*, 2009). Individuals have also been recorded from Eighty Mile Beach in the Pilbara and occasional individuals have also been taken from considerably deeper water from trawl fishing (Morgan *et al.*, 2009). A study in north-western Western Australia found that estuarine habitats are used as nursery areas by Dwarf sawfish, with immature juveniles remaining in these areas up until three years of age (Thorburn *et al.* 2007a). Adults are known to seasonally migrate back into inshore waters (Peverell 2007), although it is unclear how far offshore the adults travel, as captures in offshore surveys are very uncommon. The Dwarf sawfish pupping, nursing and foraging BIAs are located along Eighty Mile Beach, approximately 90 km from the Operational Area.	Adults are known to seasonally migrate back into inshore waters (Peverell 2007), although it is unclear how far offshore the adults travel.	Given the species distribution and nearby pupping, nursing and foraging BIAs, the presence of the species in the EMBA is expected to be low.

4.3.8 Marine Reptiles

4.3.8.1 Marine Turtles

Marine turtles have similar life cycle characteristics, which include migration from foraging areas to mating and nesting areas. All species, with the exception of flatback turtles, have an oceanic pelagic stage before moving to nearshore waters to breed. The region is considered to be significant for supporting large feeding and nesting turtle populations.

Five threatened and migratory marine turtle species were identified in the EPBC Act Protected Matters Database search as having the potential to occur in the Operational Area and EMBA. A description of their distribution, habitats, life stages and likely presence within and around the Operational Area during the survey is provided in Table 4-8.

There are several BIAs for turtle species in the region, including along the coastline and offshore islands adjacent to the Operational Area (Figure 4-13). No foraging, internesting, or nesting BIAs overlap with the Operational Area.

In 2017, the DoEE (now DCCEEW) identified “habitat critical to the survival of marine turtle species” in the Recovery Plan for Marine Turtles in Australia (DoEE 2017). It should be noted that this is different to Critical Habitat to Survival, as defined under the EPBC Act. No habitat critical to the survival of a marine turtle species occurs within the Operational Area. The closest habitat is the flatback turtle internesting buffer at Eighty Mile Beach, approximately 60 km from the Operational Area (Figure 4-14). The flatback turtle internesting buffer is the only habitat critical to the survival of a marine turtle species to overlap with the wider EMBA.

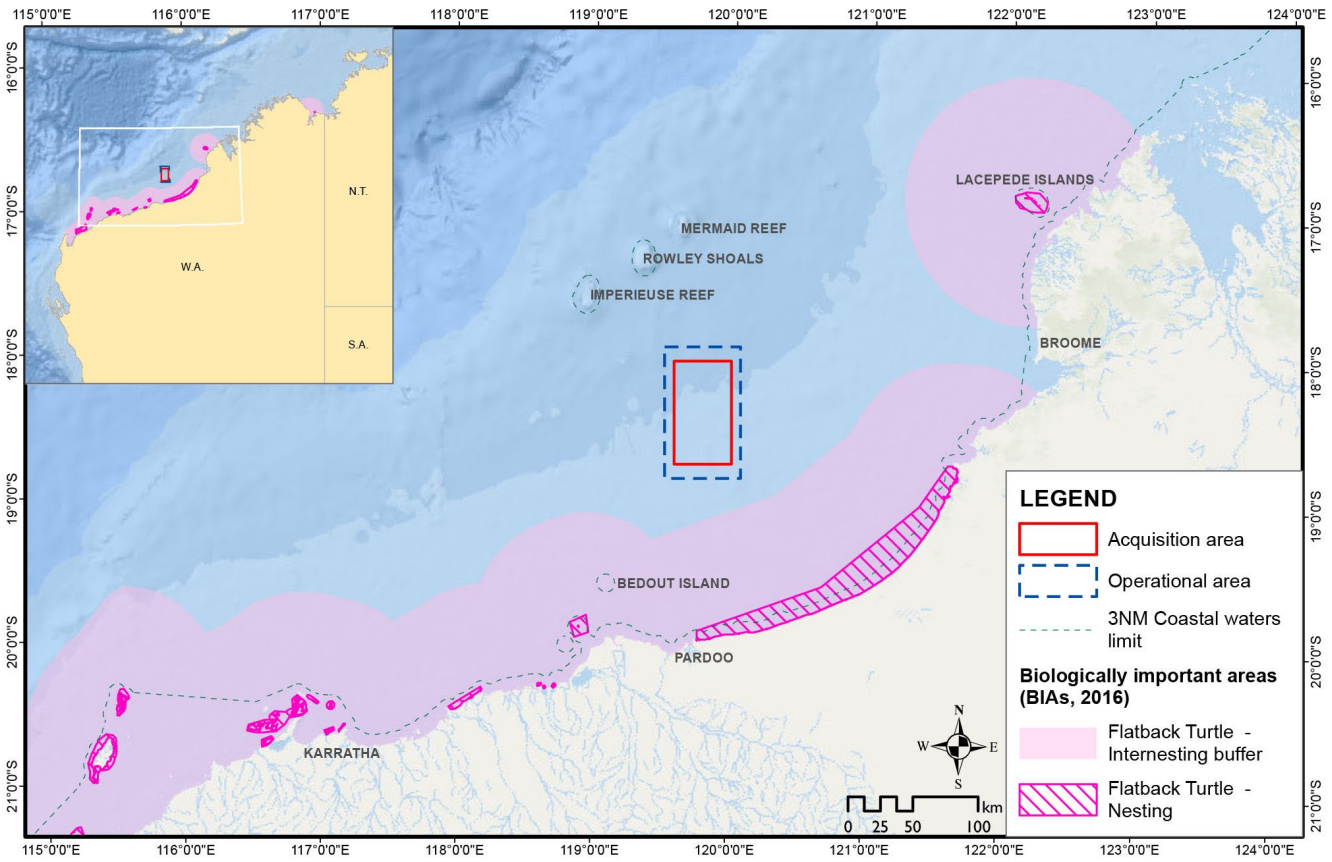


Figure 4-13 – Flatback Turtle BIAs

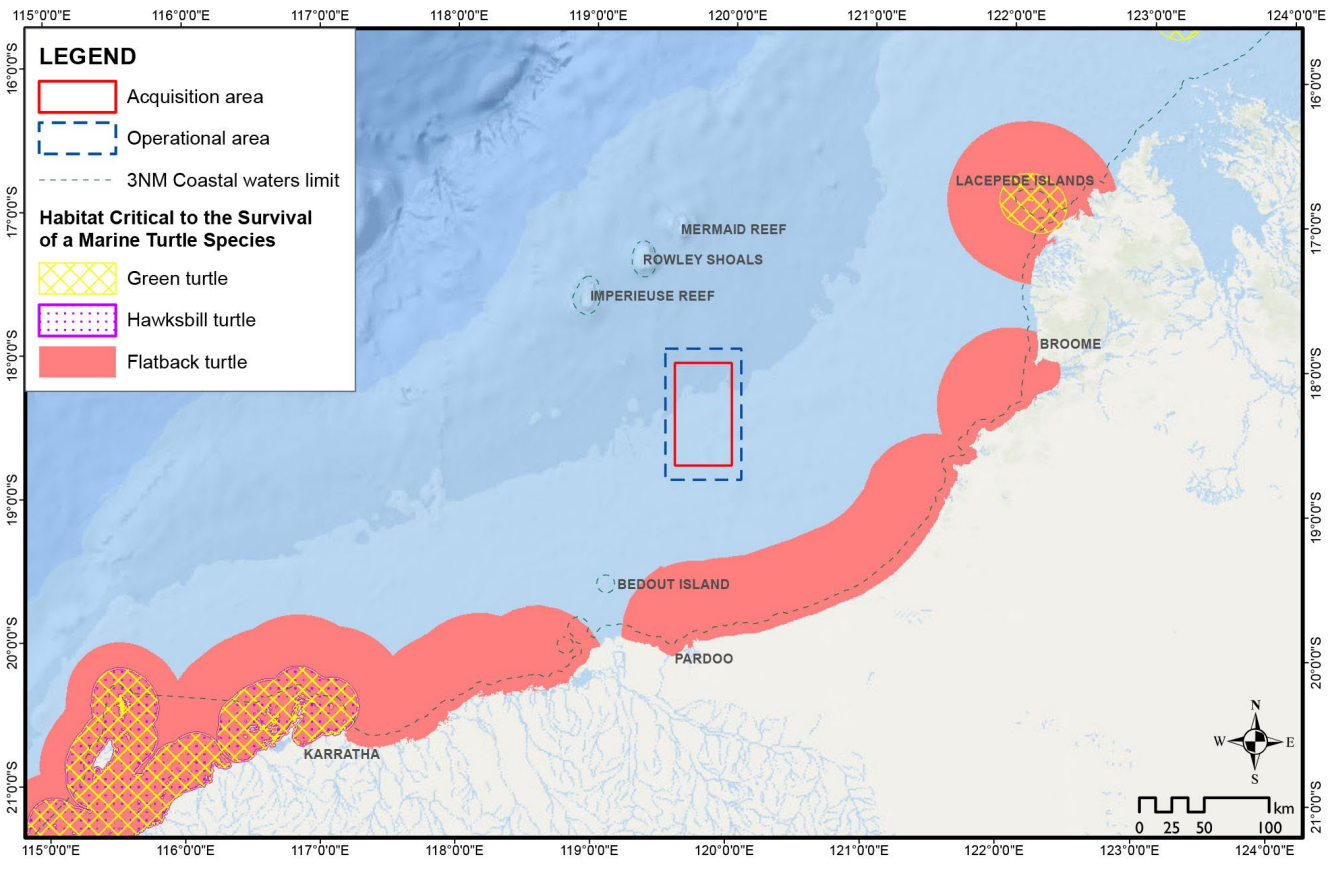


Figure 4-14 – Habitat Critical to the Survival of Marine Turtles

4.3.8.2 Sea Snakes

Sea snakes are essentially tropical in distribution and habitats reflect influences of factors such as water depth, nature of seabed, turbidity and season (Heatwole and Cogger 1993). Some species have extensive distributions and individuals may cover large distances, while other species have limited home ranges (Heatwole and Cogger 1993). Most sea snake species tend to be found in the shallower parts of the region to allow for increased benthic foraging time (DEWHA 2008a).

Sea snakes that inhabit coral reefs in the region live out their lives within a few hectares, with little movement between the reefs (Guinea 2013; PTTEP 2013). The distance between reefs in the region and the deep water between reefs inhibits migration and supports the concept that sea snakes at each reef form a discrete 'management unit' for each species and prevents species from occupying all reefs (PTTEP 2013).

At least 20 species of sea snake occur within the region (DEWHA 2008a). Amongst these species, two threatened sea snake species (the Short-nosed sea snake and Leaf-scaled sea snake) were identified in the EPBC Act Protected Matters Database search as having the potential to occur in the Operational Area and EMBA. Further details on its habitats, life stages and likely presence within the Operational Area is provided in Table 4-8.

No coral reefs or shoals occur within the Operational Area and therefore sea snakes are expected to occur in low numbers.Table 4-8 – Threatened and Migratory Marine Reptiles Potentially Occurring Within the Operational Area and EMBA

Common Name	Habitat and Distribution	Phenology	Relevance to EP
Marine Reptiles Potentially Occurring Within the Operational Area			
Loggerhead turtle	The Loggerhead turtle has a global distribution and occurs in eastern, northern and western parts of Australia (Limpus 2008). Loggerhead turtles are known to show fidelity to both their foraging and breeding areas and can make reproductive migrations of over 2,600 km between foraging and nesting areas (DoEE 2019). The species is known to forage nearshore, in water depths up to approximately 50–60 m (DoEE 2019). In WA, the species nests on the Muiron Islands (approximately 630 km away) and on the beaches of North West Cape (approximately 665 km away) (DoEE 2019; Guinea 1995). The species is known to nest between October and February, with a peak in December (DoEE 2019). As a juvenile, this species feeds on algae, pelagic crustaceans, molluscs and flotsam whilst as an adult it feeds on gastropod molluscs, clams, jellyfish, starfish, coral, crabs and fish (DoEE 2019).	Nesting occurs between October and February, with a peak in December (DoEE 2019).	There are no known Loggerhead turtle BIAs located within the Operational Area or EMBA and the Operational Area occurs outside of known foraging depths. Therefore, Loggerhead turtles may occur within the Operational Area in low numbers as transitory individuals. Foraging habitat potentially occurs in the wider EMBA where individuals may occur in higher numbers.
Green turtle	The Green turtle has a global distribution and occurs in tropical and subtropical waters, with WA supporting one of the largest Green turtle populations in the world (Limpus 2004). Principal rookeries in WA include the Lacepede Islands (approximately 250 km away), Barrow Island (approximately 475 km away), the Montebello Islands (approximately 450 km away), North West Cape (approximately 665 km away) and the Muiron Islands (630 km away) (Commonwealth of Australia 2012; Department of the Environment and Energy 2017). Smaller rookeries in the region include Ashmore Reef and Cartier Island (approximately 670 km away), Browse Island (approximately 550 km away), Cassini Island (approximately 740 km away), Maret Island (approximately 650 km away) and Sandy Islet at Scott Reef (approximately 250 km away) (Commonwealth of Australia 2012; Department of the Environment and Energy 2017). The species primarily forages in shallow benthic habitats (10 m) such as tropical tidal and subtidal coral and rocky reef habitat or inshore seagrass beds, feeding on seagrass beds or algae mats (Hazel *et al.* 2009). The closest foraging BIA to the Operational Area is located at Bedout Island (approximately 90 km away) and James Price Point (approximately 190 km away). The nearest nesting BIA is located at Lacepede Islands (approximately 250 km away). Females are known to stay within approximately 20 km from nesting beaches (Commonwealth of Australia 2012). The Green turtle 'habitat critical to the survival of marine turtles' BIA is located approximately at Adele Island and Lacepede Island, 230 km to the east of the Operational Area.	Nesting occurs between November and March (DoEE 2019). Female Green turtles go into an inter-nesting cycle after each nesting occurrence. The inter-nesting cycle takes approximately two weeks once nesting starts. The females spend this period in shallow waters beyond the reef edge, where they visit different substrates, occupy different depths and move up to tens of kilometres from the nesting beach. The species undertakes extensive post-nesting migrations from foraging areas to traditional breeding areas (Commonwealth of Australia 2012).	There are no known Green turtle BIAs located within the Operational Area or EMBA, and the Operational Area occurs outside of known foraging depths. Therefore, Green turtles are unlikely to occur within the Operational Area. Foraging habitat potentially occurs in the wider EMBA where individuals may occur in higher numbers.
Leatherback turtle	Leatherback turtles are pelagic feeders, spending extended periods of time in tropical, subtropical and temperate open ocean waters (Limpus 2009). The species has been recorded feeding in the coastal waters of all Australian states and territories in low densities. Leatherback turtles forage on pelagic soft bodied creatures (such as jellyfish, squid, salps, siphonophores and tunicates) all year round in Australian waters (DoEE 2019). No BIAs have been identified for the species within the Operational Area or wider EMBA.	Nesting occurs on tropical beaches and subtropical beaches (Marquez 1990), but no major centres of nesting activity have been recorded in Australia. The species is understood to migrate from Australian waters to breed at larger rookeries in neighbouring countries such as Indonesia, Papua New Guinea and Solomon Islands between December and January (DoEE 2019)	Given the species distribution, and low-density population in Australian waters, the presence of the species within the Operational Area and EMBA is expected to be low.
Hawksbill turtle	Hawksbill turtles are found in tropical, subtropical and temperate waters, with nesting mainly confined to tropical beaches (Limpus and Miller 2008). The Hawksbill turtle is commonly found in the NWMR and NMR, nesting	Hawksbill turtles nest year-round, with a peak between October and December (DEWHA 2008a). Inter-nesting females are known to stay within approximately 20 km of nesting beaches.	Given the species nesting, internesting and foraging BIAs are located in close proximity to the

Common Name	Habitat and Distribution	Phenology	Relevance to EP
	extensively along the coasts and foraging in the region. Australia has the largest breeding population of Hawksbill turtles in the world (Limpus 2008). As a juvenile, the Hawksbill turtle feeds on plankton in the open ocean and then feeds on sponges, hydroids, cephalopods, gastropods, jellyfish, seagrass and algae as an adult (DoEE 2019). The closest foraging BIA to the Operational Area is located at Bedout Island (approximately 90 km away). The nearest nesting BIA is located at the Dampier Archipelago (i.e. islands to the west of the Burrup Peninsula), 270 km from the Operational Area. The nesting BIA is surrounded by an internesting BIA (buffer of 20 km). The 'habitat critical to the survival of marine turtles' BIA is also located at the Dampier Archipelago.	The north-east subpopulation breeds throughout the year with a peak nesting period during July to October (DSEWPaC 2012), whilst breeding in the WA population peaks around October to January. The species is highly migratory and is known to migrate long distances between nesting and foraging areas (ranging from 35 to 2,400 km) (DoEE 2019).	Operational Area, transient turtles may be present within the Operational Area and wider EMBA.
Flatback turtle	The Flatback turtle is found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya, and nesting is only known to occur in Australia (Limpus 2007). The NWMR is an important nesting area, with major rookeries present from Exmouth to the Lacepede Islands (approximately 250 km away) and along the Kimberley coast and islands. There are significant rookeries on Barrow Island, Thevenard Island, Montebello Islands and Lowendal Islands (Commonwealth of Australia 2012). Nesting occurs between November and March, peaking in January (Commonwealth of Australia 2012). The nearest nesting BIA is located at Eighty Mile Beach, approximately 95 km from the Operational Area (Figure 4-13). A 'habitat critical to the survival of marine turtles' (internesting) is also located along Eighty Mile Beach, approximately 60 km from the Operational Area (Figure 4-14). Nesting occurs between May and July (DoEE 2019). Internesting habitat is located immediately seaward of nesting habitat. Female Flatback turtles may occur within 60 km of nesting beaches during the internesting period (DoEE 2019). An internesting BIA is located 60 km from the Operational Area, at Eighty Mile Beach. Flatback turtles are known to feed on gastropod molluscs, squid, soft corals, hydroids and jellyfish (DoEE 2019). The closest foraging BIA to the Operational Area is located at Bedout Island (approximately 90 km away) and James Price Point (approximately 190 km away).	In the Kimberley and Pilbara regions of Western Australia, from approximately the Lacepede Islands to Exmouth, there is a mid-summer peak nesting season. Flatback turtle hatchlings do not have an offshore pelagic phase. Instead, hatchlings grow to maturity in shallow coastal waters thought to be close to their natal beaches (Commonwealth of Australia 2012). Although turtles remain close to nesting beaches during the internesting period, there is evidence that some Flatback turtles undertake long-distance migrations between breeding and feeding grounds. A survey carried out in the region between 2005 and 2012 identified the distances 73 female Flatback turtles travelled to their foraging grounds; 11 remained within 100 km of their rookeries, four migrated an average of 400 km and 58 migrated between 1,000 and 1,500 km (Pendoley *et al.* 2014).	Given the species internesting BIA located approximately 15 km from the Operational Area, and Congregation/aggregation is known to occur in area, transient turtles may be present within the Operational Area. Foraging habitat potentially occurs in the wider EMBA where individuals may occur in higher numbers.
Marine Reptiles Potentially Occurring Within the EMBA			
Short-nosed sea snake	The Short-nosed sea snake is endemic to WA and has been recorded from Exmouth Gulf to the reefs of the Sahul Shelf (Commonwealth of Australia 2012). The species is thought to have a very restricted distribution. The species can be found in reef flats and shallow water, in water depths to 10 m (Commonwealth of Australia 2012). The species is typically found within 70 km from the shoreline, preferring shallow depths of 10 m; the species' limited range results in the species only occupying an area of less than 10 km^2 around the reef (Lukoschek *et al.*2010). Few Short-nosed sea snakes move further than 50 m from the reef flats (DoEE 2019).	Sea snakes are long-lived and slow growing with small broods and high juvenile mortality. Little is known of the age at which sea snakes reach sexual maturity. Sea snakes have a gestational period of 6-7 months, indicating that females are unlikely to breed every year. The species is expected to be restricted to shallow waters and may occur in the shallow coastal waters of the wider EMBA.	The PMST search identified the species as potentially occurring within the EMBA, and not within the Operational Area.
Leaf-scaled sea snake	The leaf-scaled sea snake is endemic to WA, being found only on the reefs around the Sahul Shelf in the northern region of the state, where it was previously commonly found but has not been surveyed since 2001 (DAWE, 2011). The habitat for the species is naturally fragmented, with deep channels between reef habitats likely to inhibit movement. The species is found in protected areas of the reef flat, proximal to coral substrates in shallow water to depths of 10 m. The species is similar in appearance to the short-nosed sea snake but can be morphologically distinguished in shallow water (< 3 m).	Sea snakes are long-lived and slow growing with small broods and high juvenile mortality. The species is likely to reach reproductive maturity between one and two years of ag, with a life expectancy estimated to be up to ten years. Sea snakes have a gestational period of 6-7 months producing live young, indicating that females are unlikely to breed every year. The species is expected to be restricted to shallow waters and may occur in the shallow coastal waters of the wider EMBA.	The PMST search identified the species as potentially occurring within the EMBA, and not within the Operational Area.
Saltwater crocodile	In Australia, the distribution of saltwater crocodiles is primarily in the northern regions, including northern Queensland, Northern Territory and northern Western Australia. Their habitat includes coastal areas, estuaries, rivers and freshwater wetlands, mangrove swamps and saltwater lagoons. Saltwater crocodiles are highly adaptable and can live in both freshwater and saltwater environments and are often found in brackish water habitats where rivers meet the sea. They can also be found in the open sea, however, are most likely to be encountered in tidal rivers and estuaries, billabongs and on floodplains.	Saltwater crocodiles exhibit seasonality primarily related to their breeding and nesting behaviours rather than migration or hibernation, as they are ectothermic reptiles adapted to warm climates. They typically breed in the wet season between November and May in northern Australia.	The PMST search identified the species as potentially occurring within the EMBA, and not within the Operational Area. There are no known BIAs for this species located within the EMBA. Due to their habitat preference, presence of the species within the EMBA is likely to be limited.

4.3.9 Marine Birds

Many migratory shorebirds (including those frequenting offshore islands) and seabird species are known to occur in the NWMR. Migratory shorebird species forage and rest in the region on their way between Northern Hemisphere breeding grounds and Northern Australian feeding grounds, known as the East Asian–Australasian Flyway. Seabird species spend the majority of their lives foraging across large distances over the open ocean and may also breed within the region.

There are 23 species considered to be ecologically significant to the NWMR; that is, they are either endemic to the region, have a high number of interactions with the region (nesting, foraging, roosting or migrating) or have life history characteristics that make them susceptible to population decline.

Three threatened, five threatened and migratory, and 11 migratory birds were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in the Operational Area and EMBA. Several biologically important areas for marine bird species have been identified within the Operational Area and EMBA (see Table 4-5).

A description of the distribution, migration movements, and preferred habitat and life stages of the identified marine bird species is provided in Table 4-9, including commentary on their likely presence in the Operational Area.

Table 4-9 – Threatened and Migratory Seabirds Potentially Occurring Within the Operational Area And EMBA

Common Name	Habitat and distribution	Phenology	Relevance to EP
Marine Birds Potentially Occurring Within the Operational Area			
Eastern curlew	Within Australia, the Eastern curlew has a primarily coastal distribution. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. Elsewhere they are patchily distributed (DoEE 2019). This species does not breed in Australia, rather in the Northern Hemisphere summer, between early May and late June (DoEE 2019). They start to depart in early March and begin to arrive back in late July. During the non-breeding season in Australia, the Eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae) (DoEE 2019).	This species does not breed in Australia, rather in the Northern Hemisphere summer, between early May and late June (DoEE 2019). They start to depart in early March and begin to arrive back in late July.	Given the distribution of this coastal wetland bird species, the survey is likely to encounter low numbers of this species in the Operational Area. Higher population density may be encountered in the nearshore waters of the wider EMBA.
Red knot	The Red knot is common in all the main suitable habitats around the coast of Australia, very large numbers are regularly recorded in northern Australia. In Australasia the Red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts or shallow pools on exposed wave-cut rock platforms or coral reefs. The Red knot usually forages in soft substrate near the edge of water on intertidal mudflats or sandflats exposed at low tide. At high tide they may feed at nearby lakes, sewage ponds or floodwaters. They have also been observed foraging on thick algal mats in shallow water and in shallow pools on crests of coral reefs. The Red knot is diurnal and nocturnal. In non-breeding areas, feeding activity is regulated by tide; they feed less just before and after high tide. The Red knot is omnivorous and eats mostly worms, bivalves, gastropods, crustaceans and echinoderms.	The Red knot lays eggs in June and nests on open vegetated tundra or stone ridge, often close to a clump of vegetation. The Red knot is migratory, breeding in the high Artic and moving south to non-breeding between 58° N and 50 °S. Peak numbers of this species in the NWMR are usually between September and October.	Given the distribution of this coastal wetland bird species, the survey is likely to encounter low numbers of this species in the Operational Area. Higher population density may be encountered in the nearshore waters of the wider EMBA.
Abbott's booby	Currently, Abbott's booby is only known to breed on Christmas Island and to forage in the waters surrounding the island. Christmas Island is close to a number of cold-water upwellings that probably provide food that is seasonal in nature, and upon which a number of the seabirds may depend for raising their young. Abbott's booby is a marine species. It spends much of its time at sea but needs to come ashore to breed. It nests in tall rainforest trees in the western, central and northern portions of Christmas Island. Abbott's booby feeds on fish and squid (Marchant and Higgins 1990; Reville *et al.* 1990).	Abbott's boobies travel large distances to feeding grounds during breeding season. It appears that some adults leave Christmas Island for 4-5 months and return in April. Breeding commences in March, when established pairs begin returning to nest sites and start collecting nest material.	Given the wide distribution and migration pattern, this species may be present in the Operational Area and EMBA in low numbers or isolated individuals/groups.
Common sandpiper	Distributed along all coastlines of Australia and many areas inland, the Common sandpiper is widespread in small numbers. The area of national importance along the coast of Western Australia is Roebuck Bay (approximately 160 km away from the Operational Area). Generally, the species forages in shallow water and on bare soft mud at the edges of wetlands. Birds sometimes venture into grassy adjoining wetlands and mangroves. Typically, the Common sandpiper eats molluscs such as bivalves, crustaceans such as amphipods and crabs and a variety of insects.	The Common sandpiper breeds in Eurasia and moves south for the boreal winter, with most of the western breeding populations wintering in Africa, and eastern breeding populations wintering in South Africa and Australia. Individuals usually arrive in Western Australia from July onwards.	Given the wide distribution and migration pattern, this species may be present in the Operational Area in low numbers or isolated individuals/groups. Higher population density may be encountered in the nearshore waters of the wider EMBA.
Common noddy	In Australia, the Common noddy occurs mainly in the ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australian coast. During the breeding season, the Common noddy usually occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand. When not at the nest, individuals will remain close to the nest, foraging in the surrounding waters. During the non-breeding period, the species occurs in groups throughout the pelagic zone. Birds may nest in bushes, saltbush, or other low vegetation. The Common noddy feeds mainly on fish, although they are known to also take squid, pelagic molluscs, medusa and aquatic insects.	The seasonality of breeding varies greatly between sites. At some locations, birds breed annually and at others, birds breed twice a year (spring to early summer and again at autumn).	Given the wide distribution of the species and location of breeding habitat, this species may be present in the Operational Area and EMBA in low numbers.
Sharp-tailed sandpiper	The Sharp-tailed sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations. In Western Australia they are widely distributed from Cape Arid to Carnarvon, around coastal plains of the Pilbara Region to south-west and east Kimberly Division. In Australasia, the Sharp-tailed sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emerged grass or low vegetation. The Sharp-tailed sandpiper forages on seeds, worms, molluscs, crustaceans and insects. Eighty-mile beach (approximately 120 km away from the Operational Area) is the closest international important site for the species.	Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations. The Sharp-tailed sandpiper migrates to Australia in late June, early July, departing the breeding grounds. The species then departs the non-breeding grounds in Australia by April/March.	Given the wide distribution of this species and the migratory pattern, it is likely the presence of this species will be encountered in low number or isolated individuals within the Operational Area. Higher population density may be encountered in the nearshore waters of the wider EMBA.

Common Name	Habitat and distribution	Phenology	Relevance to EP
Pectoral sandpiper	In Australasia, the Pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The Pectoral sandpiper is omnivorous, consuming algae, seeds, crustaceans, arachnids and insects. While feeding, they move slowly, probing with rapid strokes. They walk slowly on grass fringing water. In WA, the species is rarely recorded. It has been observed at the Nullarbor Plain, Reid, Stoke's Inlet, Grassmere Lake, Warden Lake, Dalyup and Yellilup Swamp, Swan River, Benger Swamp, Guraga Lake, Wittecarra, Harding River, coastal Gascoyne, the Pilbara and the Kimberley.	The Pectoral sandpiper breeds in the northern hemisphere during the boreal summer, before undertaking long distance migrations to feeding grounds in the southern hemisphere. The species occurs throughout mainland Australia between spring and autumn.	Given the wide distribution of this species and the migratory pattern, it is likely the presence of this species will be encountered in low number or isolated individuals within the Operational Area. Higher population density may be encountered in the nearshore waters of the wider EMBA.
Streaked shearwater	The Streaked shearwater occurs frequently in northern Australia from October to March, with some records as early as August and as late as May (Marchant and Higgins 1990). Whilst it does not breed in Australia, it is known to forage in the region. The Streaked shearwater feeds mainly on fish and squid. The Streaked shearwater is a colonial breeder that lays a single egg in a burrow. Colonies are usually in a well forested area (Birdlife 2019)	The species breeds in temperate regions of East and South-east Asia before migrating to tropical regions near the equator, however little is known about their movements during the non-breeding period (Yamamoto *et al.* 2010).	Given the distribution of the species and habitat, this species may be present in the Operational Area and EMBA
Lesser frigatebird	The Lesser frigatebird is usually seen in tropical or warmer waters off northern Western Australia, Northern Territory, Queensland and northern New South Wales. The species is usually pelagic and often found far from land, but is also found over shelf waters, in inshore areas, and inland over continental coastlines (Marchant and Higgins 1990). The Lesser frigatebird breeds in mangroves or bushes, and even on bare ground. It feeds mainly on fish (especially flying fish) and squid, but also on seabird eggs and chicks, carrion and fish scraps (Birdlife 2019). In Australia, the Lesser frigatebird's egg laying occurs mostly about mid-year. A breeding BIA overlaps with a small portion of the southern section of the Operational Area.	The Lesser frigatebird breeds between May and December and usually stays within 100 – 200 km of the colony during the breeding season, but when not breeding they range widely throughout tropical seas (Lindsey 1986).	Given the distribution of the species and habitat, this species may be present in the Operational Area and EMBA.
Osprey	Osprey is most abundant in northern Australia, where high population densities occur in remote areas. The breeding range of the Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW. Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Ospreys mainly feed on fish, especially mullet where available, and rarely take molluscs, crustaceans, insects, reptiles, birds and mammals. The species usually forage diurnally but have also been observed hunting prey at night.	Osprey breeds from April to February in Australia.	Given the distribution of the species and habitat, this species may be present in the Operational Area and EMBA.
White-tailed tropicbird	The White-tailed tropicbird is found in pelagic waters and tropical waters. The White-tailed tropicbird forages in warm waters and over long distances – many kilometres from its breeding sites. A breeding BIA has been identified at the Rowley Shoals, which overlaps with the northern portion of the Acquisition Area.	Breeding is recorded in May and October at the Rowley Shoals.	Given the distribution of the species and nearby breeding habitat, this species may be present in the Operational Area and EMBA.
Great frigatebird, Greater frigatebird	Great frigatebirds are found in tropical waters globally. It breeds on small, remote tropical and sub-tropical islands, in mangroves or bushes and occasionally on bare ground Great frigatebird feeds on fish, squid and chicks of other bird species.	Breeding is known to occur between May to June and in August (DoEE 2019).	Given the distribution of the species and nearby breeding habitat, this species may be present in the Operational Area and EMBA.
Christmas Island white-tailed tropicbird	The Christmas Island White-tailed Tropicbird is endemic to Christmas Island, which is its only known breeding location. It is widely distributed across Christmas Island itself and roosts and forages over the surrounding Indian Ocean. The bird is found throughout the island, particularly within the Christmas Island National Park. Outside the breeding season, both adults and juveniles disperse widely and have been recorded up to 1,660 km from Christmas Island toward the south and southeast.	Christmas Island white-tailed tropicbirds breed all year round on Christmas Island, laying their eggs in rock crevices and the hollows of rainforest trees.	The PMST identified this species as potentially occurring in the Operational Area and EMBA. Given their distribution and habitat, presence of the species within the Operational Area and EMBA is likely to be limited.
Red-tailed tropicbird	The Red-tailed tropicbird nests in the southern Indian Ocean and just north of the Tropic of Cancer and south of the Tropic of Capricorn in the Pacific Ocean. It breeds on islands but can also be found on the south-west coast of Australia. This species feeds mostly on fish, especially flying-fish, large quantities of squid and occasionally crustaceans. Prey is caught by plunge-diving but flying-fish can be taken in flight. Breeding occurs seasonally in loose colonies on small, remote oceanic islands mostly on inaccessible cliffs.	No regular migrations are known; adults can be found in the vicinity of colonies all year round (del Hoyo *et al.* 1992).	Given the wide distribution of this species and the migratory pattern, it is likely the presence of this species will be encountered in low numbers or isolated individuals within the EMBA.
Marine Birds Potentially Occurring Within the EMBA			
Curlew sandpiper	The Curlew sandpiper's breeding areas are mainly restricted to the Arctic of northern Siberia (DoEE 2019). This species does not breed in Australia. Within Australia, Curlew sandpipers occur around the coasts, while also being widespread inland, though in smaller numbers (DoEE 2019). This species forages mainly on invertebrates, including worms, molluscs, crustaceans and insects, as well as seeds. Outside Australia, they also forage on shrimp, crabs and small fish. Curlew sandpipers usually forage in water, near the shore or on bare wet mud at the edge of wetlands (DoEE 2019).	The species is known to move into certain areas in Australia during northward migration in April, fatten up, and migrate out of Australia during May. They start returning to the area in August and throughout September (DoEE 2019).	Given the distribution of the species and nearby foraging habitat, this species may be present in the nearshore waters of the EMBA.

Common Name	Habitat and distribution	Phenology	Relevance to EP
Little tern	The Little tern is widespread in Australia, with breeding sites widely distributed. The species has three separate populations in Australia; the northern subpopulation breeds across northern Australia, the eastern subpopulation breeds in the eastern and south-eastern coast of Australia; and the third subpopulation comprises of Asian migrants that migrate to spend their non-breeding season in Australia. The species has a widespread and continuous distribution from north-western Australia, around the north and east coast to south eastern Australia (DoEE 2019). The Little tern is a coastal seabird, which usually forages in very shallow water, more often in brackish lagoons and saltmarsh creeks (DoEE 2019). The Little tern usually forages close to breeding colonies (DSEWPaC 2012d). The closest breeding site to the Operational Area for the non-Asian migrants of the species is on the coastline of the Kimberley. A resting BIA is located around the Rowley Shoals, approximately 25 km from the Operational Area. In addition, a breeding BIA is located approximately 85 km south of the Operational Area.	The migration habits of this species are poorly known. However, it is recorded that breeding typically occurs in late April-July and September to early January.	Given the distribution of the species and habitat, this species may be present in the nearshore waters of the EMBA.
Brown booby	The Brown booby occurs in, but is not restricted to, tropical waters of all major oceans. They often stay close to their breeding islands. The species is also known to be present along coastal waters, harbours and estuaries; however, they seldom fly over land. The Brown booby generally feeds in inshore water, in both shallow and deep waters (DoEE 2019). The Brown booby nests on rugged rocky terrain such as cliffs and steep slopes, on larger islands, beaches, coral rubble and guano flats on cays (DoEE 2019). The species is known to be resident and partly nomadic (i.e. birds dispersing widely between breeding seasons). Breeding occurs in and adjacent to the region, including on Ashmore Reef, Adele Island, White Island, Lacepede Islands and Bedout Island. The closest breeding BIA is located approximately 40 km south of the Operational Area.	The species typically leaves breeding islands when not breeding, in search of better foraging grounds (DoEE 2019). Breeding times are unknown.	Given the distribution of the species and habitat, this species may be present in the nearshore waters of the EMBA.
Roseate Tern	The Roseate tern occurs in both coastal and marine subtropical/tropical areas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands (DAWE 2021b). In Western Australia, the Roseate terns are regularly recorded north from Mandurah to Eighty Mile Beach, in the Pilbara Region (DAWE 2021b). Around the Kimberley coastline, the species occurs at scattered sites, north to the Bonaparte Archipelago and potentially further (DAWE 2021b).	The movements of the Roseate tern are poorly known. Breeding in Western Australia occurs in two quite distinct periods, with peak months for laying April to November. At some sites including the Montebello Islands breeding occurs during both late spring-summer and late autumn-winter (DAWE 2021b).	Given the distribution of the species and habitat, this species may be present in the nearshore waters of the EMBA.

4.3.10 Timing of Biological Sensitivities

A number of biological sensitivities related to the phenology of marine fauna are expected to occur within the Operational Area and wider EMBA.

Table 4-10 identifies the timing of key biological sensitivities relevant to the Operational Area and wider EMBA. The fauna listed in Table 4-10 are species listed under the EPBC Act and considered relevant to this EP. The fish species are those identified as key indicator species for the relevant fisheries identified in Section 4.4.4, or brood stock that have habitat that may occur within the Operational Area.

Table 4-10 – Timing of Key Biological Sensitivities Relevant to the Operational Area and EMBA

Sensitivity	January	February	March	April	May	June	July	August	September	October	November	December
Proposed Sauropod 3D MSS timing												
Humpback whale (north migration)[1]												
Humpback whale (south migration)[1]												
Pygmy blue whale (north migration)[2]												
Pygmy blue whale (south migration)[2]												
Whale shark foraging BIA[3]												
Goldband snapper spawning (Pilbara stock)[4]												
Rankin cod spawning[4]												
Red emperor spawning[4]												
Blue-spotted emperor spawning[4]												
Giant ruby snapper spawning[4]												
Silver-lipped pearl spawning												
Other demersal fish species spawning[4]												
Blacktip shark breeding[4]												
Sandbar shark breeding[4]												
White-tailed tropicbird foraging BIA[5]												
Lesser frigatebird foraging BIA[5]												
*Flatback turtle internesting[6]												
*Spanish mackerel (Pilbara stock)[4]												

[1] (Source: DoEE 2019), [2] (Source: DoE 2015, McCauley & Jenner 2010; McCauley & Duncan 2011; Double *et al.* 2012; Double *et al.* 2014)

[3] (DoE, 2015; CALM 2005, Environment Australia 2002), [4] (Source: DPIRD 2019), [5] (Source: DoEE 2015), [6] (Source: DoEE 2017, CALM 2005, DSEWPaC 2012).

Hatched cell = peak period.

* occur in EMBA only

4.4 Socio-Economic and Cultural Environment

4.4.1 Commonwealth Protected Areas

4.4.1.1 Argo-Rowley Terrace Australian Marine Park

The Argo-Rowley Terrace Australian Marine Park (AMP) is located approximately 20 km north of the Operational Area and overlaps the EMBA. The Argo-Rowley Terrace AMP is located approximately 270 km west-north-west of Broome (Figure 4-15) and covers an area of 146,003 km^2 in water depths between 220–6,000 m from the continental slope to the edge of

the Exclusive Economic Zone (EEZ) (Director of National Parks, 2018). The MP includes an 83,379 km^2 Marine National Park Zone (IUCN II), a 62,720 km^2 Multiple Use Zone (IUCN VI), and a 1,140 km^2 Special Purpose Zone (Trawl). The Argo-Rowley Terrace AMP boundary is contiguous with the Rowley Shoals State Marine Park (Section 4.4.2.1) and Mermaid Reef Australian Marine Park (Section 4.4.1.2), providing continuous protection to the three coral atolls - Clerke Reef, Imperieuse Reef and Mermaid Reef (collectively known as the Rowley Shoals).

The Argo-Rowley Terrace AMP contains habitats, species and ecological communities associated with the Northwest Transition and Timor Province (Director of National Parks 2018). The Northwest Transition is an area of shelf break and continental slope, of which the Rowley Shoals are a key topographic feature. The Timor Province is dominated by warm, nutrient-poor waters. The AMP contains a range of sea floor features such as canyons on the slope between the Argo Abyssal Plain. These geomorphic features are thought to contribute to small, periodic upwellings that result in localised higher levels of biological productivity (Director of National Parks 2018).

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the marine park include resting and breeding habitat for seabirds and a migratory pathway for the Pygmy blue and Humpback whales. The marine park is thought to be an important area for sharks, which are found in abundance around the Rowley Shoals and provides important foraging areas for migratory birds and the endangered loggerhead turtle (DoEE n.d).

The Argo-Rowley Terrace AMP contains two KEFs: the canyons linking the Argo Abyssal Plain with the Scott Plateau and the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. The canyons linking the Argo Abyssal Plain with the Scott Plateau KEF are thought to contribute to high productivity and aggregations of marine life through the upwelling of nutrient rich water (DoEE n.d.). The Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals KEF is valued for enhanced productivity, aggregations of marine life and high species richness (DoEE n.d.). These KEFs are further described in Section 4.4.3.

4.4.1.2 Mermaid Reef Australian Marine Park

Mermaid Reef AMP is located approximately 69 km from the Operational Area, but within the wider EMBA (Figure 4-15). The AMP covers an area of approximately 540 km^2 and is listed as a National Park Zone (IUCN II). The AMP is near the edge of Australia's continental slope and is surrounded by waters that extend to a depth of over 500 m. The AMP contains Mermaid Reef, the most north-easterly of three reef systems forming the Rowley Shoals. Mermaid Reef is totally submerged at high tide and therefore falls under Australian Government jurisdiction. The other two reefs of the Rowley Shoals (Clerke Reef and Imperieuse Reef) are managed by the Western Australian Government as part of the Rowley Shoals State Marine Park. Mermaid Reef–Rowley Shoals is listed on the Commonwealth Heritage List.

Mermaid Reef AMP contains habitats, species and ecological communities associated with the Northwest Transition (Director of National Parks 2018). The reefs of the Rowley Shoals are one of the few offshore reef systems on the North-West Shelf and are thought to provide ecological steppingstones for reef species originating in Indonesian/Western Pacific waters (Director of National Parks 2018). The Rowley Shoals may also provide a degree of connectivity between these reefs and reefs located further south.

Mermaid Reef is a biodiversity hot spot and key geomorphic feature of the Argo Abyssal Plain (Director of National Parks 2018). Collectively, Mermaid Reef, Clerke Reef and Imperieuse Reef support over 200 species of hard corals and 12 classes of soft corals with coral formations in pristine condition. The shoals are an important area for sharks, including the grey reef shark, the whitetip reef shark and the silvertip whaler; important foraging area for marine turtles; toothed whales; dolphins; tuna and billfish; an important resting and feeding site for migratory seabirds; and a migratory pathway for Pygmy Blue Whales (DoEE n.d.).

The AMP contains the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF, valued for its high species richness, high productivity and aggregations of marine life (DoEE n.d.). The Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF is further described in Section 4.4.3.2. The marine park contains one known shipwreck, the *Lively* (wrecked in 1810), which is located to the north-west side of Mermaid Reef. The wreck is listed under the *Underwater Cultural Heritage Act 2018*.

4.4.1.3 Eighty Mile Beach Australian Marine Park

Eighty Mile Beach AMP is located approximately 72 km south of the Operational Area and overlaps the wider EMBA (Figure 4-15). The AMP is located approximately 74 km north-east of Port Hedland and adjacent to the Western Australian Eighty Mile Beach Marine Park. The marine park covers an area of 10,785 km² and water depth ranges between less than 15 m and 70 m. The entire marine park is zoned as a Multiple Use Zone (IUCN VI).

The Eighty Mile Beach AMP consists of shallow shelf habitats, including terrace, banks and shoals. The marine park supports a range of species including threatened, migratory, marine and cetacean species. Biologically important areas within the marine park include breeding, foraging and resting habitat for seabirds, internesting and nesting habitat for marine turtles, foraging, nursing and pupping habitat for sawfish and a migratory pathway for Humpback whales (Director of National Parks 2018).

The Eighty Mile Beach Ramsar site lies adjacent to the AMP and is recognised as one of the most important areas for migratory shorebirds in Australia.

The marine park contains three known shipwrecks listed under the *Historic Shipwrecks Act 1976*, *Lorna Doone* (wrecked in 1923), *Nellie* (wrecked in 1908), and *Tifera* (wrecked in 1923).

Eighty Mile Beach AMP has a range of cultural values for the community. Sea Country is valued for Indigenous cultural identity, health and wellbeing. The Sea Country of the Nyangumarta, Karajarri and Ngarla peoples extends into Eighty Mile Beach AMP (Director of National Parks 2018). Sea Country is culturally significant and important to their identity. There is also living cultural value of Sea Country including as a source of traditional staple foods such as saltwater fish, turtles, dugong, crabs and oysters (Director of National Parks 2018).

4.4.2 State Protected Areas

4.4.2.1 Rowley Shoals State Marine Park

The Rowley Shoals are located approximately 48 km from the Operational Area, while the wider EMBA overlaps with the Rowley Shoals State Marine Park (Figure 4-15).

Rowley Shoals (state managed) consist of three reefs – Mermaid Reef (managed under Commonwealth legislation), Clerke Reef (30 km south-west of Mermaid Reef), and Imperieuse Reef (40 km south-west of Clerke Reef), which is the largest of the three reefs.

Rowley Shoals State Marine Park is covered by the 'Rowley Shoals Marine Park Management Plan 2007–2017', which is still in effect. The boundary of the Argo-Rowley Terrace MP bounds Rowley Shoals to the north and Mermaid Reef AMP to the east.

Rowley Shoals and surrounding waters are important to the region in supporting high species richness, higher productivity and aggregations of marine life associated with the reefs. The enhanced productivity in Rowley Shoals is facilitated by the breaking of internal waves in the waters surrounding the reef system, therefore, causing mixing and resuspension of nutrients from water depths of 500–700 m (DoEE n.d.).

The marine environments within the shoal are typical of clear-water environments and include resident organisms and migrant species (Department of Environment and Conservation 2007). Given the remote location of the reefs, there is no history of disturbance by coral predators, and therefore creating a diverse number of marine species, including many molluscs, echinoderms and finfish that are not recorded anywhere else in Western Australia and similar habitats in Eastern Australia (DoEE n.d).

The Rowley Shoals contain intertidal and subtidal coral reefs, which support a diverse number of marine fauna and a range of reef biota. Surveys carried out by the Western Australian Museum identified 184 species of corals, primarily Indo-West Pacific species, indicating the strong affinity of the Rowley Shoals communities with Indonesia. In terms of other species, 264 species of molluscs, 82 species of echinoderms and 389 species of finfish were also identified (Department of Environment and Conservation 2007).

As per Section 4.4.1.2, Mermaid Reef has a diverse shark population, which extends to Rowley Shoals. Aside from sharks, reef edges also attract migratory pelagic species such as dolphins, tuna and billfish (DoEE n.d.). Furthermore, Rowley Shoals provides important habitat, feeding, resting and breeding grounds for a number of migratory birds, including the red-tailed tropicbird, white-tailed tropicbird and little tern.

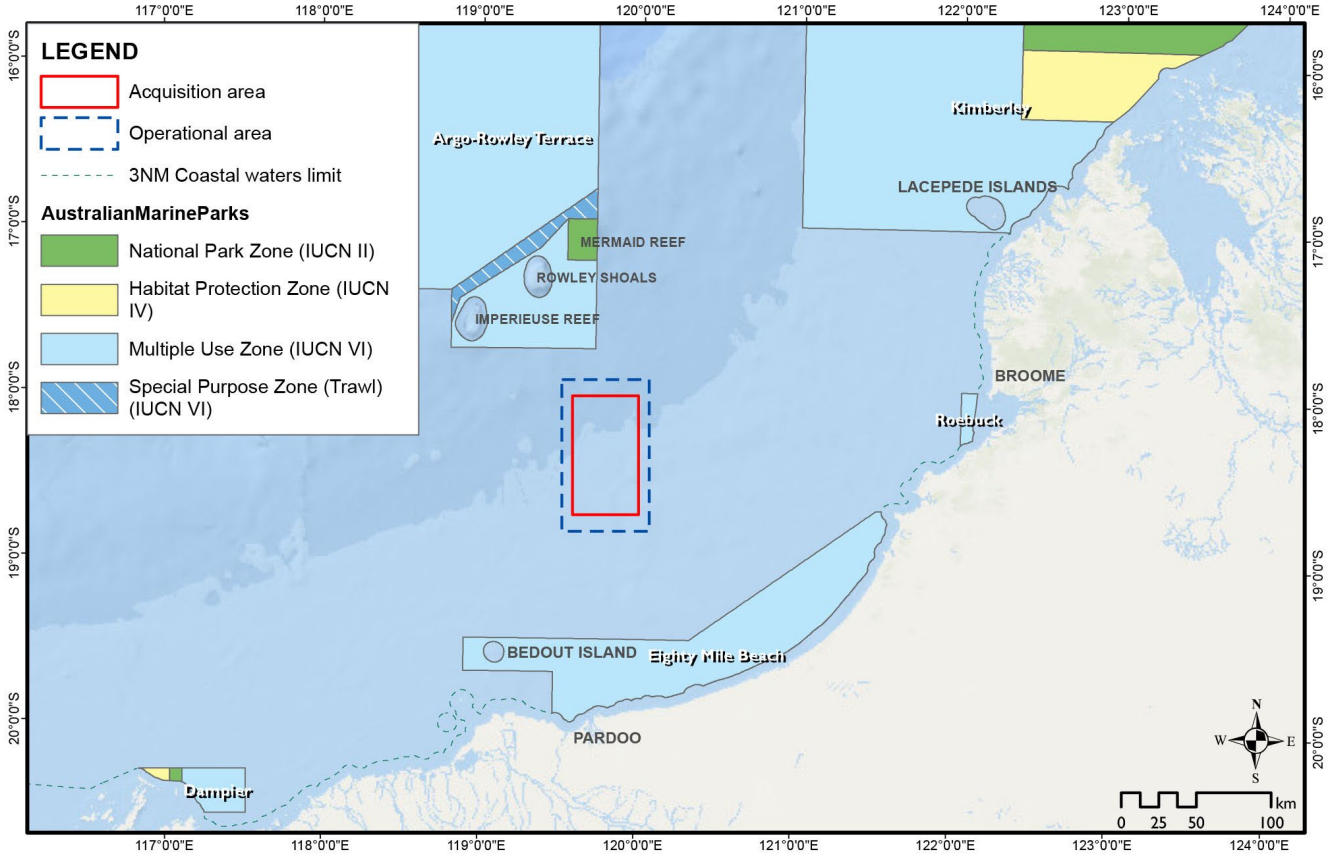


Figure 4-15 – Commonwealth Marine Protected Areas

4.4.3 Key Ecological Features

KEFs are the parts of the marine ecosystem that are considered to be of importance for a marine region's biodiversity or ecosystem function and integrity (DoEE n.d.). KEFs have been identified by the Australian Government on the basis of advice from scientists about the ecological processes and characteristics of the area.

One KEF occurs within the Operational Area (the ancient coastline at 125 m depth contour), and two KEFs occur within the wider EMBA (the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals, and the Continental Slope Demersal Fish Communities) (Figure 4-16). These KEFs are described below.

4.4.3.1 Ancient Coastline At 125 m Depth Contour

Several steps and terraces as a result of Holocene sea level changes occur in the region with the most prominent of these features occurring as an escarpment along the NWS and Sahul Shelf at a water depth of 125 m. These steps and terraces form the ancient coastline at 125 m depth contour KEF, which covers an area of approximately 16,190 km^2. The ancient coastline at 125 m depth contour is defined as a key ecological feature as it is a unique sea floor feature with ecological properties of regional significance. The feature represents the drowned coastline from around 17,000 years ago (https://atlas.parksaustralia.gov.au/exciting-discovery-kimberley-marine-park). It is not continuous and is fragmented along the 125 m depth contour.

Where the ancient, submerged coastline provides areas of hard substrate, it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (DSEWPaC 2012a). Parts of the ancient coastline, represented as rocky escarpment, are considered to provide biologically important habitat in an area predominantly made up of soft sediment.

The topographic complexity of escarpments associated with this feature may facilitate vertical mixing of the water column, providing relatively nutrient-rich localised environments. Migratory pelagic species (e.g. Humpback whales and whale sharks) may use this escarpment as a guide.

Although the ancient coastline adds habitat types to a representative system, the habitat types are not unique to the coastline as they are widespread on the upper shelf (Falkner *et al.* 2009).

The Operational Area and the wider EMBA overlap with the ancient coastline at 125 m depth contour. In particular, the Operational Area spatially covers approximately 1,535 km^2 or 9% of the KEF.

4.4.3.2 Mermaid Reef and Commonwealth Waters Surrounding Rowley Shoals

Mermaid Reef and Commonwealth waters surrounding Rowley Shoals are regionally important in supporting high species richness, higher productivity and aggregations of marine life associated with the adjoining reefs themselves. The Mermaid Reef and Commonwealth waters surrounding Rowley Shoals are listed as a KEF due to its high productivity and aggregations of marine life. The Rowley Shoals are a collection of three atoll reefs, Clerke, Imperieuse and Mermaid. Mermaid Reef lies 29 km north of Clerke and Imperieuse reefs and is totally submerged at high tide. Mermaid Reef falls under Commonwealth jurisdiction (DOEE 2019). Clerke and Imperieuse reefs constitute the Rowley Shoals Marine Park, which falls under Western Australian Government jurisdiction (EA 2000).

The reefs provide a distinctive biophysical environment in the region, with steep and distinct reef slopes, which attract a range of migratory pelagic species and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. The Rowley Shoals are known to contain 214 coral species and approximately 530 species of fishes, 264 species of molluscs and 82 species of echinoderms (Done *et al.* 1994; Gilmour *et al.* 2007).

Rowley Shoals' reefs are different from other reefs in the chain of reefs on the outer shelf of the North-west Marine Region, both in structure and genetic diversity as there is little connectivity between Rowley Shoals and other outer-shelf reefs (Done *et al.* 1994; Hooper and Ekins 2004; Underwood *et al.* 2009). An additional difference is that sea snakes do not occur at the Rowley Shoals (Done *et al.* 1994).

The wider EMBA overlaps with the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals, while the Operational Area is located approximately 46 km north-east away from the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals.

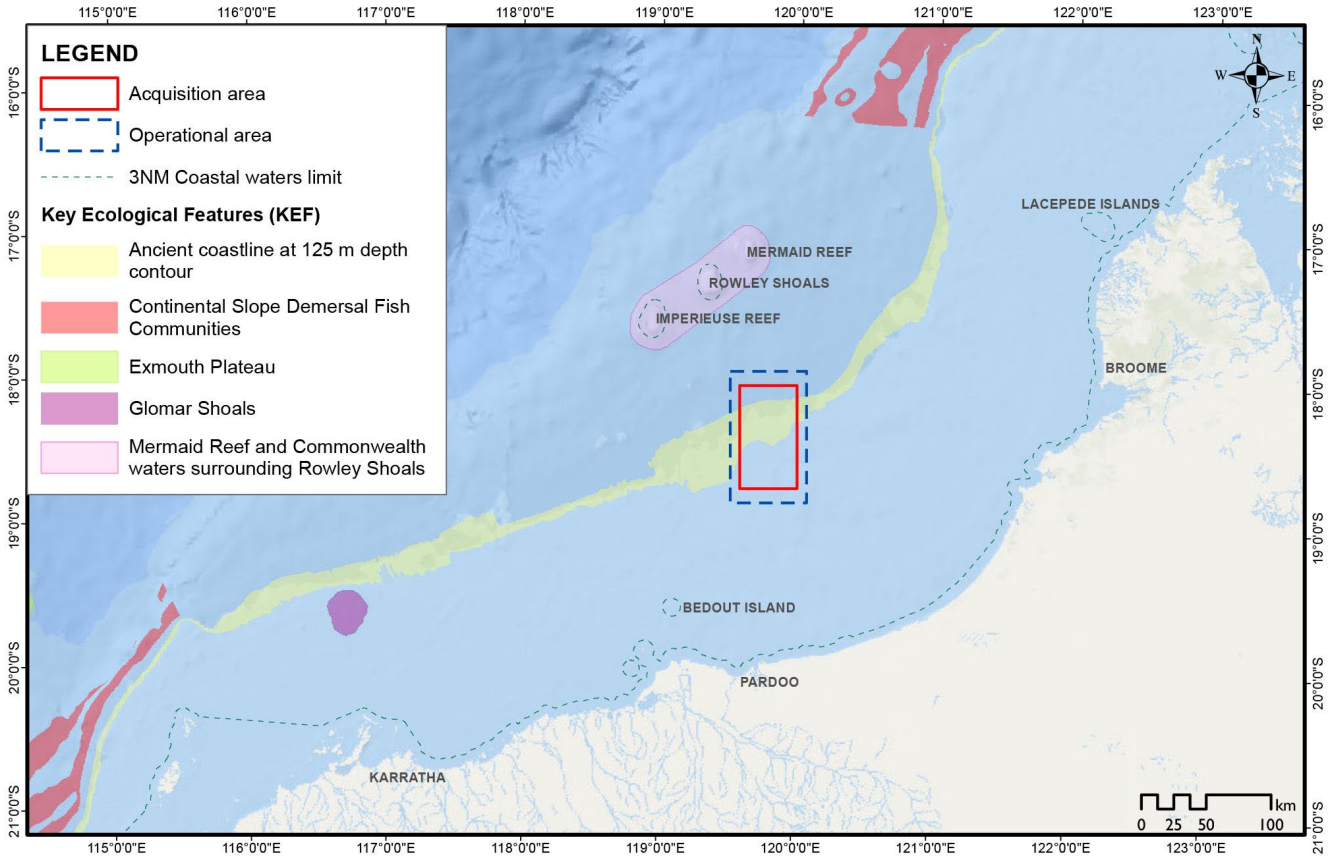


Figure 4-16 – Key Ecological Features

4.4.4 Commercial Fisheries

Commercial fishing in Western Australia is comprised of WA state managed fisheries and Commonwealth managed fisheries, and is mainly based on low-volume, high-value products (DPIRD, 2018).

The Australian Fisheries Management Authority (AFMA) manages Australian fisheries on behalf of the Commonwealth Government from 3 nm to the edge of the Australian Fishing Zone (AFZ). AFMA carries out objectives that are listed in the *Fisheries Administration Act 1991* and the *Fisheries Management Act 1991*. Commonwealth managed fisheries with management boundaries that overlap the Operational Area and EMBA include the:

- Southern Bluefin Tuna Fishery (SBTF)
- Western Tuna and Billfish Fishery (WTBF)
- Western Skipjack Tuna Fishery (WSTF)
- North-West Slope Trawl Fishery (NWSTF).

The Department of Primary Industries and Regional Development (DPIRD) manage fisheries that take place predominantly within the offshore waters of Western Australia and within 3 nm of the coastline. WA state managed fisheries with management boundaries that overlap the Operational Area include the:

- Mackerel Managed Fishery (MMF)
- The Pilbara Demersal Managed Fisheries, comprising of the:
    - Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)
    - Pilbara Trap Managed Fishery (PTMF)
    - Pilbara Line Fishery (PLF)
- Northern Demersal Scalefish Managed Fishery (NDSMF)
- Nickol Bay Prawn Managed Fishery (NBPMF)
- Broome Prawn Managed Fishery (BPMF)
- Beche-de-mer Managed Fishery
- Marine Aquarium Managed Fishery (MAMF)
- Specimen Shell Managed Fishery (SSMF)
- Western Australian North Coast Shark fishery (WASF)
- Pearl Oyster Managed Fishery (POMF).

The Commonwealth and WA state managed commercial fisheries with the licence to operate within the Operational Area and/or EMBA are described in Table 4-11.

Table 4-11 – Commonwealth and WA State Managed Fisheries

Fishery	Overlap with fisheries Management Area		Description	Overlap with historical catch and effort		Relevance to EP
	Operational Area	EMBA		Operational Area	EMBA	
Commonwealth Managed Fisheries						
Southern Bluefin Tuna Fishery (SBTF)	✓	✓	The SBTF management area covers the entire Australian Fishing Zone and overlaps with the Operational Area. The fishery targets southern bluefin tuna (*Thunnus maccoyii*) using purse seine, pelagic longline and some minor line. The SBTF fishing season runs for 12 months beginning 1 December. In the 2022-2023 fishing season, 30 active vessels caught 6,034 tonnes of southern bluefin tuna (Butler *et al.* 2024). Effort is concentrated in the Great Australian Bight (purse-seine) and off New South Wales (hooks), and no catch or effort from the SBTF occurred in WA. The only known spawning grounds of the southern bluefin tuna occurs in the Java Sea, beyond the wider EMBA.	X	X	No effort from the SBTF occurs in Western Australia. Therefore, activities of the SBTF are considered to be outside the scope of this EP.
Western Tuna and Billfish Fishery (WTBF)	✓	✓	The WTBF management area covers the western portion of the AFZ from the SA–Victorian border to the Cape York Peninsula and overlaps with the Operational Area. The fishery targets bigeye tuna (*Thunnus obesus*), yellowfin tuna (*T. alacares*), striped marlin (*Kajikia audax*), swordfish (*Xiphias gladius*), and albacore (*T. alalunga*) using pelagic longline, minor line and purse seine. The WTBF fishing season runs for 12 months beginning 1 February. In the 2023 season, three active vessels (two pelagic longline, one minor line) caught 196 tonnes of the various target species (Butler *et al.* 2024). The WTBF typically fish in Australia's Economic Zone and the high seas of the Indian Ocean. In recent years, effort has been concentrated off south-west Western Australia and South Australia (Butler *et al.* 2024).	X	X	The Operational Area partially overlaps with the management area of the WTBF; however, the proposed survey is not expected to affect the activities of this fishery.
Western Skipjack Tuna Fishery (WSTF)	✓	✓	Australia's Skipjack Tuna Fishery is divided into the Eastern Skipjack Tuna Fishery and the Western Skipjack Tuna Fishery (WSTF) that target separate stocks of skipjack tuna (*Katsuwonus pelamis*) in Australia using purse seine (predominantly) and pole-and-line methods. Although the management area of the WSTF overlaps the Operational Area, there has been no fishing effort for Western skipjack tuna since the 2008–2009 season and management arrangements for this fishery will be reviewed if active boats re-enter the fishery (Butler *et al.* 2024).	X	X	The Operational Area may possibly overlap with the management area of the WTBF; however, the proposed survey is unlikely to affect activities of this fishery which has been inactive since 2008.
North-West Slope Trawl Fishery (NWSTF)	X	✓	The NWSTF management boundary is located from the coast of the Prince Regent National Park to Exmouth, between the 200 m depth contour to the outer limit of the Australian Fishing Zone. The Operational Area is located approximately 10 km south-east of the NWSTF boundary (Figure 4-17). The fishery targets scampi (*Metanephrops australienis, M. boschmai*, and *M. velutinus*) using demersal trawl. The NWSTF fishing season runs for 12 months beginning 1 July. In the 2022–2023 season, three active vessels caught 85.4 tonnes of scampi and other catch (Butler *et al.* 2024). Effort is concentrated mostly towards the 200 m isobaths boundary of the NWSTF from north of the Montebello Islands to Scott Reef.	X	✓	No effort occurs within the Operational Area. Effort historically occurs in the EMBA and this fishery may be impacted by an unplanned hydrocarbon spill.
State Managed Fisheries						
Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)	✓	✓	This fishery is licensed to fish in the offshore waters of the Pilbara region, subject to specific closure areas (Figure 4-18). The PFTIMF targets red emperor (*Lutjanus sebae*); bluespotted emperor (*Lethrinus punctulatus*); and rankin cod (*Epinephelus multinotatus*) and a variety of other demersal snappers, emperors and groupers using demersal trawl techniques. Trawl fishing is permitted in the southern third of the Operational Area. Of the total commercial catches of demersal scalefish in the Pilbara in 2021 (2,714 t), the majority (74%, 2,594 t) was landed by the trawl sector (Newman *et al.* 2024). This has been a common pattern in previous years when between 66% and 78% of the retained catch in the Pilbara demersal scalefish fisheries was retained by the trawl sector, with the trap and line fisheries making up significantly smaller catches. Three vessels were active in the fishery between 2013–2014 and 2015–2016, reducing to two vessels from the 2016–2017 season, with four vessels active in 2022 (Newman *et al.* 2018, 2024). Total catch by the trawl sector has increased steadily in the same period from 1,172 t in 2015 (Newman *et al.* 2018, 2024).	✓	✓	The Operational Area overlaps with the management area of the PFTIMF, and trawl fishers may be active within this overlap. There is low catch and fishing effort within the Operational Area, relative to other areas within the fishery (refer to Section 4.4.4.1).
Pilbara Trap Managed Fishery (PTMF)	✓	✓	This fishery is licensed to fish in the offshore waters of the Pilbara region, subject to specific closure areas (Figure 4-18). The PTMF targets red emperor (*Lutjanus sebae*); bluespotted emperor (*Lethrinus punctulatus*); and rankin cod (*Epinephelus multinotatus*) using fish traps, and three vessels were active in the fishery during the 2023 fishing season (Newman *et al.* 2024). In the 2023 fishing season, these vessels reported a total catch of 573 t (Newman *et al.* 2024).	✓	✓	The Operational Area overlaps with the management area of the PTMF. There is low catch and fishing effort within the Operational Area, relative to other areas within the fishery (refer to Section 4.4.4.1).
Pilbara Line Fishery (PLF)	✓	✓	This fishery is licensed to fish in the offshore waters of the Pilbara region and operates as an exemption-based fishery. The PLF targets pink snapper (*Pagrus auratus*), red emperor (*Lutjanus sebae*); bluespotted emperor (*Lethrinus punctulatus*); and rankin cod (*Epinephelus multinotatus*) using pole-and-line techniques. In the 2010 fishing season a total catch of 114 t was reported (Newman *et al.* 2022, 2024).	X	✓	The Operational Area overlaps with the management area of the PLF, however, there is no catch or fishing effort within the Operational Area (refer to Section 4.4.4.1).
Northern Demersal Scalefish Managed Fishery (NDSMF)	✓	✓	The Northern Demersal Scalefish Managed Fishery operates off the north-west coast of Western Australia. The NDMSF is divided into an inshore sector (Area 1), and an offshore sector (Area 2). Area 1 occurs between the high-water mark and the 30 m isobath where only line fishing is permitted. Area 2 extends from the 30 m isobath to the AFZ, and permits handline, dropline and fish traps. Fishing access to the research-fishing zone can only be facilitated through an agreed research framework. The fishery targets goldband snapper (*Pristipomoides mutidens*); and red emperor (*Lutjanus sebae*) using trap and line techniques. The NDSMF season runs for 12 months from 1 January. In the 2023 fishing season, the fishery reported a total catch of 1,458 t, which exceeded the acceptable catch range for the fishery (Newman *et al.* 2024).	✓	✓	The Operational Area partially overlaps with Area 2 of the NDSMF at the far eastern portion of the Operational Area and trap fishers may be active within this overlap. There is low catch and fishing effort within the Operational Area, relative to other areas within the fishery (refer to Section 4.4.4.1). The Acquisition Area does not overlap the NDSMF, and so the potential for interaction with fishers is limited.

Fishery	Overlap with fisheries Management Area		Description	Overlap with historical catch and effort		Relevance to EP
	Operational Area	EMBA		Operational Area	EMBA	
Mackerel Managed Fishery (MMF)	✓	✓	The MMF is divided into three management areas, Area 1 (Kimberley), Area 2 (Gascoyne), and Area 3 (Gascoyne-West Coast). Each area has its own management arrangements. The MMF targets Spanish mackerel (*Scomberomorus commerson*) using surface trolling techniques. Small amounts of grey mackerel (*S. semifasciatus*) and other pelagic species are also captured. The MMF is predominately active in the North Coast and Gascoyne Coast Bioregions. In the 2022 season, the fishery reported 198 t of commercial catch and 35 -78 t of recreational catch of Spanish mackerel (Newman *et al.* 2024). The Area 2 (Pilbara) fishing season runs from 1 April to 30 September. The peak period of annual Spanish mackerel fishing effort in the Pilbara sector is July to October whereas annual effort is lowest from December to March (Mackie *et al*. 2010).	✓	✓	The Operational Area overlaps with the management area of the MMF, however, there is very limited fishing effort within the Operational Area and the survey will occur outside of the peak fishing period (refer to Section 4.4.4.1).
Sea Cucumber Managed Fishery (SCF)	✓	✓	The SCF is a nearshore hand-harvest fishery operating from Exmouth Gulf to the Northern Territory border. The fishery targets Sandfish (*Holothura scabra*); and Redfish (*Actinopyga echinities*) by nearshore diving and wading. Diving is typically in water < 5 m deep and 1 -2 vessels operate in the fishery (Hart et al. 2022). In the 2023 fishing season, it was reported that there was a total catch of 126.1 t. It should be noted, the majority of effort is concentrated around the Kimberley region (Newman et al. 2024). However, there have been several years where substantial effort was within the Pilbara region.	X	X	The Operational Area overlaps with the management area of the SCF. However since the SCF is shore-based in waters < 5 m deep the proposed survey is not expected to overlap with the actual activities of this fishery.
Marine Aquarium Managed Fishery (MAMF)	✓	✓	The Marine Aquarium Managed Fishery is able to operate in all state waters (between the Northern Territory border and South Australia border). The MAMF sources up to 1,500 species of marine aquarium fishes, as well as coral, live rock, algae, seagrass and invertebrates. The fishery collects species by diving and hand collection in waters <30 m depth. In 2023, the MAMF reported a total commercial catch of 20,604 individual fishes (including fish, syngnathids, invertebrates and sponges) (Newman *et al.* 2024). Typically, the fishery is most active in waters south of Broome and the highest amount of effort is generally around the Capes region, Perth, Geraldton, Exmouth and Dampier.	X	X	The Operational Area overlaps with the management area of the MAMF; however the proposed survey is not expected to overlap with the actual activities of this fishery and there is no overlap with the EMBA.
Specimen Shell Managed Fishery (SSMF)	✓	✓	The Specimen Shell Managed Fishery is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. The fishery covers the entire coastline of Western Australia. The SSMF collects shells by hand by a small group of drivers in shallow waters (<20 m) or wading along coastal beaches. 5,807 shells distributed over 200 species were collected in the 2023 fishing season by 18 vessels (Newman *et al.* 2024). The majority of effort is located adjacent to population centres such as Broome, Exmouth, Perth, Mandurah, the Cape Areas and Albany.	X	X	The SSMF management boundary overlaps with the Operational Area. However the proposed survey is not expected to impact the activities of this fishery and there is no overlap with the EMBA.
Nickol Bay Prawn Managed Fishery (NBPMF)	✓	✓	The NBPMF operates along the western part of the North-West Shelf between Dampier and the western extend of Eighty Mile Beach. The fishery targets Banana prawns (*Penaeus esculentus*) using high opening otter trawl systems. The Nickol Bay Prawn Managed Fishery season is year-round, with designated nursery areas closed between August and November. In the 2021 season, a total catch of 89 t was reported (Newman *et al.* 2024).	X	X	The Operational Area partially overlaps with the management area of the NBPMF. However there is no catch or fishing effort within the Operational Area and no overlap with the EMBA (refer to Section 4.4.4.1).
Broome Prawn Managed Fishery (BPMF)	✓	✓	The BPMF management area extends east of the 120° E longitude line to north of Derby, however the majority of the area is prohibited to fishing, with only a small portion of area nearshore of Broome permitting fishing activity. The fishery targets Western King prawns (*Penaeus latisulcatus*) using high opening otter trawl systems.	X	X	The Operational Area partially overlaps with the management area of the NBPMF. However there is no catch or fishing effort within the Operational Area and no overlap with the EMBA as there is no fishing permitted in the area.
Northern Shark Fishery (NSF)	✓	✓	The NSF management area extends from longitude 114°06´E (North West Cape) to 123°45´E (Koolan Island), however the area between North-West Cape and 120°E and all waters south of latitude 18°S has been closed indefinitely. The NSF targets Dusky whaler, Sandbar, Gummy and Whiskery sharks using demersal gillnets, however no fishing activity has been recorded in the NSF since 2008/2009 (Newman et al. 2024).	X	X	The NSF management boundary partially overlaps with the Operational Area, however the fishery has not been active since 2008. Therefore, the proposed survey is not expected to impact the activities of this fishery.
Pearl Oyster Managed Fishery (POMF)	✓	✓	The POMF is the only remaining significant wild-stock fishery for pearl oysters in the world. The species targeted is the Indo-Pacific silver-lipped pearl oyster (*Pinctada maxima*). It is a quota-based, dive fishery, operating in shallow coastal waters along the NWS from Exmouth to the NT border. The harvest method is drift diving. Fishing activity primarily occurs in water depths of 10 to 35 m (DoF 2016b). In 2023, the number of wild-caught pearl oysters was 798,217. Total effort was 10,641 dive hours (Newman *et al.* 2024).	X	✓	The POMF management boundary partially overlaps the Operational Area. Considering the diving operation depth of the fishery is less than 35 m, whilst the shallowest waters of the operational area is 95 m, POMF activity is not expected to occur within the Operational Area. The closest possible activity is estimated to occur at least 85 km from the Operational Area at the 35 m contour. However, there is a small overlap of the southern tip of the EMBA with an area of low fishing activity.

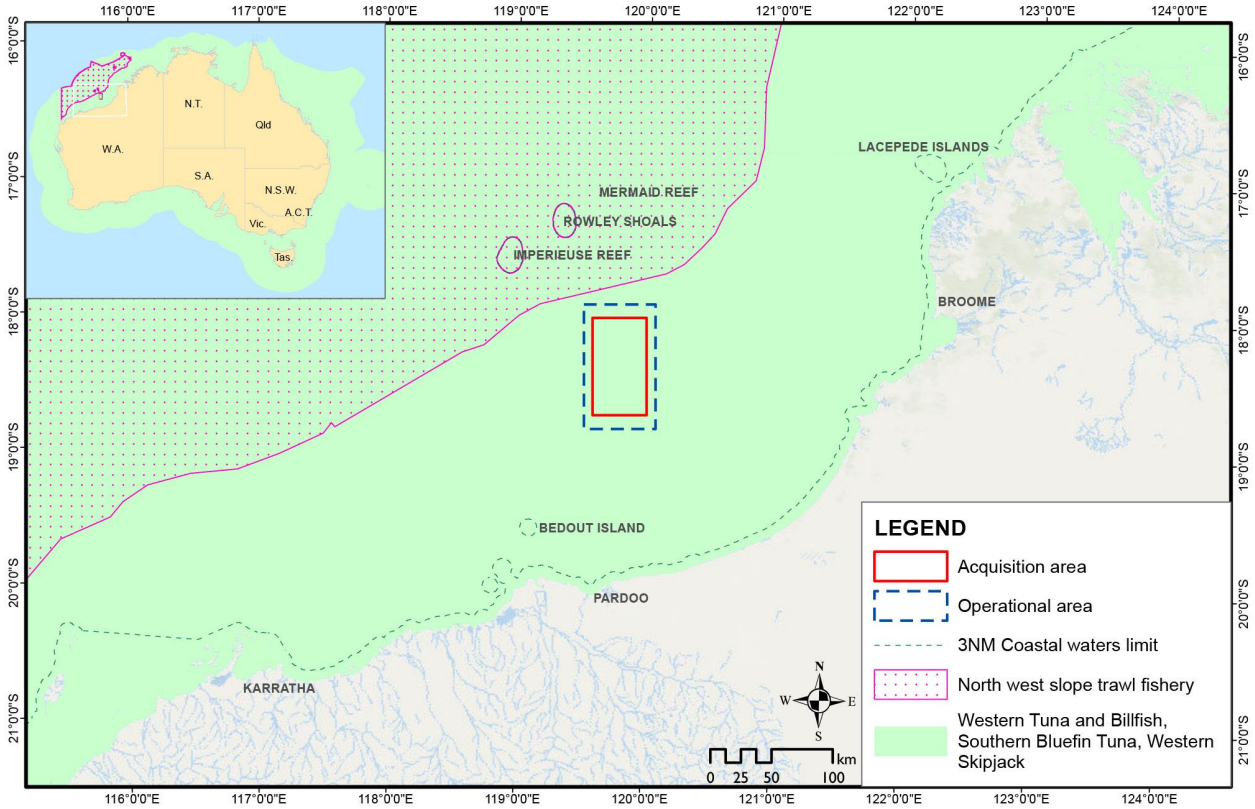


Figure 4-17 – Commonwealth Fisheries within the Operational Area and wider EMBA

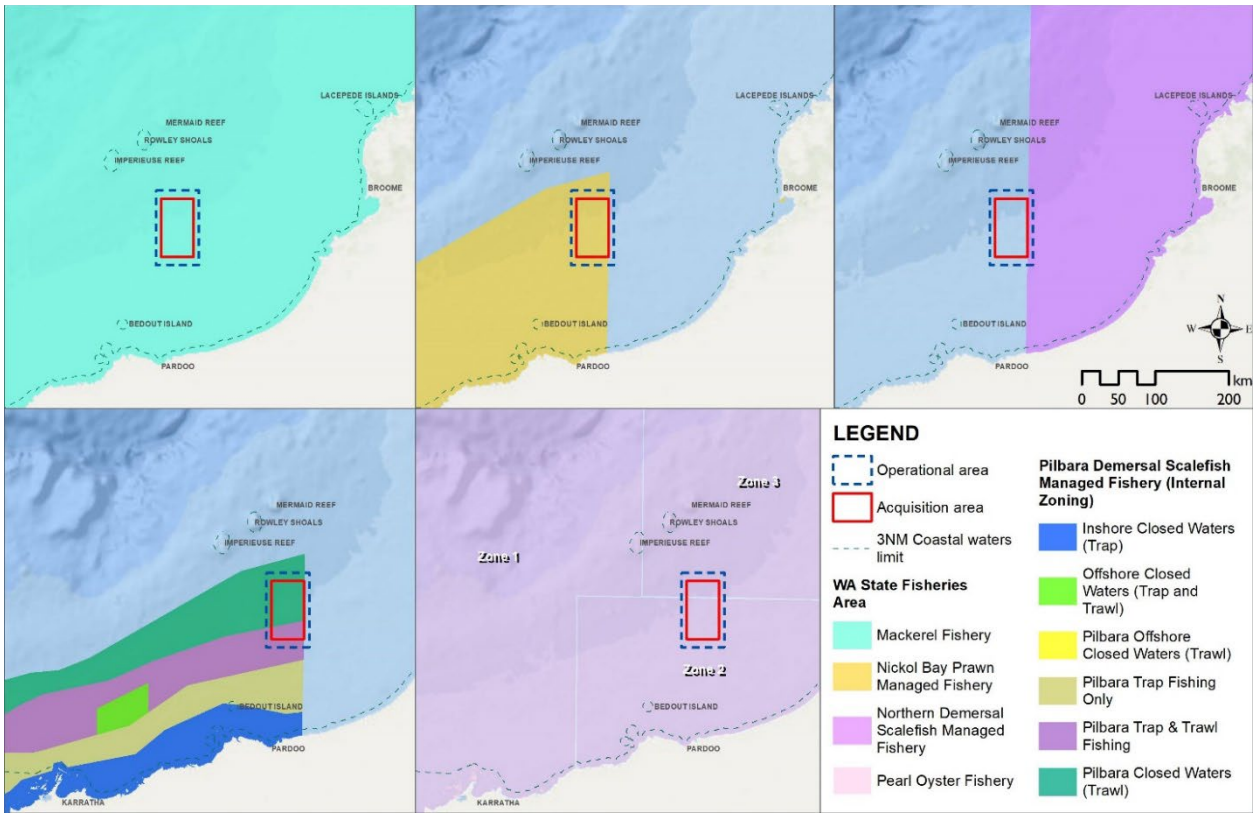


Figure 4-18 – WA State Fisheries within the Operational Area

4.4.4.1 Review of Catch and Effort Data

CGG requested annual catch and effort data (FishCube data) from DPIRD for WA managed fisheries understood to operate within or near to the Operational Area. FishCube data is not available for Commonwealth managed fisheries.

Data was assessed for 60 nm × 60 nm or 10 nm × 10 nm Catch and Effort System (CAES) blocks, depending on fishery reporting arrangements, for annual catch and effort data for the period January 2020 to December 2024. Data was assessed to identify where the greatest fishing effort in each fishery occurred and the relative importance of waters within the Operational Area.

Data provided by DPIRD included:

- Weight (kg) – a measure of fish catches per CAES block during the period of interest
- Vessel Count – a measure of the number of vessels that fished in a CAES block during the period of interest
- Fishing Day Count – a measure of fishing effort, represented by the number of days when one or more vessels fished in a CAES block during the period of interest.

Due to confidentiality reasons, DPIRD is unable to release catch and effort data for CAES blocks where less than three vessels fished during the period of interest (i.e. less than three vessels per month). Where this applies, the Vessel Count is marked 'Less than three vessels', while Weight and Fishing Day Count are marked as 'N/A'. CAES blocks where the results are provided in this way confirm that fishing effort did occur within the block during that period, but the associated catch and effort values are not available. CAES blocks where no fishing is recorded do not return any data.

It is important to recognise the limitations of referring to blocks with less than three vessels; although the number of vessels may be less than three, a block may experience high catch or effort by just one or two vessels. However, these blocks may experience less effort than other blocks where three or more vessels frequent the area to fish.

This review of catch and effort data was used to inform an assessment of relevant persons for the purposes of consultation as described in Section 5. Review of five years of catch and effort data is considered appropriate for this EP to represent the potential for future fishing effort and past fishing effort considering the limited duration of the proposed MSS (60 days, see Section 3.2) and that the potential impacts to fish and fish stocks from the proposed activity are expected to be temporary (see Sections 7 and 8). In addition, five years aligns with the review cycle of Commonwealth fisheries harvest strategies aimed at managing performance of the stock or fishery through time as well as the time scale of inter-annual variability of environmental parameters that affect fisheries resources (DAWR 2018), both indicating the suitability of this time scale to fishing decision of individual fishers.

4.4.4.1.1 Mackerel Managed Fishery

Analysis of FishCube data shows that the Operational Area overlapped with approximately 30 km^2 (0.02%) of the area of fishing effort for the five-year period between January 2020 and December 2024 (with reporting block 185195; Figure 4-19). This effort was by 'less than 3 vessels' in 2020 and again in 2021, with no other effort recorded in this block for the five-year period between 2020 and 2024, or with other blocks that overlap the Operational Area. The Acquisition Area did not overlap with the area of effort. Fishers operating within Area 2 (Pilbara sector) of the MMF, in which the proposed MSS is located, generally fish in shallower waters south of the Operational Area (Figure 4-19). In 2023 there were six vessels operating in Area 2 of the fishery (Newman et al. 2024). The peak period of annual Spanish mackerel fishing effort in the Pilbara sector is July to October whereas annual effort is lowest from December to March (Mackie *et al*. 2010).

4.4.4.1.2 Nickol Bay Prawn Managed Fishery

Analysis of FishCube data shows that the Operational Area does not overlap with the area of fishing effort for the five-year period between 2020 and 2024. Fishing effort is located in shallow nearshore waters, around bays and river mouths such as De Grey River mouth approximately 130 km south of the Operational Area between June and October.

4.4.4.1.3 Northern Demersal Scalefish Managed Fishery

Analysis of FishCube data shows that the Operational Area overlapped with approximately 648 km^2 (0.6%) of the area of fishing effort for the five-year period between 2020 and 2024 (Figure 4-20). This effort was by 'less than 3 vessels' in four blocks along the southern edge of the fishery (181200, 182200, 183200 and 184200), with the distribution of effort shown in Figure 4.20 highlighting the broad area of low-level activity by the vessels operating in the fishery (eight vessels in 2022; Newman et al. 2024), and their focus on fishing grounds in the Kimberley region. The data also shows that fishing effort

occurs relatively consistently across the entire year in this area of overlap with no identified peak periods. The Acquisition Area did not overlap with the area of effort.

4.4.4.1.4 Pilbara Demersal Scalefish Fisheries

Fishing effort within the Pilbara Demersal Scalefish Fisheries (PFTIMF, PTMF and PLF) is highest in western areas of the fisheries that are closest to the home ports of fishers and have higher historical and current levels of effort compared to the eastern areas of the fisheries (where the Sauropod 3D MSS is located), which are more distant from port (Gaughan *et al.* 2018; Figures 4.21 and 4.22). This also aligns with information obtained by Santos during consultation with the Pilbara Fish Trawl Interim Managed Fishery (PFTIMF) for their Keraudren 3D MSS, which showed that the main home port for the two main operators in the fisheries were Exmouth (MG Kailis) and Point Samson (Westmore Seafoods) (Santos 2020). Further analysis of the distribution of fishing effort for these fisheries, in relation to the Sauropod 3D MSS, is provided in the following subsections.

4.4.4.1.4.1 Pilbara Fish Trawl (Interim) Managed Fishery

Of the total commercial catches of demersal scalefish in the Pilbara in 2023 (2,594 t), 74% (1,907 t) were landed by the trawl sector (Newman et al. 2024), Analysis of FishCube data shows that the Operational Area overlaps with approximately 1,958 km^2 (7%) of the area of fishing effort, of which 1,225 km^2 is within the Acquisition Area (Figure 4-21). Reported fishing effort within the southern portion of the Operational Area is relatively low with effort much more focussed on waters south-west of the Operational Area and to the north-west of Dampier and Karratha (refer to Figure 4-21). The data shows that fishing effort is fairly consistent across the entire year with no identified peak periods. Four vessels operated in the fishery during 2023 (Newman et al. 2024).

4.4.4.1.4.2 Pilbara Trap Managed Fishery

FishCube data for the PFTIMF was only available in a coarse 60 nm fisheries reporting block resolution. As such, the area of fishing effort and overlap is likely to be overestimated as fishing is likely to be limited spatially to discrete locations rather than across the entire area of these blocks. The data shows that the Operational Area overlaps with approximately 4,863 km^2 (3%) of the area of fishing effort, of which 3,501 km^2 is within the Acquisition Area (Figure 4-22). The data also indicates a low level of activity by the PTMF relative to the PFTIMF, accounting for 22% (573 t) of the total catch for the Pilbara Demersal Scalefish fisheries in 2023 (Newman et al. 2024). FishCube data shows that less than three vessels have typically operated in the Operational Area each year for the last five years (2020 – 2024; noting that only three vessels in total operated in the fishery during 2023 (Newman et al. 2024)), compared with greater fishing effort located to the south-west of the Operational Area between Exmouth and Dampier (up to nine vessels). Fishing effort occurs relatively consistently across the entire year with no identified peak periods.

4.4.4.1.4.3 Pilbara Line Fishery

FishCube data for the PLF was only available in a coarse 60 nm fisheries reporting block resolution. As such, the area of fishing effort and overlap is likely to be overestimated because effort is likely limited spatially to discrete locations rather than over the entire area of these blocks. Analysis of the data shows that the Operational Area did not overlap with the area of fishing effort for the five-year period between 2020 and 2024, with effort located in waters further to the south and west of the Operational Area, particularly near Dampier, Karratha, Onslow and Barrow Island. The data also indicates a low level of activity by the PLF relative to other sectors, accounting for 4% (114 t) of the total catch for the Pilbara Demersal Scalefish fisheries in 2023 (Newman et al. 2024). Fishing effort occurs between May to September each year.

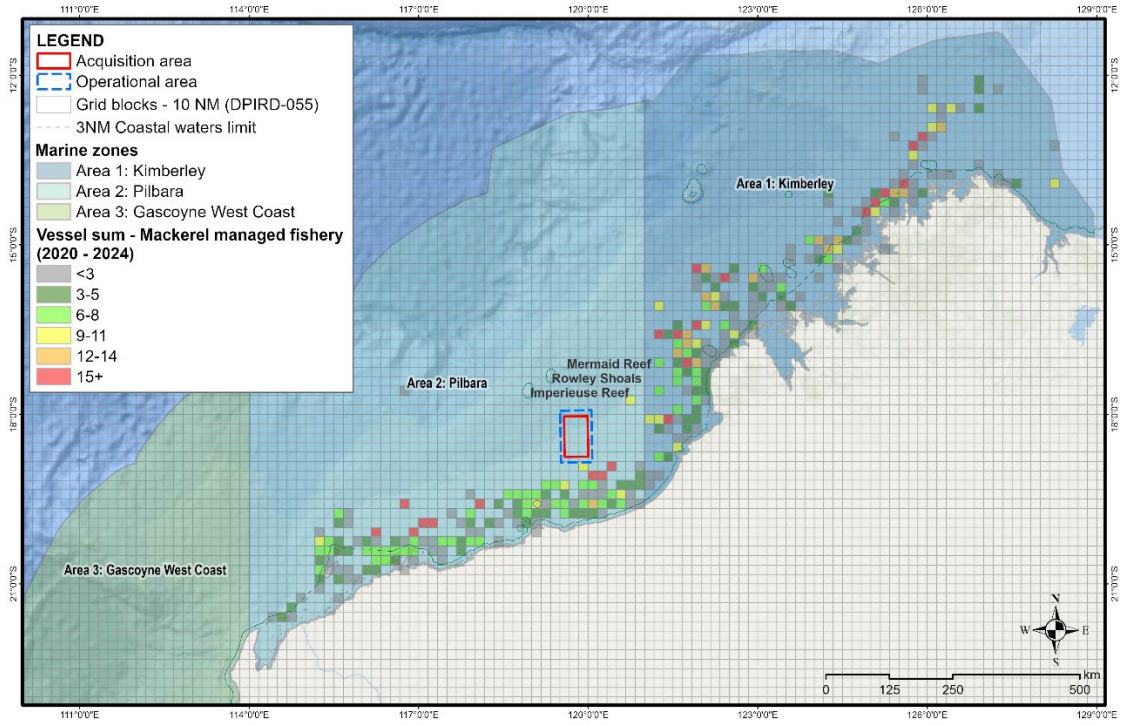


Figure 4-19 – Count of Fishing Vessels within Areas 2 and 3 of the Mackerel Managed Fishery for the period 2020 - 2024 (pooled sum of annual data within each Fishery Reporting Block)

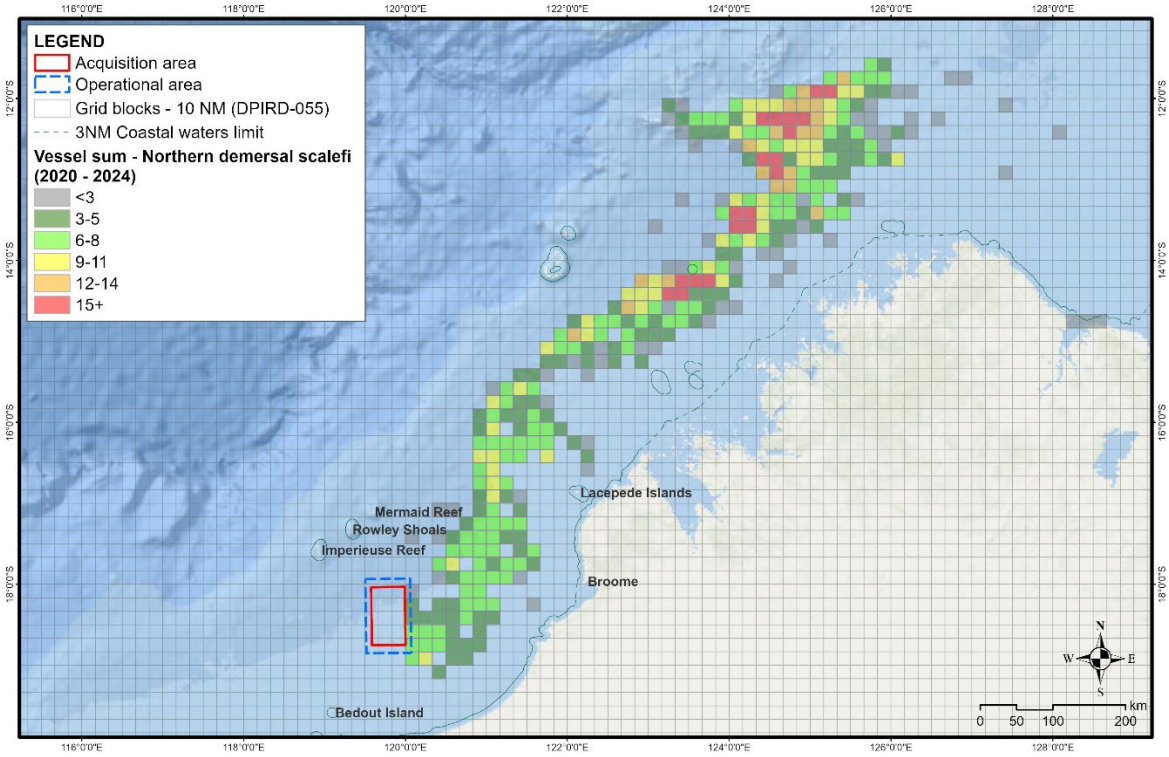


Figure 4-20 –Count of Fishing Vessels within the Northern Demersal Scalefish Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Block)

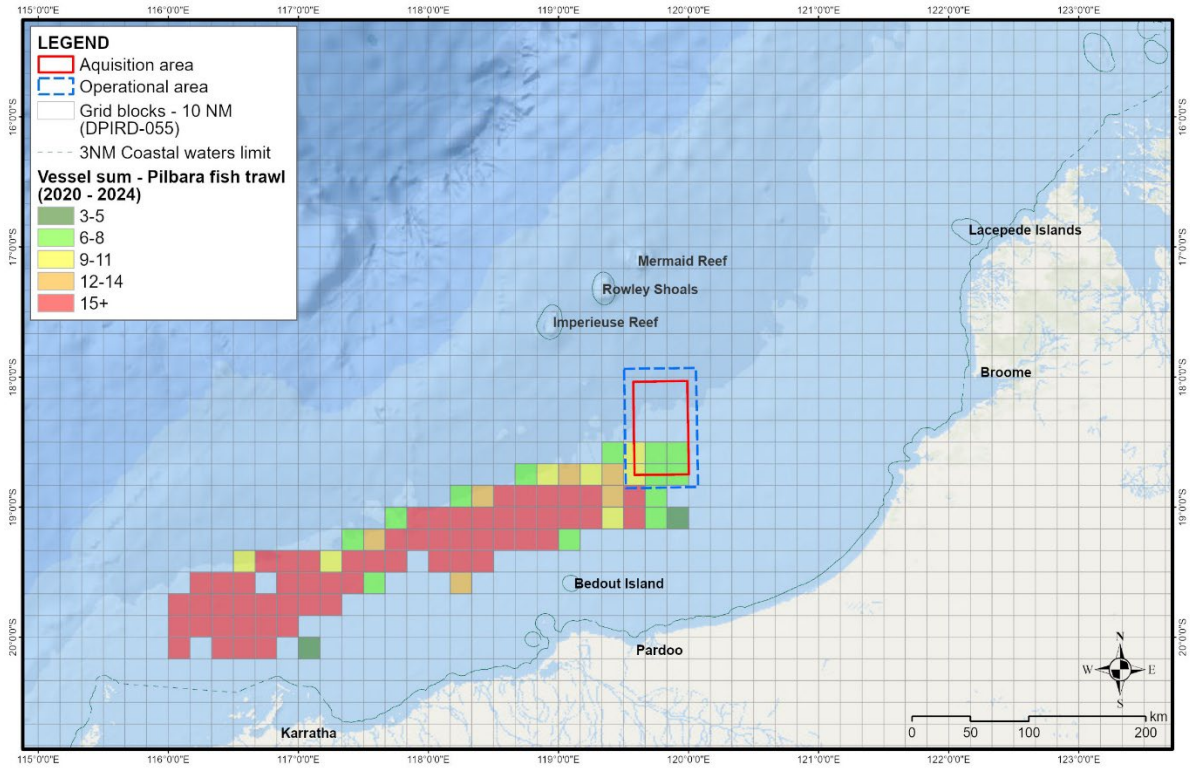


Figure 4-21 – Count of Fishing Vessels within the Pilbara Fish Trawl (Interim) Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Blocks

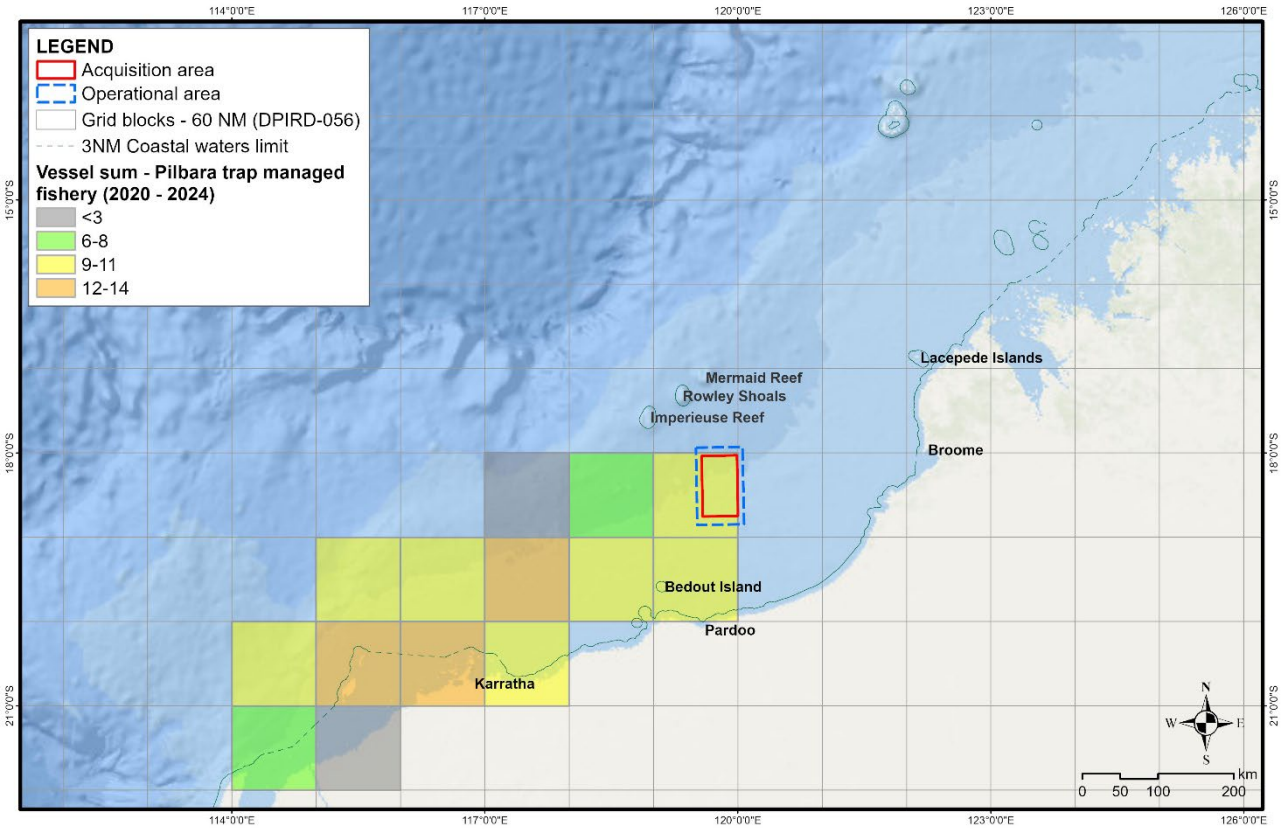


Figure 4-22 – Count of Fishing Vessels within the Pilbara Trap Managed Fishery for the period 2020 – 2024 (pooled sum of annual data within each Fishery Reporting Blocks; note that data only available for 60 x 60 nm reporting blocks)

4.4.5 Tourism and Recreation

No tourism activities are known to take place specifically within the Operational Area; however, it is acknowledged that there are growing tourism and recreational sectors in north-west Western Australia. Potential for growth and further expansion in tourism and recreational activities in the Pilbara and Gascoyne regions is recognised, particularly with the development of regional centres and a workforce associated with the resources sector (Gascoyne Development Commission 2012).

Recreational fishing in the North Coast Bioregion is mainly concentrated on the continental shelf south of the Kimberley and within the North West Shelf Province, the Central Western Shelf Transition Province and the Central Western Shelf Province. An estimated 640,000 fishers participate in recreational fishing each year (Fletcher and Santoro 2012). The recreational and charter sectors do not catch significant quantities of most demersal scalefish species targeted by the commercial fisheries (Newman et al. 2024) and given the depth of waters (95 m–150 m) and the distance offshore, it is unlikely that recreational fishing occurs within the Operational Area.

Recreational fishing occurs at Rowley Shoals, which are located within the EMBA. However, Mermaid Reef that forms part of Rowley Shoals does not permit recreational fishing. Whilst recreational fishing does occur at Rowley Shoals, it is occasional due to the remote location. Clerke Reef and Imperieuse Reef are also subject to tourism, with charter boat operators taking visitors to these remote islands (Department of Environment and Conservation 2007). Scuba diving, snorkelling and other water sports are known to take place at the Rowley Shoals (Department of Environment and Conservation 2007). Boat charter trips of two days or longer regularly visit the Rowley Shoal between September to December when conditions are at their best (Tourism Western Australia 2019).

4.4.6 Oil and Gas Activities

The region currently supports a number of industries including petroleum exploration and production. Petroleum titleholders with titles that are adjacent to the Operational Area are listed in Table 4-12. However, based on information published on the NOPSEMA website (EPs that are either accepted or under assessment) and consultation with other titleholders no other seismic surveys will occur concurrently with the proposed Sauropod MSS. The extent of seismic activities in the vicinity of the title area in previous years are detailed in Table 4-13. The last seismic survey undertaken in the region was the Capreolus-2 3D MSS in March 2023, approximately 1,008 days prior to the start of the window for the proposed Sauropod MSS. No other MSS are approved or under assessment for the north west region where the Sauropod MSS is planned.

Table 4-12 – Oil and Gas Permits Relevant to the Operational Area (current 3/7/2025)

Permit	Permit Type	Operator	Current expiry date	Distance from the Operational Area
WA-487-P	Exploration Permit	Pathfinder Energy Pty Ltd	21/11/2026	Within Operational Area
WA-540-P	Exploration Permit	Santos Offshore Pty Ltd	5/6/2028	Within Operational Area
WA-436-P	Exploration Permit	Santos WA Northwest Pty Ltd	13/02/2030	Within Operational Area
WA-438-P	Exploration Permit	Santos WA Northwest Pty Ltd	13/02/2030	Within Operational Area
WA-533-P	Exploration Permit	INPEX Browse E&P Pty Ltd	18/3/2028	63 km east
WA-435-P	Exploration Permit	Santos WA Northwest Pty Ltd	13/02/2030	51 km west
WA-532-P	Exploration Permit	INPEX Browse E&P Pty Ltd	1/11/2027	Within Operational Area
WA-479-P	Exploration Permit	Pathfinder Energy	12/11/2026	Within Operational Area
WA-541-P	Exploration Permit	Santos WA Northwest Pty Ltd	25/09/2028	100 km west
WA-551-P	Exploration Permit	BP Developments Australia Pty. Ltd	6/02/2028	150 km west
WA-542-P	Exploration Permit	Beagle No. 1 Pty Ltd	9/10/2028	150 km west

Permit	Permit Type	Operator	Current expiry date	Distance from the Operational Area
WA-547-P	Exploration Permit	Finder No 16 Pty Ltd	4/01/2030	150 km west
WA-437-P	Exploration Permit	Santos WA Northwest Pty Ltd	13/02/2030	50 km southwest

Table 4-13 – Extent of seismic activities in within 150 km of the survey area in the past 5 years

Survey Name	Survey Location	Survey Timing and Duration	# days from survey end to (earliest start date for Sauropod MSS)
TGS-NOPEC Geophysical Company Pty Ltd, Capreolus-2 3D Marine Seismic Survey 2020 - 2024	The Sauropod Acquisition Area is located approximately 81.3 km east of the TGS Acquisition Area.	Completed early January – late March 2023.	1,008
INPEX 2D MSS WA-532-P, WA-533-P and WA-50-L	The Sauropod Acquisition Area is located 45.4 km southwest of the INPEX 2D Acquisition Area.	Completed December 2021 - 2 May 2022	1,340
Santos Keraudren Extension 3D MSS (phase 2)	The Sauropod Acquisition Area overlaps 5.6 km^2 of the Keraudren Extension (phase 2) Active Source Area.	Completed 6 – 17 February 2022	1,414
Santos Keraudren Extension 3D MSS (phase 1)	The Sauropod Acquisition Area is located 0.2 km east of the Keraudren Extension (phase 1) Active Source Area.	Completed 6 June – 26 July 2021	1,620
Santos Archer 3D MSS	The Sauropod Acquisition Area is located 81.4 km west northwest of the Archer Active Source Area.	Acquired 23 April – 1 June 2021	1,675

4.4.7 World and National Heritage Areas

World Heritage sites are natural or manufactured sites, areas, or structures recognised as being of outstanding universal value by the United Nations Educational, Scientific and Cultural Organization (UNESCO). There are no World or National Heritage sites within the Operational Area.

Australia's National Heritage List contains natural, historic and Indigenous places of significance to the nation and are protected under the EPBC Act (DoEE n.d.). One National Heritage listed place occurs within the EMBA, the Mermaid Reef – Rowley Shoals. Mermaid Reef – Rowley Shoals was listed for values meeting Category A, B, C and D of the National Heritage List criterion (Commonwealth of Australia n.d.). The significance and values of Mermaid Reef and the Rowley Shoals are described above in Section 4.4.1.2 and Section 4.4.2.1.

4.4.8 First Nations Cultural Features and Heritage Values

First Nations cultural features and heritage values can include tangible and intangible values associated with ecosystems, natural and physical resources, locations, places and areas. Intangible values are frequently associated with creation stories and narratives and often referred to as songlines. These contain important information about lore, kinship and biology as well as referring to physical places and totemic species. It's important to note that there is a strong connection between the spiritual world and the physical world for First Nations peoples. Heritage values include the physical elements of place, sometimes referred to as sacred sites or cultural heritage sites. These include meeting places, fish trap camps, middens and rock art sites. However, these are also often linked to songlines and the intangible values of culture such as kinship and lore.

4.4.8.1 First Nations People and Communities

Archaeological evidence indicates that humans have occupied the Australian continent for at least 50-65,000 years, with the Kimberley region potentially the first area to be inhabited (Clarkson et al. 2017, Hayes et al. 2022). During this time First Nations peoples have experienced dramatic change in their landscape due to sea level rise at the end of the Pleistocene ice age, with sea levels stabilising at around their current levels around 9,000 years ago. Therefore, whilst there are no known sites of First Nations cultural heritage significance within the Operational Area or the EMBA, with the closest recorded sites of significance located on land along Eighty Mile Beach and around the Port Hedland area (DPLH 2022; Section 4.4.8.2), it is possible that the Operational Area and EMBA overlap with country previously inhabited by First Nations peoples – particularly given the fact the Ancient Coastline at 125 m KEF traverses the Operational Area (Section 4.4.3).

More recently, the coastal regions adjacent to the EMBA, described here by the area from Ardyaloon (northern tip of Dampier Peninsula) to Pardoo, nearly 600 km down the coast, is roughly equivalent to the Shire of Broome (census region IREG501; Figure 4-23). Census data from 2021 (ABS 2021) lists an Aboriginal and Torres Strait Islander (ATSI) population of approximately 4,800 people, most of whom live immediately on the coast or with access to the coastal region. This region supports more than 50 outstations, communities and townships of First Nations peoples from at least eight native title claimant groups as well as the diaspora of First Nations peoples from outside the area. Census data and independent data on livelihoods suggests that First Nations peoples derive their livelihoods and food resources, at least partly, from land and sea resources (Buchanan et al. 2009, Lincoln et al. 2021, ABS 2021). The Operational Area and EMBA are within the Kimberley Land Council (KLC) Representative Aboriginal/Torres Strait Islander Body Area (RATSIB) under section 203AD of the *Native Title Act 1993* (Figure 4-24).

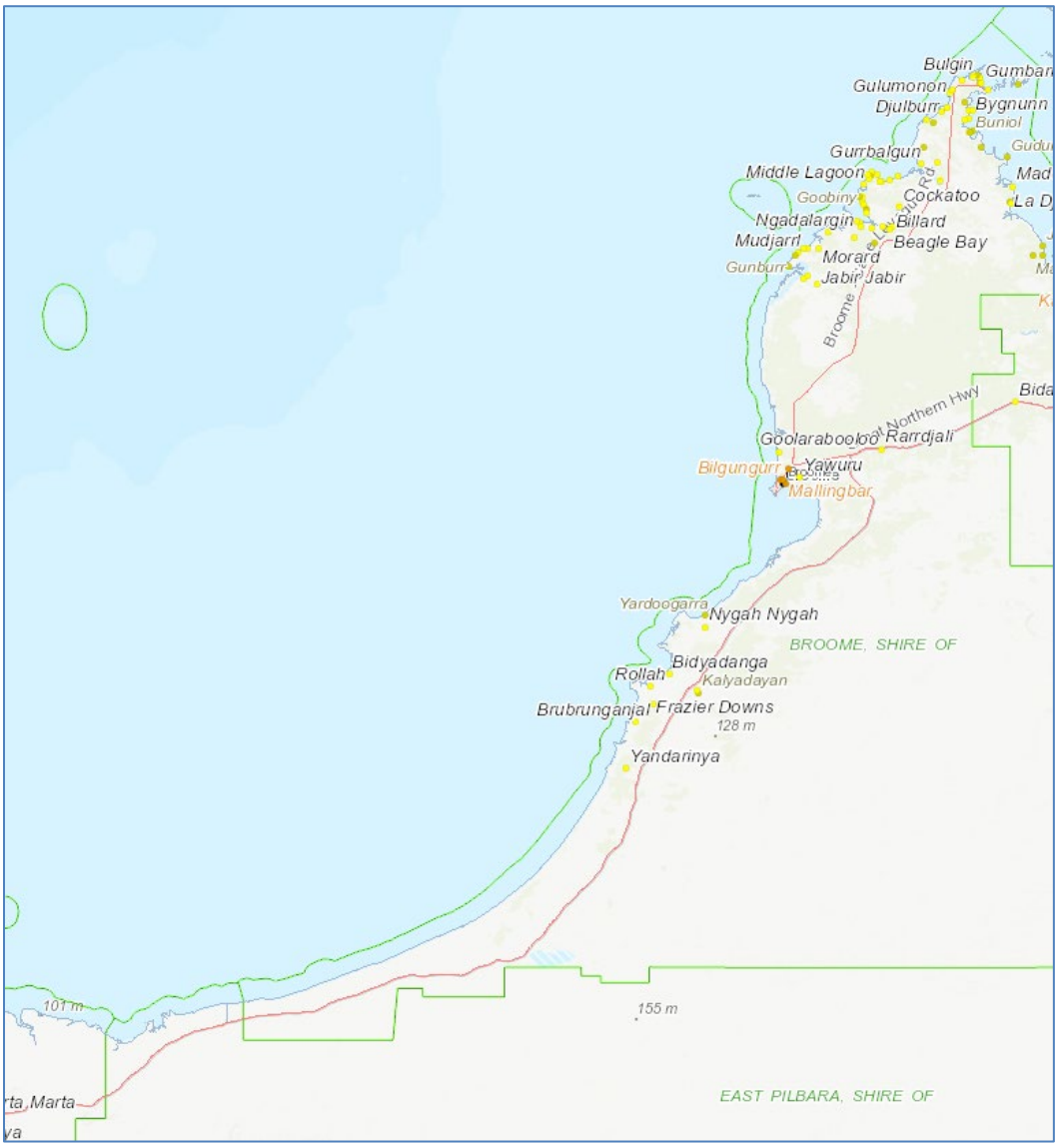


Figure 4-23 Indigenous communities and townships along the coastal regions adjacent to the EMBA (ACHIS)

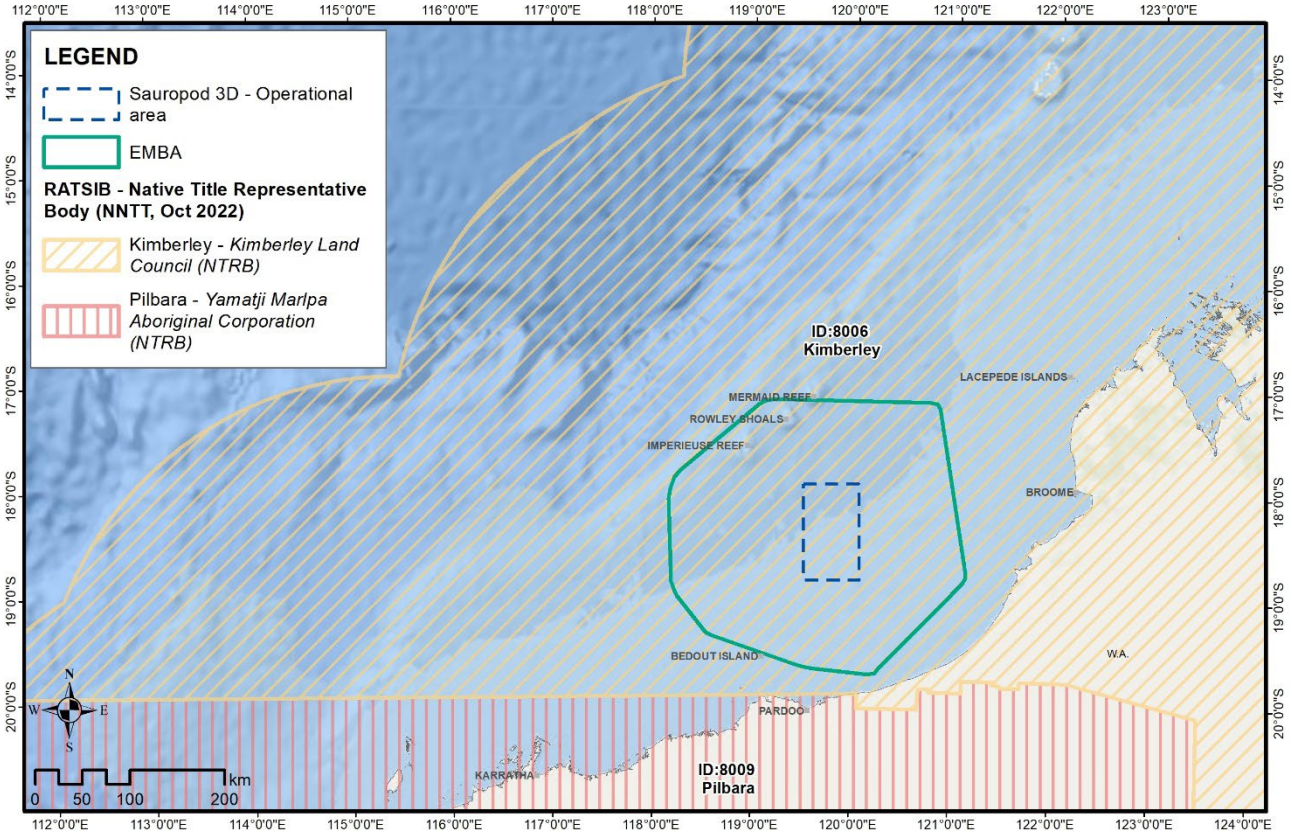


Figure 4-24 – RATSIB within the Operational Area and EMBA

4.4.8.2 Cultural Heritage Sites and Surveys within and adjacent the EMBA

Cultural heritage values include the cultural significance of a place. A search of the Aboriginal Cultural Heritage Inquiry System (ACHIS) online portal, administered by the Department of Planning, Lands and Heritage (DPLH), was undertaken to gain information on registered and lodged Aboriginal cultural heritage sites in coastal areas within and adjacent to the EMBA (including the Operational Area). Given the spatial limitations of the *Aboriginal Heritage Act 1972*, within state boundaries and the limited extent of dedicated Aboriginal cultural heritage surveys within the Operational Area and EMBA, there was limited scope for the listing of either registered or lodged sites. No registered or lodged sites were found within the Operational Area or EMBA. The single closest lodged site to the EMBA, approximately 4 km away, was Place ID 20621 on Bedout Island, a listed creation and dreaming site. Further details regarding the specific knowledge holders and significance of the site is held by the DPLH. This site was listed in 2003 as a result of a single archaeological survey (Survey Report ID 106856), with the corresponding report, *A report of an archaeological survey of Bedout Island, near Port Hedland WA by L Warren*.

A similar search for Aboriginal cultural heritage in the ACHIS online portal was undertaken for all island and mainland coastal areas adjacent to the EMBA, (i.e., Port Hedland to the tip of Dampier Peninsula, roughly 800 km of coastline). This identified 272 registered heritage sites and a further 126 lodged sites, both of which include numerous important burial sites, ceremonial sites and creation ritual sites (Appendix B). The registered and lodged Aboriginal cultural heritage sites in the coastal margin adjacent to the EMBA are shown in Figure 4-25 and Figure 4-26. As stipulated under Section 5 of the *Aboriginal Heritage Act 1972* lodged sites are treated similarly to registered sites with regards to requirements for development proposals.

A total of 106 heritage surveys have been conducted across the coastal margin as shown in Figure 4-27, covering an estimated 60% of the coastal area. These results highlight the significant cultural heritage value of these coastal areas, particularly along the Dampier Peninsula, near Broome and immediately south of Roebuck Bay. These listed sites were also compared with information found in management plans for the identified national reserves discussed in subsequent sections. It is important to remember that not all culturally significant sites are registered or lodged under the *Aboriginal Heritage Act 1972*, but that the legislation protects all Aboriginal heritage, irrespective of whether it is listed.

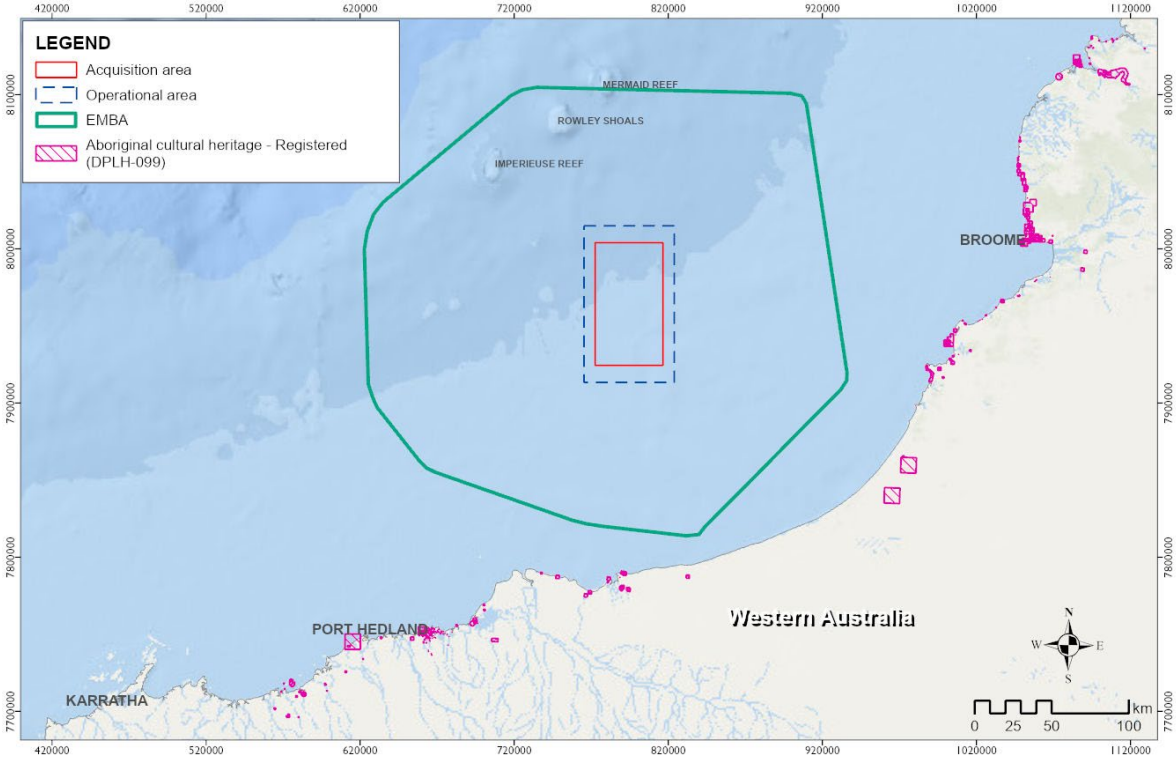


Figure 4-25 Registered Aboriginal cultural heritage sites in the coastal margin adjacent to the EMBA (Source: ACHIS).

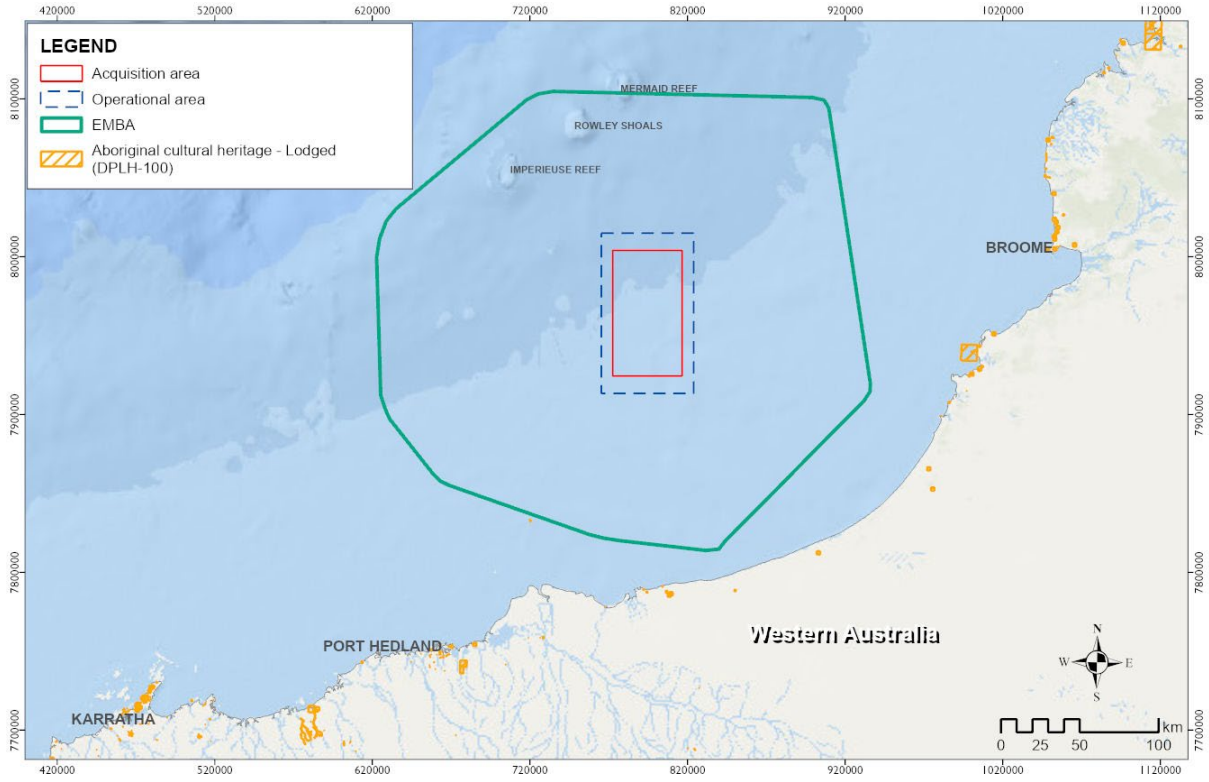


Figure 4-26 Lodged Aboriginal heritage sites in the coastal margin adjacent to the EMBA (Source: ACHIS).

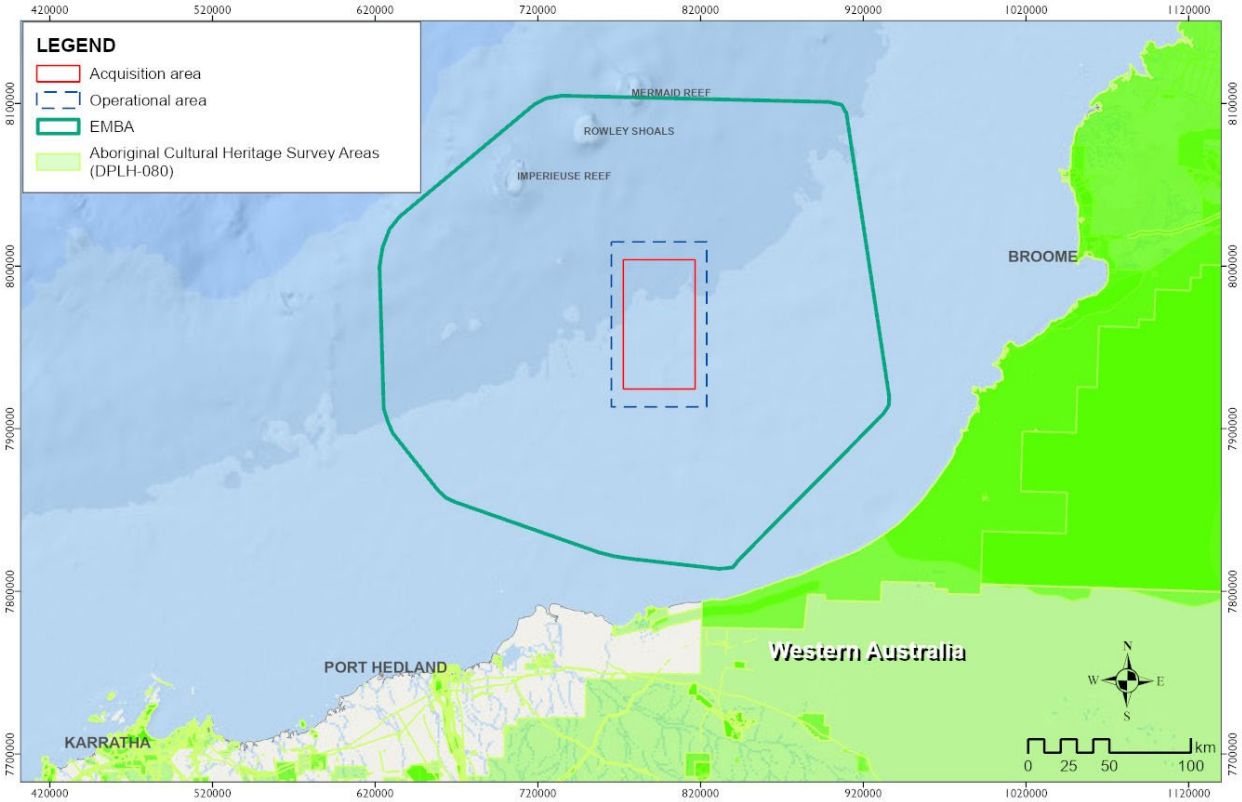


Figure 4-27 Aboriginal cultural heritage surveys conducted along the coastal margin adjacent to the EMBA.

4.4.8.3 Native Title Rights and Interests

Native Title claims, determinations and Indigenous Land Use Agreements (ILUAs), as defined under the *Native Title Act 1993* (Cth), that are overlapped by the EMBA provide the basis for understanding social and cultural features of the environment for Indigenous groups. CGG considers this to be the broadest extent over which Indigenous groups have claimed native title rights and interests, while acknowledging that cultural features and heritage values may exist outside of the native title framework. Native title claims and determinations in relation to the Operational Area and EMBA are shown in Figure 4-28 and listed in Table 4-14.

Whilst there are no in effect – finalised or schedule applications for Native Title overlapping the Operational Area or EMBA, 'Saltwater country' is a term that Kimberley First Nations peoples recognise and which, along with land, fresh waters, islands, rivers, reefs and the heavens, is meaningful through the events of ‘the Dreamtime’ when the natural and human worlds were formed by ancestral creator beings who are manifestations of powerful spiritual forces (DCCEEW n.d.). CGG also appreciates that First Nations peoples are keenly aware of the extent of their rights, interests and responsibilities for Country, and these are generally discrete, defined areas, including areas of sea (Smyth 2007). To identify cultural features and heritage values which may exist outside of Native Title claim, determination and ILUA areas, CGG considers Native Title claims and determinations coastally adjacent to the EMBA to be an instructive means of identifying potentially relevant Indigenous groups to be consulted (See Table 4-14).

CGG understands that extending a Native Title group's responsibility to areas which those groups have elected to not include in their claims or ILUAs can have significant cultural consequences for Indigenous groups and individuals. This may also, over time, build expectations in the broader Indigenous community that a group is responsible for maintaining environmental values in areas for which they do not hold traditional knowledge. CGG also acknowledges that Native Title holders’ relative proximity to any Operational Areas or EMBA is not necessarily a meaningful indicator of the connection of Indigenous groups to the area, and providing advice over such areas can be culturally difficult. As a result, caution must be used when interpreting what intangible cultural values may exist outside of the native title determinations and who may be the knowledge holders for these values.

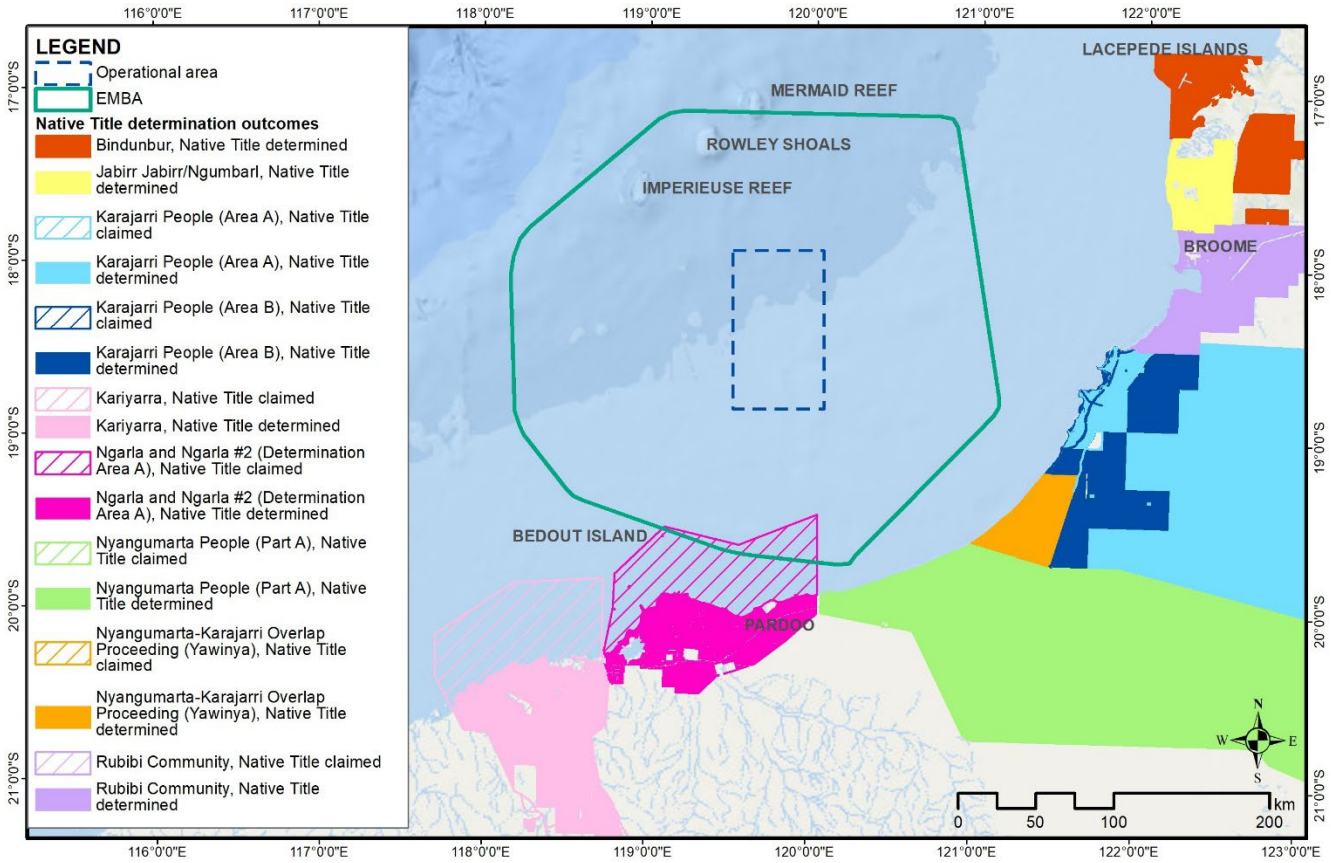


Figure 4-28 Native title claims and determinations in relation to the Operational Area and EMBA. Note that 'determined' areas are those where native title does exist, while 'claimed' areas are those where native title was determined not to exist.

Table 4-14 Summary of Native Title Claims and Determinations which overlap or are coastally adjacent to the EMBA.

Claim/Determination/ILUA	Registered Native Title Body Corporate	Overlap with EMBA	Coastally Adjacent to the EMBA
Bindunbur	Gogolanyngor Aboriginal Corporation Nimanburr Aboriginal Corporation Nyul Nyul PBC Aboriginal Corporation	No	Yes
Jabirr Jabirr/Ngumbarl	Gogolanyngor Aboriginal Corporation	No	Yes
Karajarri People (Area A)	Karajarri Traditional Lands Association (Aboriginal Corporation)	No	Yes
Karajarri People (Area B)	Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	No	Yes
Kariyarra	Kariyarra Aboriginal Corporation	No	Yes
Ngarla and Ngarla #2 (Determination Area A)	Wanparta Aboriginal Corporation	No*	Yes
Nyangumarta People (Part A)	Nyangumarta Warrarn Aboriginal Corporation	No	Yes
Nyangumarta-Karajarri Overlap Proceeding (Yawinya)	Nyangumarta Karajarri Aboriginal Corporation	No	Yes
Rubibi Community (WCD2001/003)	Kunin (Native Title) Aboriginal Corporation	No	Yes

Claim/Determination/ILUA	Registered Native Title Body Corporate	Overlap with EMBA	Coastally Adjacent to the EMBA
Rubibi Community (WCD2006/001)	Yawuru Native Title Holders Aboriginal Corporation	No	Yes

*Note that this does not include the Ngarla and Ngarla #2 (Determination Area A) claimed area (shown in pink in Figure 4-28) as the determined outcome for this area was that 'Native title does not exist' (NNTT 2023j)

4.4.8.4 Indigenous Protected Areas (IPAs) and Indigenous Ranger program

Indigenous Protected Areas (IPAs) contribute over 54% of all protected areas listed in the National Reserve System of Australia. IPAs are jointly funded and managed through the Commonwealth National Indigenous Australians Agency (NIAA) and DCCEEW and are founded on selection criteria designed to identify and protect cultural and ecological values, provide employment and promote continuation of cultural practises and traditional management of country. IPAs are managed by indigenous ranger groups who operate on their traditional lands, not only in IPAs but across native title lands and Aboriginal land trusts throughout Australia.

There are currently 91 dedicated IPAs across Australia covering more than 104 million hectares of land and six million hectares of sea country. The development of a specific IPA program is conducted by the relevant RNTB applicant with assistance from regional Aboriginal land councils and in collaboration with outside knowledge experts where needed. Development of an IPA involves a long period of consultation and discussion with communities "on country" with traditional owners and represents a thorough public version of knowledge associated with cultural sites and values as well as traditional ecological knowledge (TEK) for the sea country and land. Considerable attention is also given to the identification of threats and mitigative actions for these values, which have been used here to summarise the relevant native title holders' consideration of the generalised threats to sea country, as well as specific threats of oil and gas industrial activities to these cultural values. These IPA management plans are therefore comprehensive and important references for the publicly available knowledge of First Nation's cultural values of the sea country areas relevant to project activities. Additional knowledge is also obtained from Healthy Country Plans, where available, for areas not represented by the IPA system and/or management plans associated with State and Commonwealth marine parks.

There are currently no IPAs within the Operational Area or EMBA whereas there are four IPAs along the coastal and sea country areas adjacent the EMBA (Figure 4-29):

- Yawuru Indigenous Protected Area Plan of Management 2016-2026 (Yawuru RNTBC 2014)
- Karajarri Healthy Country Plan 2013 – 2023 Palanapayana Tukjana Ngurra (KTLA 2014)
- Nyangumarta Warrarn Indigenous Protected Area Management Plan 2022 — 2032 (Nyangumarta Warrarn Aboriginal Corporation & YMAC 2022).
- Nyul Nyul Healthy Country & Indigenous Protected Area Management Plan 2024-2033 (Nyul Nyul PBC Aboriginal Corporation RNTBC 2024)

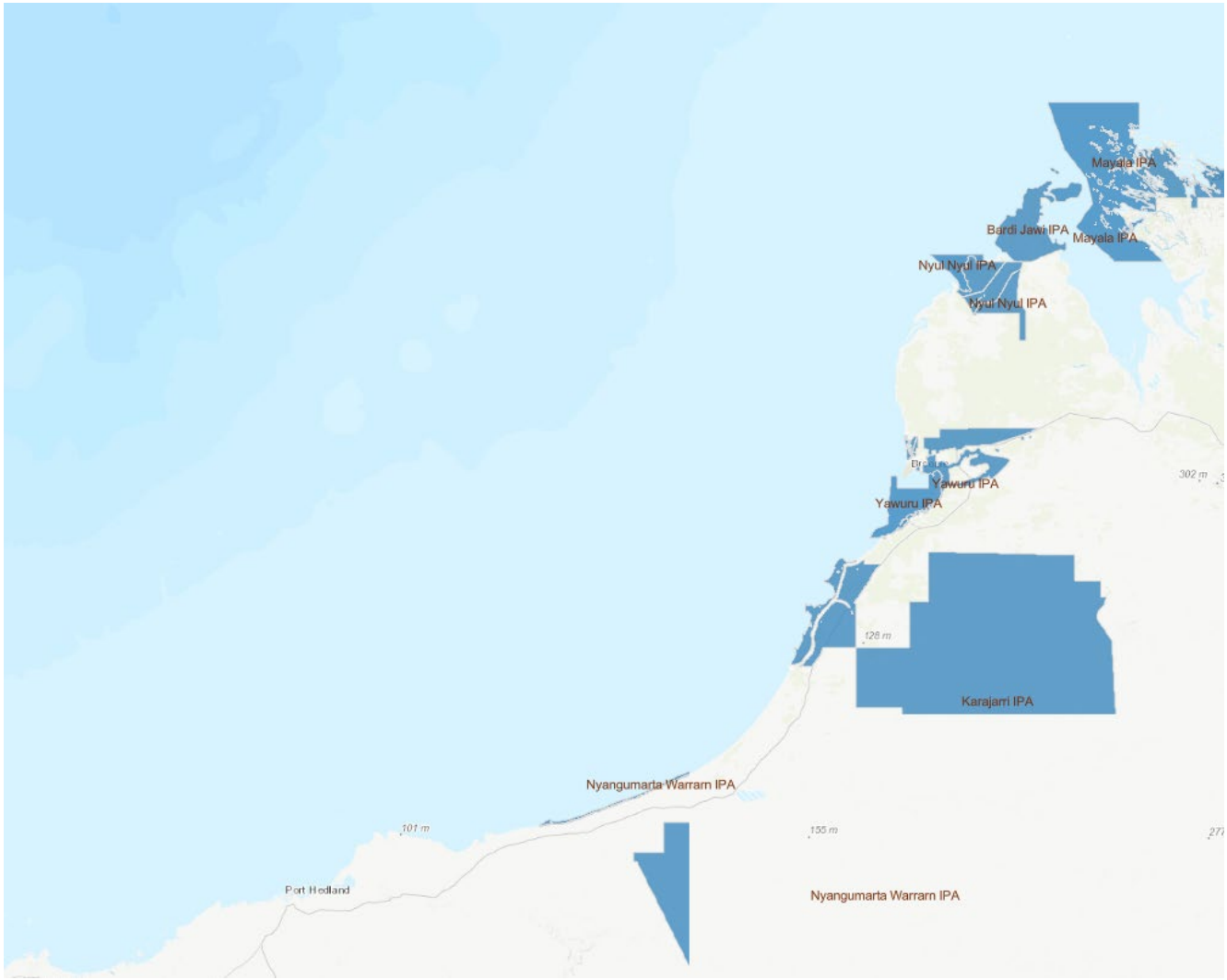


Figure 4-29 Declared Indigenous Protected Areas in coastal and sea country areas adjacent to the EMBA

Details of IPA extent (whether it includes sea country and/or coastal areas), declaration date, a summary of cultural and ecological values are outlined in Table 4-15. Further discussion of the values, cultural totems and customary use of marine species as well as identified threats to their management are discussed below in the context of the project. There is a range of additional published texts which demonstrate the deep and living cultural connection between First Nations peoples and their country, including *The Traditional Ecological Knowledge of Nyangumarta Warrarn* (YMAC 2016). This booklet is a compilation of traditional knowledge of botanical and various cultural knowledge of medicinal and ceremonial uses of plants and fungi of the Nyangumarta IPA region. Nyangumarta have also produced an introduction to *Pukarrikarra (creation or dreamtime),* in the book *Five dreamtime stories in Nyangumarta* (Gardiner 1995), with content about important creation stories. Additional relevant resources include the Kimberley Indigenous Turtle & Dugong Initiative 2022–2032 (ISWAG 2022), an indigenous led collaborative approach to management of these important cultural resources. This collaboration includes Bardi-Jawi, Nyul Nyul, Yawuru, Karajarri and Nangumarta peoples along the coastal margins of the areas adjacent to the EMBA, as well as other groups in the west and east Kimberley. These documents highlight the importance of sea country to the traditional owner groups of the coastal areas in proximity to the EMBA, as both a living cultural landscape and an ongoing livelihood. These accounts add to the body of evidence provided in the state and Commonwealth marine parks management plans which highlight the ongoing cultural and customary use of sea country and its resources by the various traditional owner groups along the coastal areas adjacent to the EMBA (DPaW 2014, DPaW 2016, DNP 2018).

Table 4-15 List of Indigenous Protected Areas with summary of relevant cultural and ecological values and details of sea country extent. Note that these IPAs all fall outside of the Operational Area and EMBA.

Indigenous Protected Area	Cultural/ecological values	Extent and sea country details	Declaration Year
Nyul Nyul	Cultural places including burial sites, fish traps, middens, bush wells. Sea Country which includes humpback whales, dugong, sharks, dolphins, whiprays, stingrays and fish, and migratory pathways for green, leatherback, loggerhead, flatback and hawksbill turtles and extensive seagrass meadows providing important foraging grounds and habitat for turtles, dugong and other sea life. Cultural food sources such as turtle, dugong and fish.	145,000 ha Includes sea country and coastal estate, multi-tenured with marine park).	2024
Yawuru	Cultural sites, fish traps, rock art, middens, burial sites. Dugong, sea turtle, waders, snubfin dolphin, reef fish. Customary use and cultural practice (ie fishing, intertidal shellfish, mangroves, mud crabs). *Nagulgan* (saltwater country): customary fishing and resource use, authority of Yawuru to manage sea country.	127,914 ha Includes sea country and coastal estate, multi-tenured with marine park).	2017
Karijarri	Cultural knowledge, sites and practises, fish traps, burial sites, customary knowledge and use of plants and animals, indigenous livelihoods on country, groundwater and surface water resources. All coastal habitats, intertidal areas, shallow and deepwater reefs, fish, turtle and dugong. Oysters and pearl shel (*Riji or jakuli*). *Riji* has strong ceremonial and cultural value.	2,480,000 ha Includes 130 kms of coastline. Proposed sea country IPA.	2014
Nyangumarta	*Marrngumili* – Nyangumarta Law and Culture maintenance and protection of the law, culture, language and traditional knowledge as integral with the maintenance and protection of the natural environment. *Yinta* – Cultural and sacred places, songlines and stories. Includes ceremonial places, burial areas, rock art sites, old living areas *Jurrar Country* – Eighty Mile Beach (80MB) saltwater country. Many important sacred sites, some connected with *Pukarrikarra* (creation stories), customary use of turtle, salmon, stingrays, oysters. Ecological values of flatback turtle nesting, waders and migratory birds in associated Ramsar wetland of 80MB and Mandora Marsh.	~2,700,000 ha Includes 100 km of coastline and intertidal area on Eighty Mile Beach and is adjacent to State and Commonwealth Marine Parks.	2015

4.4.8.5 Marine Parks

CGG acknowledges that Australian and State Marine Park Management Plans have sought to recognise cultural values of Indigenous groups. Australian Marine Parks (AMP) describe this framework as: "*when making decisions about what can occur in marine parks and what action we will take to protect marine parks, we take values into account*". AMP summarise these values as natural values, cultural values, heritage values and socio-economic values.

CGG considered the management plans of marine parks that overlap the Operational Area and EMBA to determine whether cultural features and heritage values have been identified and whether there are Traditional Custodians or representative bodies referenced to contact regarding potential cultural values.

As described in Section 4.4.1, the Operational Area does not overlap any Australian Marine Parks. The EMBA overlaps the Argo-Rowley Terrace, Mermaid Reef and Eighty Mile Beach AMPs, all managed under the North-West Marine Parks Network Management Plan 2018. The EMBA overlaps one state Marine Park, the Rowley Shoals Marine Park, managed under Rowley Shoals Marine Park management plan 2007-2017. Where these plans specify identifiable representative bodies who may hold knowledge of heritage values or cultural features—including but not limited to Registered Native Title Bodies Corporate—these bodies are consulted (See Table 5-9). Consultation with these groups may identify heritage values and cultural features beyond those addressed in the marine park management plans.

The marine park management plan for Eighty Mile Beach AMP notes that the Kimberley Land Council (KLC) and Yamatji Marlpa Aboriginal Corporation (YMAC) are the Native Title Representative Bodies for the AMP area, and identifies the

Karajarri Aboriginal Corporation, Nyangumarta Karajarri Aboriginal Corporation, Nyangumarta Warrarn Aboriginal Corporation, and Wanparta Aboriginal Corporation as the points of contact for their respective areas of responsibility for Sea Country in the Marine Park (Table 4-16).

In the management plans for the AMPs it is noted that "Sea Country is valued for Indigenous cultural identity, health and wellbeing." Fishing, hunting and the maintenance of culture and heritage through ritual, stories and traditional knowledge continue as important uses of nearshore and adjacent areas.

Australia's National Reserve System also includes the Indigenous Protected Area (IPA) program, which constitutes over 50% of the NRS, including both land and sea areas.

Table 4-16 Summary of Commonwealth and State Marine Park management Plans overlapping the EMBA

Marine Park	Operational Area Overlap	EMBA Overlap	Identified cultural heritage
Commonwealth Marine Parks			
Argo-Rowley Terrace	No	Yes	At the commencement of this plan there is limited information about the cultural significance of this Marine Park.[1]
Mermaid Reef	No	Yes	At the commencement of this plan there is limited information about the cultural significance of this Marine Park. [1]
Eighty Mile Beach	No	Yes	The Sea Country of the Nyangumarta, Karajarri and Ngarla people extends into Eighty Mile Beach Marine Park. Sea Country is culturally significant and important to their identity. They have an unbroken, deep spiritual connection to their Sea Country, with traditional practices continuing today. Staple foods of living cultural value for the Nyangumarta, Karajarri and Ngarla people include saltwater fish, turtles, dugong, crabs and oysters. Access to Sea Country by families is important for cultural traditions, livelihoods and future socio-economic development opportunities. The native title holders for the Nyangumarta, Karajarri and Ngarla people are represented by the Karajarri Aboriginal Corporation, Nyangumarta Karajarri Aboriginal Corporation, Nyangumarta Warrarn Aboriginal Corporation, and Wanparta Aboriginal Corporation. These Prescribed Body Corporates represent traditional owners with native title over coastal area adjacent to the Marine Park and are the points of contact for their respective areas of responsibility for Sea Country in the Marine Park. The Kimberley Land Council and the Yamatji Marlpa Aboriginal Corporation are the Native Title Representative Bodies for Kimberley and Pilbara regions. [1]
State Marine Parks			
Rowley Shoals	No	Yes	None identified[2]

[1]Director of National Parks 2018, North-west Marine Parks Network Management Plan 2018, Director of National Parks, Canberra.

[2]Department of Environment and Conservation 2007, Rowley Shoals Marine Park Management Plan 2007-2017, Department of Environment and Conservation, Government of Western Australia.

4.4.8.6 Sea Country values, intangible cultural heritage and totemic species

There has been significant debate and interpretation discussion concerning the cultural values associated with traditional custom and lore, and songlines in particular. Attempts to interpret and reference intangible cultural values associated with these practises for assessment under related legislation for the oil and gas sector has proven challenging.

Understanding of cultural lore in songlines is provided by some examples of definition in specific co-authored anthropological studies such as Dr John Bradley with the Yanyuwa people. *Kujika* is defined as song line or song cycles of power that are embedded in the earth and thought to still be coursing through the land and sea. These songs contain information on lore,

ecology and kinship and are used in various ceremonial performances including initiation and death (Bradley and Yanyuwa families 2010). For *Anangu* people of central Australia, *Tjukurpa* provides answers to important questions, the rules for behaviour and for living together. It is the law of caring for each other and the land that supports them. *Tjukurpa* tells of the relationships between people, plants, animals and the physical features of the land. It is the past, present and future – all at the same time (San Roque 2006). Groups have specific definitions for song cycles that are broken, either through lack of continued practise or adherence to cultural obligations and practises, or through physical disturbance from unapproved industrial development. The holistic context of the interrelation of all physical components with the spiritual and cultural values doesn't lend itself to single species management plans and mitigation of, or offset of, impacts on chosen fauna or flora.

It is also important to note that specific information and geolocation of songlines is not readily available in public literature, as this is an oral history. There are particular exceptions to this, as previously referenced, however some traditional owners and custodians have expressed strong reservations with this knowledge being referenced out of context in cases such as this document. All that being said, there are examples of published literature with First Nations groups identifying public versions of songlines with reference to specific places and animals, and we attempted to summarise that information with reference to the proposed activities in the project area.

Sea country values for areas and groups who have contributed to the National Reserve System, as listed previously, provide opportunity for the production of literature documenting traditional owner cultural values and TEK for their estates. It is important to remember that there are many other traditional owner groups and native title holders along this coastal margin who do not currently have a dedicated IPA, jointly managed State Marine Park or adjacent Australian Marine Park, but with no less a connection and deep understanding of their sea country and traditional lands. As shown in Figure 4-28, there is established Native Title for traditional owners all along Dampier Peninsula adjacent to the EMBA from Bindunbur in the north, through to the Ngarla and Kariyarra native title determinations along the Pilbara coast. These native title determinations comply with the provisions of the *Native Title Act 1993*, which requires applicants to demonstrate ongoing and continuous cultural connection in their traditional lands with demonstrated practise of traditional lore and custom. These requirements and the documentation provided for each applicant is a demonstration of the longstanding cultural connection and abiding cultural obligations to manage both sea country and land according to traditional lore. Whilst there may not be the same publicly available body of literature documenting this connection, there is the same level of connection and understanding of country and similar obligations for management and use of customary resources throughout the entire coastal margin adjacent to the EMBA.

There is one indigenous ranger program, Nyul Nyul rangers, operating under the KLC on Bidinbur Native Title land on Dampier Peninsula to the north of Broome. The rangers look after approximately 350,000 hectares of land and sea country and work on traditional management of cultural sites as well as collaborating with western science collaborators to manage the ecology of their land, freshwater and sea country resources, including dugong and sea turtle. Nyul Nyul have produced a freshwater management and monitoring plan that identifies important cultural and ecological values that also relate to nearshore sea country sites (Dobbs et al. 2015). The recently established Nyul Nyul IPA also now forms part of the management jurisdiction of the Nyul Nyul rangers, alongside the Nyul Nyul PCB. The Nyul Nyul IPA includes coastal areas and sea country and encompasses ecologically and culturally important areas along the coastline and spring system of Beagle Bay (Nyul Nyul PBC Aboriginal Corporation RNTBC 2024).

There are two additional Native Title claimant groups that either overlap with or are adjacent to the EMBA; the Ngarla and Karriyarri groups in the Port Hedland-Pardoo region. YMAC is in the process of developing opportunities for ranger groups for these groups and undertaking a Healthy Country Planning process, however no resources are currently available to determine sea country cultural and customary practises or ceremonial and songline totems and pathways relative to the project and EMBA areas for these groups. Nevertheless, both groups demonstrate ongoing connection to country and cultural practises through the Native Title determinations and there are also important registered and lodged cultural heritage sites in these coastal areas as determined under the *Aboriginal Heritage Act 1972* (Figure 4-25 and Figure 4-26). In addition, the potential value of Yamatji Marlpa sea country and dreamtime stories in areas overlapping the EMBA was noted by a member of YMAC during consultation YMAC, 20/06/2023, see Appendix C of CGG (2024)).

The Ngarla people are represented by the Wanparta Aboriginal Corporation (WAC). During CGG's period of consultation with this group, the WAC noted the Ngarla people's deep spiritual connection to sea country. This includes the importance of Ngarla totem species, which include the octopus, stingray, spiny bream fish and kestrel (Wanparta Aboriginal Corporation RNTBC, 30/08/2023, see Appendix C of CGG (2024)). The WAC also stated that the protection and management of marine life plays a significant role in Ngarla peoples practise of lore, culture and customs, and that the exercising of their Native Title rights and interests is contingent on a healthy and well managed sea country.

The majority of the literature and management programs identified here relate to the coastal and nearshore marine environments, mostly due to the legislative restrictions regarding Native Title determinations over sea country, but also due to the pressing cultural and traditional ecological concerns for traditional owners for management of their land and sea country estates. There is less documented information about the extent of intangible cultural values for the sea country areas further offshore and the inundated cultural landscape from the current shoreline to the 125 m bathymetry line of previous occupation in the last 60,000 years. As discussed in Section 4.4.8.1, identifying specific peoples and groups who have traditional ownership and knowledge regarding the underwater cultural heritage in the area of the EMBA is not a straightforward process. There are likely to be many songlines and stories for coastal groups that overlap with the EMBA and possibly the project area, but there were no specific geospatial representations of these in any published texts available to the authors at the time of publication and none were identified through consultation with relevant persons. Oil and gas development was listed as a key threat to cultural environments in the Yawuru IPA Management Plan, but there was no specific cultural information, tangible or intangible, mentioned in reference to this. Karajarri elders identified concerns held for whales due to oil and gas industrial activities but there were no specific references to intangible cultural values of the offshore sea country areas. There was specific mention of concerns over the potential impact of oil spills associated with a developing oil and gas industry and the impact this would have on coastal and sea resources such as seagrass and reef communities and turtle and dugong populations.

In addition to the list of cultural values and features discussed in the IPA management plan section, we have summarised the likelihood of overlap occurring between First Nations cultural values and the project Operational Area and the EMBA. For further details on cultural values for specific First Nations groups see Table 4-17 and Table 4-18.

Table 4-17 Summary of likely cultural values in the Operational Area and EMBA

First Nations Group/Native title claimant group	Cultural values	Source	Likelihood of overlap	
			Operational Area	EMBA
Bidunbur NT claimant group	Cultural sites along coastal areas and in freshwater sites, associated cultural heritage values in sea country	Manado (on behalf of the Bindunbur Native Title Claim Group) v State of Western Australia, WCD 2018/005	No	Possible, Sea country cultural values may exist (unspecified)
	Management of customary resources with cultural significance (dugong and sea turtle)	Dobbs et al. (2015), Lincoln et al. (2021), Nyul Nyul PBC (2024)	Possible (unspecified)	Possible, migratory paths of these animals pass through EMBA
Jabirr Jabirr / Ngumbarl	Habitat of customary resources with cultural significance (dugong and sea turtle) Sacred sites along coastal areas	Rita Augustine & Ors and State of Western Australia & Ors (Jabirr Jabirr/Ngumbarl), WCD 2018/004	No	Possible, Sea country cultural values may exist (unspecified)
Yawuru	Habitat of customary resources with cultural significance (dugong and sea turtle) Sacred sites along coastal areas and sea country values	Yawuru RNTBC (2014), Lincoln et al (2021)	Possible (unspecified)	Possible, migratory paths of these animals pass through EMBA. Sea country cultural values may exist (unspecified)
Karajarri	Habitat of customary resources with cultural significance (dugong and sea turtle) Sacred sites along coastal areas and sea country values	Karrajari Traditional Lands Association (2014), Lincoln et al (2021)	Possible (unspecified)	Possible, migratory paths of these animals pass through EMBA. Sea country cultural values may exist (unspecified)

First Nations Group/Native title claimant group	Cultural values	Source	Likelihood of overlap	
			Operational Area	EMBA
Nyumgamarta	Habitat of customary resources with cultural significance (dugong and sea turtle) Sacred sites along coastal areas and sea country values	Nyangumarta Warrarn Aboriginal Corporation and Yamatji Marlpa Aboriginal Corporation (2022), Lincoln et al (2021), Gardner W (1995)	Possible (unspecified)	Possible, migratory paths of these animals pass through EMBA. Sea country cultural values may exist (unspecified)
Ngarla and Ngarla	Sacred sites along coastal areas and sea country values	Brown (on behalf of the Ngarla People) v State of Western Australia, WCD2007/003	Possible (unspecified)	Possible (unspecified)
Ngarla	Totemic species: octopus, stingray, spiny bream fish and kestrel	Consultation (Wanparta Aboriginal Corporation; 30/08/2023)	Possible, habitat present	Possible, habitat present
Kariyarra	Sacred sites along coastal areas and sea country values	Gordon (on behalf of the Kariyarra Native Title Claim Group) v State of Western Australia, WCD2018/015	Possible (unspecified)	Possible (unspecified)

4.4.8.7 Threats and Management Actions

A range of threats to land and sea country values and cultural sites are described in each of the four IPA Management Plans described above, including generalised threats from mining and exploration activities (Table 4-18). Each IPA Management Plan also expresses concern over the continuation of cultural practises, management of visitors and their behaviour around cultural sites, and continued access to resources for livelihoods. It is relevant to note that there is no specific mention of threats from seismic exploration activity to intangible cultural values such as songlines over sea country and undersea cultural heritage in any of the IPAMPs. However, it is apparent in several of these plans that traditional owners hold concerns for cultural obligations for land and sea management broadly across their estates due to a variety of anthropogenic factors. For example, Karajarri elders talk of the importance of *Pukarrikarrajangka (*dreamtime), which encompasses all life and people within the lore and customs as an obligation for them to manage. This is a generalised form of holistic management in western science terms, which is a common element to First Nations world view of ecological management and threatening processes.

Table 4-18 – Threats to land and sea country values and cultural sites described in Indigenous Protected Area Management Plans

Indigenous Protected Area	Threats (Summary of relevant sea country threats)	Management Actions
Nyul Nyul	1. Lack of management and visitation by cultural guardians 2. Unmanaged visitation (particularly vehicles) 3. Pollution including ghost-nets and spills 4. Climate change 5. Wrong-way hunting of nesting green turtles 6. Lack of Traditional Owner input into management	Seek creation of a jointly-managed marine park Work with western science partners to determine green turtle, dugong and fish population health Increase the presence of rangers on Sea Country, to engage with visitors, monitor system health and identify emerging issues

Indigenous Protected Area	Threats (Summary of relevant sea country threats)	Management Actions
		Map cultural places, resources, locations and usage
Yawuru	1. Mining resource exploration and development: Interference with culturally significant environment is a major threat from oil and gas 2. Climate change 3. Marine pests	Guiding principle is *liyan*, comes from our connection to our country, our ancestors and our way of life; it reflects our sense of belonging to Yawuru society. Specific actions: Protect, manage and monitor wetlands. Development of western science and TEK monitoring and managing of sea country resources.
Karijarri	1. Lack of Karrijarri jurisdiction and authority in managing country 2. Lack of capacity and resources to manage country 3. Mining and exploration- affecting wildlife including whale migrations, livelihoods, hunting, cultural exchange, seagrass and reefs affected by oil spills 4. Unmanaged visitation: Damage to sacred sites and sea country ecology, coastal resources	Record TEK of saltwater country from Karajarri elders. Develop, monitor and assess a system for management of customary resources. Engage with outside stakeholders and agencies about Karajarri aspirations for managing country.
Nyangumarta	1. Inappropriate mining and industry development. Concerns that cultural values will be harmed without consent by development of industry 2. Lack of Traditional Knowledge transfer between generations. Concerned that knowledge (Mirtanya and Mirtawarri) will not be passed to younger generations and will be lost. 3. Wrong way visitation to Country. Visitors lack knowledge and respect for traditional lore, cultural places being visited by unauthorised people. Loss of access to customary resources and continuation of cultural practices	Stakeholders, partners and proponents engage meaningfully with Nyangumarta. Respect their traditional management and lore over country. Increased capacity for rangers to be on country to inform and educate visitors about cultural site management and respect. More signs to inform visitors. Undertake “on country” trips with elders, rangers and children to facilitate knowledge exchange.

The publicly available resources highlight the continuing cultural practises, customary resource use and some references to key totemic or ceremonial animals for sea country. In particular, dugong and sea turtles hold a strong ceremonial role and continued customary use within coastal communities and indigenous people in this area. This is highlighted within specific management plans for IPAs and marine parks, as well as evidenced by the collaborative approach to traditional management (Lincoln et al 2021). Other referenced ceremonial species include pearl shell (*riji*) for Karajarri people.

During this investigation, no public records of spatially explicit songlines and creation stories were found which could be mapped onto the project area. Further comprehensive ethnographic studies with appropriate permissions from knowledge holders and traditional owners would be required to elucidate this information and enable it to be used specifically for the purpose of mapping the potential impacts of the proposed activities on the intangible cultural heritage of First Nations peoples and communities.

4.4.9 Ramsar Wetlands

The Ramsar Convention on Wetlands is an intergovernmental treaty that aims to conserve wetlands of international importance. Ramsar wetlands are recognised as a matter of national environmental significance under the EPBC Act (DoEE n.d.). No Ramsar wetlands occur within the Operational Area or EMBA. The closest Ramsar wetlands are located in the coastal waters of Eighty Mile Beach, approximately 113 km south-east of the Operational Area and beyond the wider EMBA, with an associated fresh and saline ephemeral lake system in Mandora Swamp. There is another listed Ramsar site in Roebuck Bay, approximately 120 kms to the east of the Operational Area, known to support abundant dugong and turtle intertidal feeding grounds as well supporting seasonal populations in excess of 300,000 migratory waders and shorebirds.

4.4.10 Marine Archaeology

All shipwrecks more than 75 years old are protected under the *Underwater Cultural Heritage Act 2018* (DAWE n.d.). A search of the Commonwealth Australasian Underwater Cultural Heritage Database (DoEE 2019b) and the Western Australian Shipwrecks database (Government of Western Australia 2023) indicated that no known historic shipwrecks occur within the Operational Area or the EMBA. Six shipwrecks are situated near the Operational Area and EMBA (

Table 4-19); however, none are listed as a Protected Place under the EPBC Act.

Table 4-19 Recorded Shipwrecks Near the Operational Area and EMBA

Vessel Name	Year Wrecked	Wreck Location	Distance from Operational Area
Koombana	1908	Bedout Island	86 km south-west
Lively	1810	Mermaid Reef	93 km north
Korda	1903	Cape Frezier	98 km east
See Taube	1954	Rowley Shoals	130 km north-east
Pelsart (Pelsaert)	1908	Rowley Shoals	130 km north-east
Alfred	1908	Rowley Shoals	130 km north-east

4.4.11 Commercial Shipping

The Pilbara offshore region facilities high shipping activity associated with mining and oil and gas activities. Port Hedland is the closest major port to the Operational Area, which is also the world's largest bulk export port. Vessels transiting the region during the proposed survey will primarily include oil tankers, bulk carrier ships and general cargo ships.

AMSA has introduced a network of marine fairways on the NWS of WA to reduce the risk of vessel collisions with offshore infrastructure. None of these fairways intersect with the Operational Area, however one fairway facilitating heavy traffic lies approximately 1 km north-west of the Operational Area (Figure 4-30). Moderate to heavy shipping traffic occurs within the wider EMBA and is generally confined to the AMSA shipping fairways. AMSA confirmed that most shipping in the area will be heading to or from Darwin.

4.4.12 Defence Activities

The Department of Defence operates military firing practice and exercise areas at several locations around Australia. There are no designated defence practice areas within the Operational Area. The closest designated defence practice area is located on the Dampier Peninsula, approximately 127 km east of the Operational Area and partially within the wider EMBA. A search of the Department of Defence’s unexploded ordinance (UXO) map confirmed UXO are not known to occur within the Operational Area or EMBA (AGDD, 2021)

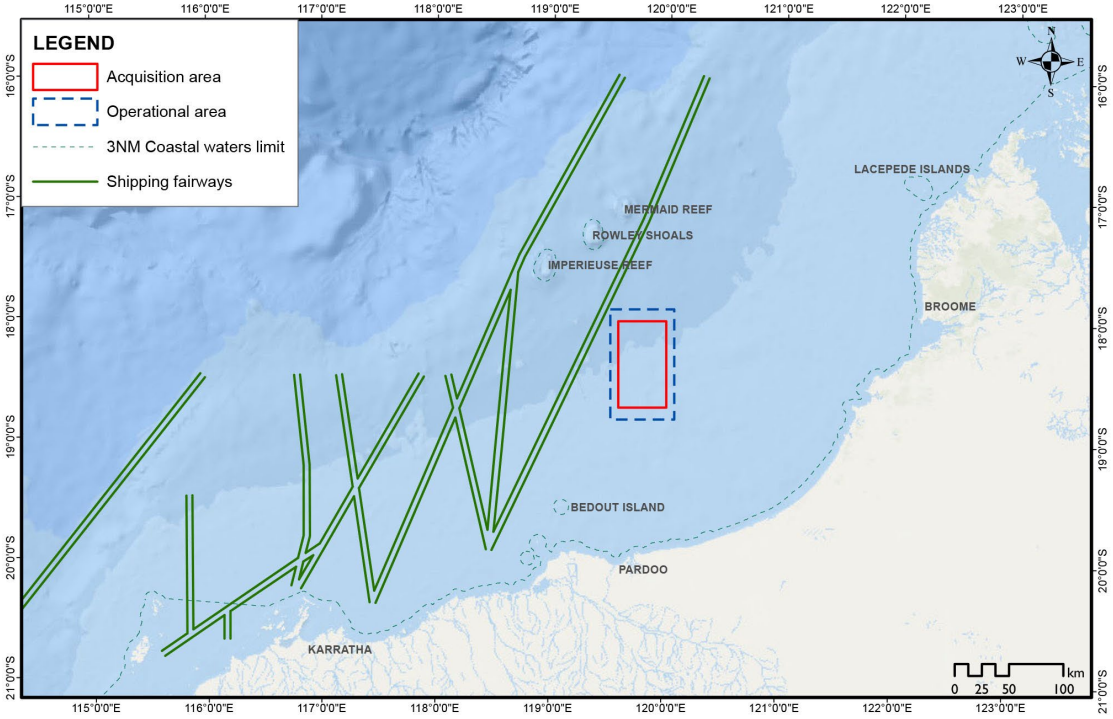


Figure 4-30 – Commercial Shipping Fairways

5 Relevant Person Engagement

CGG is committed to transparent, ongoing and effective engagement with the communities in which it operates and recognises that this is critical to project success.

The objectives of consultation for the Sauropod MSS are:

- To maximise transparency and to ensure that the rights of relevant persons are upheld and appropriately considered throughout the planning, permissioning and execution stages of the survey.
- To ensure that relevant persons are identified and given sufficient information and a reasonable period to allow them to make an informed assessment of the possible consequences of the proposed activity on them.
- To ensure that Titleholders can consider and adopt appropriate measures in response to the matters raised by relevant persons.
- To support CGG's objective to ensure that the environmental impacts and risks of the activity are reduced to ALARP and an acceptable level, consistent with regulation 3 of the EPBC Regulations.
- To meet the consultation requirements of the OPGGS(E) Regulations.

In order to meet the objectives above, the following key principles were adopted for CGG's consultation process for the Sauropod MSS:

- Communication is open and effective.
- Consultation is collaborative, inclusive and transparent.
- Sufficient information is provided to relevant persons to allow them to identify potential impacts on their functions, interests and activities.
- Consultation is timely, allowing relevant persons a reasonable period to identify and communicate any claims or objections.
- The impact and risk assessment and control measures are informed by relevant person feedback.
- Trust is built and maintained with relevant persons and the local community.

Three EPs for this activity have been previously accepted by NOPSEMA, one that was developed and submitted by 3D Oil in 2020 for a survey to occur during 2021, one developed and submitted by CGG for a survey to occur in 2022, and one developed and submitted by CGG for a survey to occur in 2024 or 2025. None of these surveys eventuated, and this section describes the relevant person engagement that has occurred in the development of this revised EP. Further information detailing the consultation undertaken during the development of previous EPs, including objectives, methodology, and outcomes can be found in those EPs.

CGG has used a methodical approach to conduct consultation for this EP. The approach has been to:

- Review all current relevant persons and identify new relevant persons (as described below).
- Provide a detailed information sheet and area map via email, project specific website and social media to commence consultation, and confirm with relevant persons how they wish to be consulted.
- Provide a table of risks and management measures for those seeking additional information through all communication channels.
- Provide the draft EP on the project website.
- Respond to requests for additional information from relevant persons who have concerns or interests and offer direct consultation with relevant technical staff where applicable.
- Allow a reasonable period of time for the relevant person to review and respond to any information provided, typically four weeks.
- Follow up relevant persons via phone, email/s or in person to ensure they have received the information and verify if they have remaining questions or concerns.
- Follow up all relevant persons who have raised concerns about the activities in the EP and offer to meet in person or by video call to discuss their concerns and answer their questions.
- Ensure relevant persons were informed about the consultation process and how their feedback, questions and concerns were considered in the EP, including the management of sensitive information.

The overarching steps are shown in Figure 5-1.

This section is divided into two parts. The first section (Section 5.1) describes CGG's consultation method, including how we apply regulation 25(1) of the Environment Regulations to identify relevant persons. The second section (Section 5.2) explains CGG's application of the consultation method including the assessment of relevant persons for this EP, and details the relevant person engagement that has occurred in the development of this revised EP, including:

- Opportunities provided to persons or organisations to be aware of CGG's proposed EP and participate in consultation, including individual Traditional Custodians.
- A summary of consultation with relevant persons resulting in changes to the EP including the consultation information provided to these relevant persons, feedback received, CGG's assessment of the merits of objections or claims and the adopted EP controls.

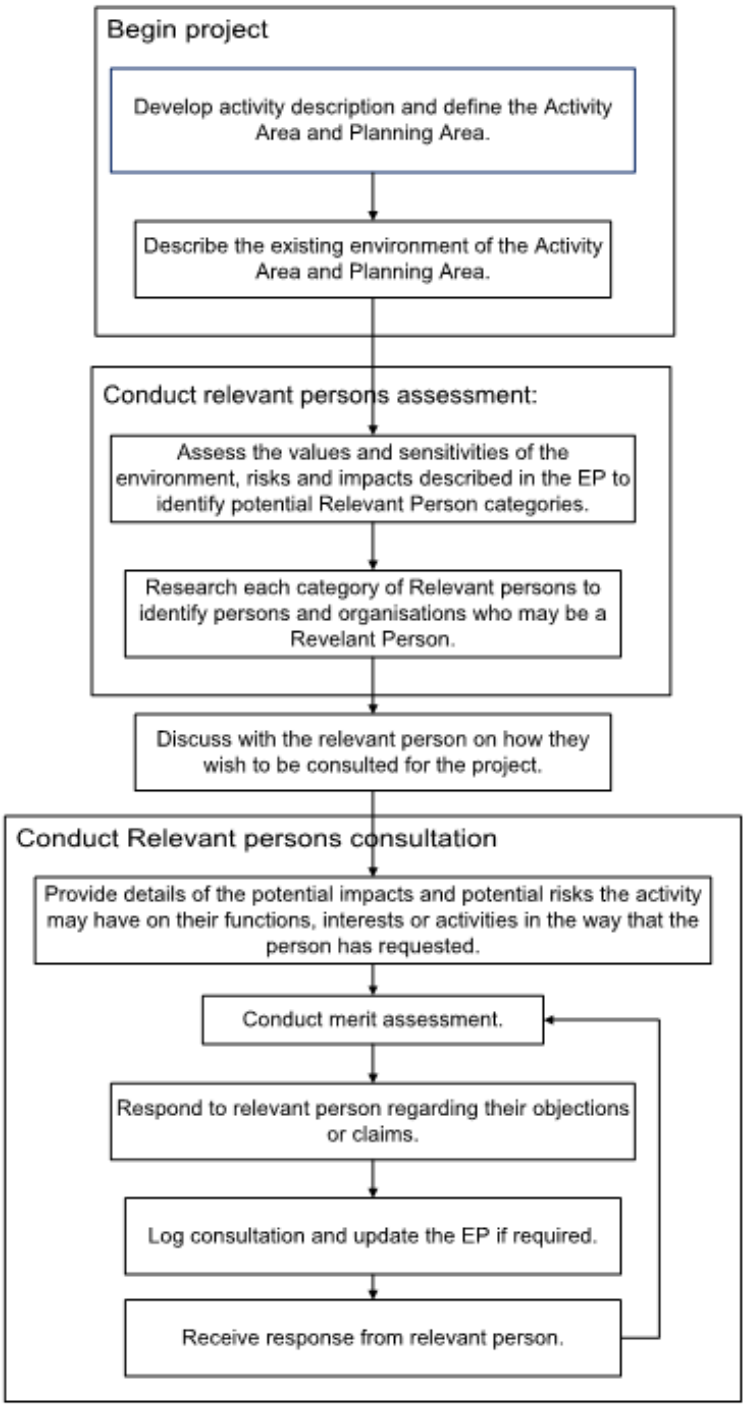


Figure 5-1 - Relevant person consultation process

5.1 Consultation method

5.1.1 Consultation regulations, guidance and case law

CGG has planned and undertaken consultation for this EP to ensure compliance with applicable regulations, the judgement of the Federal Court of Australia in Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No 2), FCA 1121, the judgement in Santos V Tipakalippa, FCAFC193, and the latest NOPSEMA consultation guidance “Consultation in the course of preparing an environment plan” (GL2086). The regulations and case law used to inform consultation are described in Table 5-1 and Table 5-2. CGG also referred to the following guidance:

- NOPSEMA Key messages: Consideration of the Tipakalippa vs NOPSEMA decision in EPs. Doc No. A878609; 11/10/2022.
- NOPSEMA Information for the community: Consultation on offshore petroleum environment plans. May 2023.
- NOPSEMA Information Paper: Consultation Requirements under the OPGGS (E) Regulations 2009.
- NOPSEMA Guidance Note: Petroleum Activities and Australian Marine Parks. June 2023.
- NOPSEMA Guideline: Consultation with Commonwealth agencies with responsibilities in the marine area. November 2024.
- NOPSEMA Guideline: Consultation in the course of preparing an environment plan. May 2024.
- Commonwealth of Australia inquiry report - Making waves: the impact of seismic testing on fisheries and the marine environment (2021).
- Commonwealth of Australia Guidance framework: Supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth marine area (2022).
- AFMA's Petroleum industry consultation with the commercial fishing industry (AFMA 2023).
- WA DPIRD Fisheries Guidance Statement: Oil and gas industry consultation with the Department (2013).
- WA DoT Guidance Statement for Marine Oil Pollution: Response and Consultation Arrangements (2020).
- WA DMIRS Consultation Guidance Note: For the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.
- WAFIC Commercial Fishing Consultation Guidance Framework October 2024.

Table 5-1 - Regulatory requirements regarding consultation

Legislation	Summary	Requirement
OPGGS Act S280	No interference	A person carrying out activities in an offshore permit area should not interfere with other users of the offshore area to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.
OPGGS(E)R 21	Environment description	Description of the environment (2) The environment plan must: (a) describe the existing environment that may be affected by the activity; and (b) include details of the relevant values and sensitivities (if any) of that environment. Note: The definition of environment in section 5 includes its social, economic and cultural features. (3) Without limiting paragraph (2)(b), relevant values and sensitivities may include any of the following: (a) the world heritage values of a declared World Heritage property; (b) the National Heritage values of a National Heritage place; (c) the ecological character of a declared Ramsar wetland; (d) the presence of a listed threatened species or listed threatened ecological community; (e) the presence of a listed migratory species; (f) any values and sensitivities that exist in, or in relation to, part or all of: i. a Commonwealth marine area; or ii. Commonwealth land.

Legislation	Summary	Requirement
OPGGS(E)R 25	Relevant persons	(1) In the course of preparing an environment plan (including a revised environment plan referred to in Division 5) a titleholder must consult each of the following (a relevant person): (a) each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant; (b) if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister; (c) if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister; (d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan; (e) any other person or organisation that the titleholder considers relevant.
OPGGS(E)R 25	Sufficient information	(2) For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.
OPGGS(E)R 25	Reasonable period	(3) The titleholder must allow a relevant person a reasonable period for the consultation.
OPGGS(E)R 25	Sensitive information	(4) The titleholder must tell each relevant person the titleholder consults that: (a) the relevant person may request that particular information the relevant person provides in the consultation not be published; and (b) information subject to such a request is not to be published under this Part.
OPGGS(E)R 26(8)	Sensitive information	All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under section 25 in the course of preparation of the plan, must be contained in the sensitive information part of the plan and not anywhere else in the plan. Note: Subparagraph 24(b)(iv) requires the plan to contain a copy of the full text of any response by a relevant person to consultation under section 25 in the course of preparation of the plan.
OPGGS(E)R 22(15)	Ongoing consultation	The implementation strategy must provide for appropriate consultation with: (a) relevant authorities of the Commonwealth, a State or a Territory; and (b) other relevant interested persons or organisations.
OPGGS(E)R 24(b)	Consultation report	The environment plan must contain the following: (b) a report on all consultations under section 25 of any relevant person by the titleholder, that contains: i. a summary of each response made by a relevant person; and ii. an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and iii. a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and iv. a copy of the full text of any response by a relevant person; .

Legislation	Summary	Requirement
OPGGS(E)R 34	Measures adopted from consultations are appropriate	For the purposes of section 33, the criteria for acceptance of an environment plan (the environment plan acceptance criteria) for an activity are that the plan: (g) demonstrates that: i. the titleholder has carried out the consultations required by section 25; and ii. the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate;

Table 5-2 - Consultation case law

Guidance	Requirement
Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No. 2) [2022] FCA 1121 (the decision) and Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (the appeal)	Some of the key findings from the appeal: [46] *Third, we observe that reg 11A(1) provides for a statutory concept of "relevant person", and that this concept is broader than the meaning ordinarily given to "person" by s 2C of the Acts Interpretation Act 1901 (Cth). Rather, reg 11A creates an artificial definition. For example, certain Departments of the Commonwealth, the States and the Northern Territory are expressed to be a "relevant person" (singular), notwithstanding that a Department is not ordinarily classified as a 'person' either under that Act or ordinary English usage (not being a body politic or corporate, or an individual).* [57] *The consultation under reg11A is also designed to ensure that the titleholder adopts appropriate measures in response to concerns conveyed to the titleholder by the affected authorities, organisations and individuals: see reg 10A(g)(ii). Equally importantly, the titleholder is obliged to inform NOPSEMA of the identity of the affected authorities, organisations and individuals, the nature of the titleholder's consultation with them, and the measures that the titleholder has adopted or proposes to adopt to meet the concerns notified to the titleholder in the consultations: reg 10A(g). Construed in this way, the Regulations are directed to fulfilling their objects, consistently with the EPBC Act.* [88] *Santos and NOPSEMA submitted that the construction of the term 'interests' must permit the ready ascertainment of persons who may have those interests. In oral argument, senior counsel for NOPSEMA agreed that persons with "interests" must be "reasonably capable of ascertainment". We accept this later proposition, but we do not consider that this tends against the conclusion we have reached.* [89] *Regulation 11A, like most statutory consultation provisions, imposes an obligation that must be capable of practicable and reasonable discharge by the person upon whom it is imposed…* [154] *As outline above, there is a separate public comment regime in regs 5C and 11B. This means that a person with no greater interest in the proposed activity than any other member of the public will, to the extent they wish to make comment, be left to this regime. However, reg 11A serves a quite different purpose, and is triggered upon a person or organisation being of a particular type or having a characteristic that is already in existence, being a function, interest or activity (reg 11A(1)(d)), or because the titleholder considers them relevant (reg 11A(1)(e)). At risk of repetition, given the object of the consultation regime, and contrary to submissions of Santos, this does not point to any narrow reading of what constitutes a relevant "interest". Put simply, if an interest (in its usual sense) is readily recognizable to the titleholder as being an existing interest over and above a member of the public at large then there is an "interest" as used in reg 11A(1)(d).* [46] notes that a 'relevant person' is broader than an individual and can comprise an organisation and an authority. This definition is used in this EP.

Guidance	Requirement
	[88], [89], and [154] relate to relevant persons being reasonably ascertainable, that the obligation to consult must be practicable and reasonable to discharge, and that an “interest” being an existing interest over and above a member of public at large. [57] provides the driver for consultation with a relevant person in that the titleholder adopts appropriate measures in response to concerns conveyed to them.

5.1.2 Process to identify relevant persons

5.1.2.1 Project activity

Section 3 of this EP details the activity description including location, timing, infrastructure, vessels and each activity required to complete the Sauropod 3D MSS. The core activity of relevance to identification of relevant persons will be seismic data acquisition, but associated activities include refuelling and resupply, use of support vessels as required, and crew changes within the Operational Area are also important. Seismic data acquisition is expected to take a maximum of 60 days including downtime and survey infill, streamer deployment and streamer recovery.

5.1.2.2 Spatial extent of the environment that may be impacted

For this EP, CGG has considered the activity’s Operational Area (as defined in Section 3) and the broader EMBA (as defined in Section 4) in undertaking consultation. However, for the purpose of consultation the key areas are considered to be the Activity Area and the Planning Area.

The Activity Area encompasses the area within which the activity will occur (the Operational Area) plus a 20 km buffer within which a change to ambient environmental conditions may occur due to planned activities. The 20 km buffer is the largest impact range of planned impacts due to the activity (light emissions to fauna from the National Light Pollution Guidelines for Wildlife, Commonwealth of Australia 2023).

The Planning Area is a broader area defined through modelling as the potential area of impact from an accidental release of MDO, elsewhere in the EP referred to as the EMBA. The Planning Area enables the identification and description of the physical environment that may be affected, the values and sensitivities in that environment, and for emergency response management planning. Section 4 of the EP sets out a detailed description of the environment within the Planning Area.

Table 5-3 summarises the environment area descriptions used to identify relevant person categories.

Table 5-3 – Environment area values and sensitivities

Environment area	Values and sensitivities
Activity Area: Change to ambient environmental conditions may occur due to planned activities.	Immediate activity area: • Routine operational discharges Physical presence in activity area • Light emissions, distance of impact • Underwater noise, distance of impact
Planning Area: Area encompassing the furthest extent of numerous oil spill scenarios, and used for assessing unplanned impacts and emergency response planning.	Modelling of MDO spills and impact assessments defines different hydrocarbon contact values of four phases (surface, dissolved, entrained and accumulated shoreline) that pose different ecological and socioeconomic risks.
Regional Environmental Setting	Broad description of the seafloor structure, marine flora and fauna, currents and upwellings.

5.1.2.3 Identification of relevant person categories

Survey activities, the physical environment and its relevant values and sensitivities, and associated risks and impacts resulting from the survey activities (Section 7 and 8) were reviewed to identify relevant person categories in accordance with OPGGS (E) Regulation 25(1):

a) each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant;
b) if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister;
c) if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister;
d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan;
e) any other person or organisation that the titleholder considers relevant.

Table 5-4 and Table 5-5 identify the relevant persons categories for this EP.

Table 5-4 - Relevant person categories based on environmental values and sensitivities

Environmental values and sensitivities	Activity Area	Planning Area	Relevant person categories
Physical and biological environment			
The physical and biological environment described in Section 4 provides the basis for further assessment of values and sensitivities, along with impact and risk assessments from planned and unplanned activities (Sections 7 and 8). The ecological and physical environment includes: • Benthic habitats and species assemblages • Soft sediment (habitat for various species) • Rocky escarpment (Ancient coastline KEF) • Coral shoals (not a dominant habitat) • Plankton • Invertebrates and fish • Birds • Marine reptiles • Cetaceans • Pest species.	✓	✓	Commonwealth Departments / Agencies State Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Groups
Threatened and migratory species and biologically important areas (foraging aggregation, breeding) are identified in Section 4	✓	✓	Commonwealth Departments / Agencies First Nations Peoples Academic and Research Organisations Environmental Conservation Groups
Socio-Economic and Cultural Environment			
Australian Marine Parks: • Argo-Rowley Terrace • Mermaid Reef • Eighty Mile Beach	×	✓	Commonwealth Departments / Agencies First Nations Peoples Academic and Research Organisations Environmental Conservation Groups Tourism & Business Associations
Western Australian protected areas: • Rowley Shoals State Marine Park • Eighty Mile Beach State Marine Park	×	✓	State Departments / Agencies First Nations Peoples Academic and Research Organisations Environmental Conservation Groups Tourism & Business Associations

Environmental values and sensitivities	Activity Area	Planning Area	Relevant person categories
Key ecological features: • Ancient coastline at 125 m depth contour (Activity Area) • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals (Planning Area) • Continental Slope Demersal Fish Communities (Planning Area)	✓	✓	Commonwealth Departments / Agencies First Nations Peoples Academic research organisations Environmental Conservation Groups
Commercial fisheries: Extensive assessment undertaken of Commonwealth and Western Australian managed fisheries and fishing effort. Historical fishing effort in both the Activity and Planning areas.	✓	✓	Commercial Fishing
Tourism and recreation industry (associated with reefs and shoals that overlap the Planning area)	×	✓	Local Government Authorities Tourism & Business Associations Commercial Marine Tourism Recreational Fishing Recreational Users
Offshore petroleum industry, titleholders within the Activity and Planning areas, other seismic survey operators	✓	✓	Oil and Gas Industry
World Heritage Areas	×	×	NA
National Heritage Places: • Mermaid Reef – Rowley Shoals	×	✓	Commonwealth Departments / Agencies First Nations Peoples Academic and Research Organisations Environmental Conservation Groups Tourism Associations
First Nations People cultural values and sensitivities.	✓	✓	First Nations Peoples
Wetlands of International Importance (Ramsar)	×	×	NA
Nationally Important Wetlands	×	×	NA
Maritime archaeological heritage	×	✓	Commonwealth Departments / Agencies Commercial Marine Tourism Environmental Conservation Groups Academic Organisations
Shipping (activity area overlaps with marine shipping fairways)	×	✓	Commonwealth Departments / Agencies
Defence activities	×	✓	Commonwealth Departments / Agencies

Table 5-5 Relevant person categories based on identified impacts and risks of the proposed activity

Aspect	Activity Area	Planning Area	Relevant person categories
Impacts			

Aspect	Activity Area	Planning Area	Relevant person categories
Underwater noise emissions: temporary, during activities	✓	×	Commonwealth Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations
Physical Presence: Disruption/Interference with Other Marine Users	✓	×	Commonwealth Departments / Agencies First Nations Peoples Commercial Fishing Oil and Gas Industry Recreational Users
Routine emissions – Treated Sewage, Grey Water and Putrescible Waste	✓	×	Commonwealth Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations
Discharge: Drains, Deck and Bilge Water	✓	×	Commonwealth Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations
Artificial Light Emissions: Vessels	✓	×	Commonwealth Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations
Atmospheric Emissions: Vessels and Mechanical Equipment	✓	×	Commonwealth Departments / Agencies
Risks			
Hydrocarbon and Chemical Spills	✓	✓	Commonwealth Departments / Agencies State Departments / Agencies Commercial Fishing First Nations Peoples Local Government Authorities Tourism & Business Associations Marine Tourism Operators Recreational Fishers Recreational Users Academic and Research Organisations Environmental Conservation Organisations
Physical Presence: Entanglement / Collision with Marine Fauna	✓	✓	Commonwealth Departments / Agencies

Aspect	Activity Area	Planning Area	Relevant person categories
Physical Presence: Loss of Equipment	✓	×	Commercial Fishing Marine transport Commonwealth Departments / Agencies
Discharge: Loss of Hazardous or Non-Hazardous Solid Waste	✓	×	Commonwealth Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations
Introduction of Invasive Marine Species: Ballast Water and Biofouling	✓	×	Commonwealth Departments / Agencies State Departments / Agencies Commercial Fishing First Nations Peoples Academic and Research Organisations Environmental Conservation Organisations

5.1.2.4 Identification of Relevant persons

5.1.2.4.1 OPGGS (E) Regulation 25 (1)(a), (b) and (c)

CGG's methodology for identifying relevant persons under OPGGS (E) Regulations 25(1)(a), (b) and (c) is as follows:

- CGG considers the defined responsibilities of each of the departments and agencies to which the activities in the EMBA to be carried out under the EP may be relevant. This list of relevant departments and agencies is formulated by reference to the responsibilities of the government departments as set out on their websites, in NOPSEMA's GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area guideline (January 2023), which describes where the Department is a relevant agency under the Environment Regulations, as well as experience and knowledge that CGG has gained from years of operating in relation to the departments and agencies, which CGG has historically consulted over the years. This list is revised from time to time, for example, for the purposes of accommodating government restructures, renaming of departments, shifting portfolios and/or to account for new agencies that might arise.
- CGG considers each of the responsibilities of the departments and agencies and determines whether those responsibilities overlap with potential risks and impacts specific to the proposed petroleum activity in the EMBA. The assessment is both activity and location based.
- CGG acknowledges the roles and responsibilities of government departments and agencies acting on behalf of various industry participants. For example, AMSA - Marine Safety is responsible for the safety of vessels and the seafarers who are operating in the domestic commercial shipping industry and AHO is responsible for maritime safety and Notices to Mariners. To undertake the activity in a manner that prevents a substantially adverse effect on the potential displacement of marine users, CGG therefore consults AMSA - Marine Safety and AHO on its proposed activities. CGG considers each of the responsibilities of the departments and agencies and determines those that would either be involved in the incident response itself or in relation to the regulatory or decision-making capacity with respect to planning for the unlikely event of a worst-case hydrocarbon release incident response specific to the activity.

CGG does not consult with departments or agencies with interests that do not overlap with risks and impacts specific to the proposed petroleum activity in the EMBA or would not be involved in incident response planning. For instance, in this EP, CGG has not consulted with the department for the Minister of the Northern Territory because there is no overlap given that the proposed activities are in Commonwealth waters offshore of Western Australia.

The results of this are described in Section 5.2.1.

5.1.2.4.2 OPGGS (E) Regulation 25 (1)(d)

Relevant persons category (d) was extensively researched to identify persons or organisations whose functions, interests or activities may be affected may project activities. The definition of functions, interests or activities was taken to be the below:

- **Functions**: Refers to “a power or duty to do something”.
- **Interests**: Conforms to the accepted concept of ‘interest’ in other areas of public administrative law and includes any interest possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation.
- **Activities**: Broader than the definition provided in regulation 5 of the OPGGS (E) Regulations and is generally taken to be what the relevant person is already doing.

Relevant persons under OPGGS (E) Regulation 25 (1)(d) are defined as a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP, or a revision of the EP. In identifying relevant persons, CGG considers:

- The planned activities to be carried out under this EP (described in Section 3); and
- The Planning Area (referred to as the EMBA elsewhere in this EP, as identified in Section 4 and assessed in Section 6).

The research approaches used to identify relevant persons in category (d) are detailed in Table 5-6.

Table 5-6 Research methods for identification of relevant persons - Regulation 25 (1)(d)

Activity/Category	Identification methodology
Database Review	A comprehensive review of the existing relevant person database for this activity was undertaken. This included assessing the list of organisations and individuals against relevant person categories identified in assessment of totality of environment values, sensitivities, impacts and risks.
Functions, interests or activities	• To ensure a full coverage of scope and associated environmental impacts and risks, identification of potential new relevant persons involved preliminary research into their functions, interests and activities from readily ascertainable information on internet search engines, social media channels and organisation websites. • Where direct consultation has been undertaken, CGG sought to clarify and update functions, interests or activities. • CGG created ongoing opportunities for relevant persons to advise CGG of their functions, interests or activities through: • using email for distribution of project information sheets that request them to advise if they believe the project may affect their functions interests or activities. • a project information sheet that sets out in greater detail the purpose of consultation being to assess and reduce impacts on functions, interests and activities. • public notice advertisements that also advise this via social media and regional newspapers. • open information sessions held in public venues in Port Hedland and Broome.
Local knowledge	• CGG discussed with relevant persons if there were any further relevant persons that should be consulted with. This included local tourism booking agents and legal aid organisations, that were not relevant persons themselves but may have local knowledge of relevant persons.
Broad based keyword search	• Searched online for potentially relevant persons using key words e.g. boat; swim; dive; sail; yacht; fish; marine environment; oceans; marine mammals. • Combined above terms with place-based search terms (“Rowley Shoals”). • Investigated media articles identified in the above searches for further relevant persons. • Investigated social media channels identified in the above searches.

Activity/Category	Identification methodology
Marine Parks	• Contacted DBCA to update database records on correct authorities and contacts for the management of the Rowley Shoals. • Contacted the commonwealth Marine Parks Authorities to determine correct authorities and contacts for the relevant Australian Marine Parks.
Conservation Groups	• Based on desktop research of media coverage and organisations, identified regional conservation groups, sought direct engagement and commenced consultations with organisations who responded. • Given the limited nature and scale of the project activities, research involved focussing on regional groups with a direct interest in the Northwest Shelf Oil and Gas industry, groups whose interests are potentially most affected, such as marine conservation, and where such consultation could contribute further information that would meet the purpose of consultation to identify concerns and implement mitigations.
Tourism Groups	• Researched marine tourism operators and tourism councils active between Port Hedland and Broome, and around the Rowley Shoals and Eighty Mile Beach. • Contacted Marine Park Authorities to determine tourism licence holders within applicable marine parks. • Searched the Australian Marine Parks 'List of authorisations issued' database to identify persons with permits to conduct activities in the relevant AMPs.
First Nations People	Refer to Section 5.1.2.4.2.1 below.
Commercial Fishers	Refer to Section 5.1.2.4.2.2 below.

5.1.2.4.2.1 Approach to identifying relevant First Nations people

CGG understands that First Nations people have deep connections to, and concerns about the protection of Sea Country, which is viewed the same way they view their onshore Country, without separation.

As described in Section 4.4.8, Sea Country is an important part of First Nations people's culture and while the many coastal and island First Nations groups around Australia have different languages and their own unique belief systems, ceremonies and relationships with Country, they all regard the estuaries, beaches, bays, and marine areas, or Sea Country, as essential parts of their traditional estates. CGG considered the management plans of marine parks that overlap the Operational Area and EMBA to determine whether cultural features and heritage values have been identified and whether there are Traditional Custodians or representative bodies referenced to contact regarding potential cultural values.

First Nations groups who reside along the coasts or on islands believe that Sea Country contains the evidence of creation stories, stories about animals, plants and people, as well as the creation of landscape features such as islands and reefs. Coastal and Islander communities hold cultural responsibilities to ensure Sea Country is cared for and Sea Country was managed very carefully and they are playing an increasingly important role in the management of this Sea Country, through formalised roles and programs that work alongside various State and Commonwealth government structures.

Values and sensitivities regarding Sea Country may include different features such as:

- Historic and contemporary cultural harvesting of marine fauna and flora.
- Sea and landscape features that hold dreamtime and creation stories, such as offshore islands.
- Different marine and avian species that hold deep connections to lore and represent spiritual emblems.

Given these Sea Country values and sensitivities, there is the potential for some First Nations people to be relevant persons in relation to the proposed activities set out in this EP.

CGG identified relevant First Nations people for this EP using the following methods:

- CGG carried out desktop research to identify any published Sea Country research that may identify marine and avian species that may represent spiritual emblems, relevant to the activities in the EP.
- Using the database of the National Native Title Tribunal to determine whether there are any Native Title Claims (historical or current) or Determinations overlapping or coastally adjacent to the EMBA (see Table 4-14). The Native Title Claims are understood to represent the lands and waters over which Indigenous groups claim or claimed rights (including rights to conduct activities) and interests, and Native Title Determinations are understood to

represent the lands and waters over which Indigenous groups have determined rights and interests and their representative institutions have certain functions (see Section 4 and below).

- Where there is a positive determination of Native Title, contacting the PBC.
- Where appropriate, contacting the relevant Native Title Representative Body to request a list of any Traditional Custodian groups asserting Traditional Custodianship over an area of coastline adjacent to the EMBA who do not and have never had a Native Title claim or determination of which the land council or Native Title Representative Body are aware.
- Review of relevant Indigenous Land Use Agreements (ILUA), or similar agreements which are publicly available, by which Aboriginal organisations or Traditional Custodian Groups have made a voluntary agreement regarding the use or management of areas of land or water overlapping or coastally adjacent to the Planning Area. ILUAs are registered with the Native Title Tribunal and may identify Traditional Custodians or representative bodies to contact regarding potential cultural values.
- Review of Commonwealth and State Marine Park Management Plans that overlap the EMBA, which may identify Traditional Custodians or representative bodies to contact regarding potential cultural values.
- CGG applies the principles of self-determination when consulting with Traditional Custodians through consulting with representative institutions utilising traditional decision-making mechanisms.
- Where the native title group is not clear or there is no representative institution, CGG may seek guidance from the Native Title Representative Body as to the Traditional Custodian group whose rights and interests may overlap with the EMBA. CGG may have reference to maps of native title claims and determinations produced by the National Native Title Tribunal, registered Indigenous Land Use Agreements, heritage databases and Indigenous Protected Areas.
- CGG will consult with individual Traditional Custodians where we have been directed to do so by the representative institution or the native title representative body. This may occur when for cultural reasons, and as recognised by the broader group, a person is regarded as having particular obligations in relation to a site or area that are distinct from that of the broader group.
- CGG provides the opportunity for individual Traditional Custodians to participate in consultation in response to broader notification and advertising, or at community information sessions (see Section 5.1.3).
- Advertised in the local newspapers to invite consultation with any persons who may have a function, interest or activity that may be affected by the activities set out in the EP. This additional step was undertaken to provide an opportunity for any persons unknowable to CGG, notwithstanding the relevant person identification steps undertaken.

CGG assesses relevance for Native Title Representative Bodies using the following steps in its methodology:

- A Representative Aboriginal/Torres Strait Islander Bodies (RATSIB) is a regional organisation appointed under the *Native Title Act 1993* (NTA) with prescribed functions set out in Part 11 of the Native Title Act 1993, which relate to: facilitation and assistance; certification; dispute resolution; notifications; agreement making. They are also known, and referred to here, as Native Title Representative Bodies.
- Review of National Native Title Tribunal RATSIB areas that overlap or are coastally adjacent to the EMBA.

CGG asks nominated representative bodies and the Native Title Representative Bodies to identify individuals, and also enables individuals to self-identify in response to national and local advertising, social media and community engagement opportunities. CGG does not directly approach individuals for consultation, because this is misaligned with UNDRIP and undermines the role of the nominated representative bodies. Approaching individuals directly is an outdated practice, which is no longer considered acceptable because of divisions it has been shown to cause in communities.

However, individuals are given the opportunity to self-identify, consult and provide feedback on the proposed activity. In these circumstances, CGG will engage individuals as relevant persons and also advise the nominated representative body of the consultation where it relates to cultural values.

CGG has not been directed to engage individual Traditional Custodians by nominated representative bodies for this proposed activity, however CGG has nevertheless provided reasonable opportunity for individual Traditional Custodians to engage in consultation through appropriate and adapted consultation methods. These methods are consistent with the requirements for notification under the Native Title Act 1993, which requires notification of the Native Title Representative Body, the PBC (or nominated representative). The notification process has been selected as a practical and pragmatic

method for consultation, rather than the authorisation process, which aims to seek authorisation of agreements and Native Title claims under the Native Title Act.

5.1.2.4.2.2 Approach to identifying Commercial fisheries and fishers

The Planning Area overlaps the jurisdictional boundaries of several Commonwealth and state-managed fisheries as described in Section 4. Operators within these fisheries were identified as those most likely to be affected by survey activities. As described in Section 4, most of these fisheries are not expected to be active within the Activity Area. The approach to identifying relevant commercial fishers is as follows:

- Review of the WAFIC *WA Commercial Fishing Consultation Guidance Framework October 2024* to guide consultation with commercial fishers that WAFIC represents.
- Define the parameters having regard to timing, location and duration of the proposed petroleum activity.
- Confirming whether the Planning Area overlaps with the fisheries management area (i.e. the spatial area the fishery is legally permitted to fish in) (see Section 4.1).
- Identify and map designated State and Commonwealth fishery areas that may be fished.
- For Commonwealth and State commercial fisheries, CGG assesses the potential spatial and temporal extent for interaction with the fishery by reviewing AFMA ABARES and DPIRD Fishcube data within the Activity Area and Planning Area (see Section 4.4.4).
- Data was assessed for 60 nm × 60 nm and for 10 nm × 10 nm Catch and Effort System (CAES) blocks for annual catch and effort data for recent years (refer to Section 4.4.4). Data was assessed to identify where the greatest fishing effort in each fishery occurred and the relative importance of waters within the Activity Area. As described in Section 4.4.4.1, review of five years of catch and effort data is considered appropriate for this EP to represent the potential for future fishing effort and past fishing effort considering the limited duration of the proposed MSS (60 days, see Section 3.2) and that the potential impacts to fish and fish stocks from the proposed activity are expected to be temporary (see Sections 7 and 8). In addition, five years aligns with the review cycle of Commonwealth fisheries' harvest strategies aimed at managing performance of the stock or fishery through time as well as the time scale of inter-annual variability of environmental parameters that affect fisheries resources (DAWR 2018), both indicating the suitability of this time scale to fishing decision of individual fishers.
- FishCube data is not available for Commonwealth managed fisheries, so CGG assessed annual Commonwealth Fisheries Status reports to determine which fisheries operating within the Planning Area over the last six years.
- State commercial fisheries that have been assessed as having a potential for interaction within the Activity Area or Planning Area (see Section 4.4.4) are assessed as relevant to the proposed activity. Commonwealth commercial fisheries that have been assessed as having a potential for interaction within the Activity Area or Planning Area (see Section 4.4.4) are assessed as relevant to the proposed activity.

As WAFIC requests at their webpage "Consultation Approach For Unplanned Events"[1], consultation on unplanned events resulting in an emergency scenario should only be undertaken if an incident occurs. Therefore, no consultation has been undertaken with commercial fishers as relevant persons that have the opportunity to fish in the EMBA has been undertaken at this stage.

5.1.2.4.3 Regulation 25 (1)(e)

Relevant persons under regulation part (e) include persons that are indicated by other relevant persons that they should be consulted, and relevant persons that have indicated in previous consultation to CGG that they should be considered relevant, for example departments or agencies responsible for oil spill response activities.

[1] Refer to Consultation Approach for Unplanned Events - WAFIC (accessed 25/6/2025)

5.1.2.4.4 Persons or organisations CGG chooses to contact

In addition to undertaking consultation with relevant persons under OPGGS (E) Regulation 25(1) there are persons or organisations that CGG chooses to contact, from time to time, in relation to a proposed activity. For example, these are persons or organisations:

- That are 'not relevant' pursuant to OPGGS (E) Regulation 25(1) but that CGG has chosen to seek additional guidance from, for example, to inform the correct contact person that CGG should consult, or engage with;
- That are 'not relevant' pursuant to OPGGS (E) Regulation 25(1) but have been contacted as a result of consultation requirements changing or updated guidance from the Regulator; or
- Where it is unclear what their functions, interests or activities are, or whether their functions, interests or activities may be affected. In this circumstance, engagement is required to inform relevance under CGG's methodology. CGG follows the same methodology for assessing a person's or organisation's relevance as it does during its initial assessment (as described in Figure 5-1 and Section 5.2.

5.1.3 Provision of information

CGG's approach to supply information to relevant persons is as follows:

- Providing consultation materials directly to identified relevant persons as well as persons who are not relevant but CGG chose to contact and providing a target date for feedback. CGG acknowledges that feedback may be received from relevant persons following the target date.
- Relevant persons have the opportunity to notify CGG of how they wish to be consulted. In the event that the relevant person has published consultation guidance, this guidance was confirmed with the relevant person at the commencement of consultation with them (see consultation records in the Sensitive Information Report).
- Acknowledging that the way in which CGG provides consultation information may vary depending on the relevant person or organisation and, may depend on the degree to which a relevant person or organisation is affected. Different consultation processes may be required for relevant persons and organisations depending on the information requirements.
- Following up with relevant persons prior to EP submission. Where possible, CGG will use an alternative method of communication to contact the relevant person.
- Engaging in two-way dialogue with relevant persons or organisations where feedback is received.

A summary of the types of information provided per relevant person category is shown in the table below.

Table 5-7 - Information provided to Relevant Persons

Relevant OPGGS (E) Regulation	Relevant Persons Category	Information Type
25(1)(a) (b)(c)	Relevant government departments and agencies	Information Sheet. Provision of further information where requested or required. Meeting or phone call where requested or required.

Relevant OPGGS (E) Regulation	Relevant Persons Category	Information Type
25(1)(d)	Organisations or individuals whose functions, interests or activities may be affected by the activity in the EP	Information sheet. Risk and management measures table. Draft EP available on CGG's project website. Detailed activity area maps overlaid with fishery maps are made available for the commercial fishery sector. Information sessions if requested. Meetings with associations and their members are actively sought out by CGG in the event of potential fishing displacement or other impacts. Phone calls are actively used where there are little or no responses to emails, where a phone number is available. Provision of further information where requested or required. Advice regarding acceptance of EP by NOPSEMA. Public advertisements in local and regional newspapers. Public advertisements in social media.
25(1)(e)	Other organisations or individuals who CGG seeks to consult with for proactive community relations	Information Sheet. Public advertisements in local and regional newspapers. Public advertisements in social media.

5.1.3.1 Commercial fishers

Commercial fishers will be engaged with by providing an information sheet to relevant fishing associations, response to questions, concerns and further information requests, seek further information on actual fishing effort, and seek support (including costing proposals where applicable) for engagement with their members, either directly or via the association as applicable.

CGG acknowledges WAFIC's consultation guidance[2] that titleholders develop separate consultation strategies for significant unplanned events (for example oil spill) where titleholders can demonstrate the likelihood of such events occurring is extremely low. WAFIC's guidance is that consultation on unplanned events resulting in an emergency scenario should only be undertaken if an incident occurs. CGG acknowledges WAFIC's consultation guidance and applies this by:

- Directly consulting fishery licence holders that are assessed as having a potential for interaction in the Operational Area; and
- Consulting fisheries that are assessed as having a potential for interaction in the EMBA via WAFIC.

5.1.3.2 First Nations Specific Consultation

CGG provides persons or organisations, including individual Traditional Custodians, with the opportunity to be aware of CGG's proposed activities and to participate in consultation. CGG's approach is guided by the United Nations Declaration on the Rights of Indigenous People (UNDRIP) which respects Traditional Custodians by directing consultations through their nominated representative body (referred to in UNDRIP as "their own representative institutions"). This has been reinforced throughout consultation with PBCs who have requested that CGG engage with them as the representative bodies for that Traditional Custodian group.

The most effective consultation methods for this activity, specifically designed for Traditional Custodians, to ensure that information is provided in a form that is readily accessible and appropriate are provided below:

[2] available at Consultation Approach for Unplanned Events - WAFIC

- Direct engagement with nominated representative bodies via the contact listed on the Native Title PBC website (nativetitle.org.au), requesting advice on how they would like to be engaged, and asking whether other members and/or individuals should be consulted. This has resulted in:
  - Phone calls to confirm receipt of the consultation materials and to provide context to the consultation information provided.
  - Requests and offers of resourcing to enable and support consultation.
  - Exchange of written feedback and correspondence.
- Ongoing efforts are made to engage and develop relationships with these bodies via a variety of means such as email, phone calls, alternative contacts, social media.
- Offers of consultation meetings with attendees decided by Traditional Custodian groups and supported by senior CGG representatives.

5.1.4 Sufficient time

CGG seeks feedback in order to support preparation of its environment plan. CGG recognises that what constitutes a reasonable period for consultation should be considered on a case-by-case basis, with reference to the nature, scale and complexity of the activity.

As detailed in Section 5.1.7, if comments and feedback are received after the EP has been submitted, CGG will consider those comments and update controls as appropriate, at all stages during the life of the EP.

5.1.5 Assessment and Management of Objections or Claims

CGG shall assess the merits of any new claims or objections made by a relevant person whereby they believe the activity will have an adverse impact on their interests, activities or functions. If the claim has merit, where appropriate, CGG may modify the management of the activity. The assessment will be done using the methodology detailed in this EP as detailed in Section 6.

CGG shall endeavour to finalise the merits of any claim or objection received during consultation within one week of receipt and undertake any resulting management of change actions as soon as practicable, but preferably within the same time.

The assessment of merit and any resulting change to the EP will be shared with the relevant person.

For objections and claims that do not hold merit, CGG will respond to relevant persons providing reasoning and supporting information (as relevant) to support CGG's conclusions.

5.1.6 Public comment

As described above three EPs for this activity have been previously accepted by NOPSEMA, and on each occasion the public were invited to comment on the contents within a 30 day period after the EP was published on the NOPSEMA website, as required under Regulations 9(AB) and 11(B).

5.1.6.1 Public comments – previous EP submissions

Previous public review periods include one undertaken in September/October 2022, when CGG published notices inviting comments on the EP within the designated comment period, including in:

- The CGG website
- A national newspaper – The Australian
- A state-wide daily newspaper – The West Australian
- Regional newspaper close to location of the activity – The North West Telegraph.

Copies of these notices are included in the Sensitive Matters Report.

CGG received 23 responses during the 2022 public comment period. All responses were considered during the review process. They were categorised as first being either relevant to the EP or the activity to which the EP relates, or not relevant. Relevant comments were sub-grouped where they raised common concerns, to provide better consistency in responses, while maintaining the intent and key claims of the responses. CGG addressed the relevant claims raised by relevant persons using reasoned and supported information contained within the EP Rev 1.2, and the responses highlighted the relevant sections in the EP. No new issues were raised which had not been adequately addressed through consultation and

preparation of the EP. Therefore, no change of objectives, impact assessment or control measures were considered necessary.

CGG's response to the 2022 public comment was published on NOPSEMA's website when the assessment process commenced.

The proposed activity schedule was then modified, triggering the need for a new public comment period under Regulation 31. The public were again invited to comment on the contents of this environment plan over a period of 30 days after this EP was published on the NOPSEMA website under Regulations 9(AB) and 11(B) in September/October 2023. CGG published notices inviting comments on the EP within the designated comment period, including in:

- The CGG website
- A national newspaper – The Australian
- A state-wide daily newspaper – The West Australian
- Regional newspaper close to location of the activity – The North West Telegraph
- The project social media channels, Facebook, LinkedIn and Instagram.

Copies of these notices are included in the Sensitive Matters Report.

There was one public comment received during the 2023 public comment period. However, as this comment was from a relevant person, the comment was assessed against the relevant persons consultation process and was not assessed in the public comment report. CGG's response to the 2023 public comment was published on NOPSEMA's website, including response to the 2022 public comment period, when the assessment process commenced.

5.1.6.2 Public comments – current EP submission

As described in Section 1.1, the proposed activity schedule has again been modified for a change in the survey year, triggering the need for another public comment period (Regulation 31). The public were invited to comment on the contents of this revised environment plan over a period of 30 days after this EP was published on the NOPSEMA website under Regulations 9(AB) and 11(B) in October/November 2025. CGG published notices inviting comments on the EP within the designated comment period, including in:

- The CGG website
- A state-wide daily newspaper – The West Australian
- Regional newspaper close to location of the activity – The North West Telegraph.

Copies of these notices are included in the Sensitive Matters Report.

CGG received 32 responses during the 2025 public comment period. All responses were considered during the review process. They were categorised as first being either relevant to the EP or the activity to which the EP relates, or not relevant. Relevant comments were sub-grouped where they raised common concerns, to provide better consistency in responses while maintaining the intent and key claims of the responses. CGG addressed the relevant claims raised by relevant persons using reasoned and supported information contained within the EP Rev 3.0, and the responses highlighted the relevant sections in the EP. No new issues were raised which had not been adequately addressed through consultation and preparation of the EP. Therefore, no change of objectives, impact assessment or control measures were considered necessary.

CGG's response to the 2025 public comment will be published on NOPSEMA's website when the assessment process commences. On completion of the 2025 assessment process and when the EP is accepted, the final EP and NOPSEMA's response to the 2025 public comments will also be published.

5.1.7 Ongoing consultation

This section describes the ongoing consultation that will occur following EP acceptance, during the planning and activity stages of the Sauropod 3D MSS.

5.1.7.1 Review of Relevant persons

CGG understands that additional relevant persons may be identified as part of consultation. Should additional relevant persons be identified prior to, or during the survey, these relevant persons will be contacted, provided appropriate information about the survey and invited to make comment.

CGG will continue to identify relevant persons after acceptance of the EP. A review of relevant persons will be undertaken during routine reviews of information relevant to the EP as per Section 9.3. Where new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per Section 5.1.5.

5.1.7.2 Relevant person Notifications

CGG will keep relevant persons up to date with activity status by sending periodic notifications to relevant persons as per Table 5-8. Key milestones or events that trigger a notification include:

- EP acceptance by NOPSEMA
- Prior to survey commencement
- Upon survey completion
- In the event of a significant incident (e.g. large fuel spill)
- If the seismic vessel is required to depart the Operational Area to avoid adverse weather (notification will be communicated by the AMSA Joint Rescue Coordination Centre as a navigational safety warning)
- If there is a change to the MSS activity scope that may affect the relevant person interests, activities or functions
- If a new or significant increase in potential impact or risk is identified that (after identification of additional control measures to manage those impacts or risks) may affect the relevant person interests, activities or functions.

All notifications will include the relevant details of the activity including the activity title, location and contact details.

Table 5-8 - Ongoing consultation requirements

Relevant person	Ongoing consultation requirement	Timing
All relevant persons	Ongoing consultation including: • Communication of information and addressing queries and concerns via email, phone or meeting; • Project updates including acceptance of EP and start and completion of activities.	As required
Relevant persons identified as marine users and relevant government departments and agencies	Notifications of activity commencement, including: • type of activity; • location of activity, coordinates and map; • timing of activity: expected start and finish date and duration; • sequencing of locations if applicable; • vessel details including call sign and contact; • any safety exclusion zones required; and • CGG contact details. Note: coordinates to be provided as degrees and decimal minutes referenced to the WGS 84 datum.	2 weeks prior to activity commencing
AHO	Vessel Contractor to issue notification of activity for publication of notice to mariners, including: • type of activity; • geographical coordinates of the survey location; • any exclusion zones required; • period that NTM will cover (start and finish date); • vessel details including name, Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), contact details and call signs; and • CGG and vessel Contractor contact details.	2 to 4 weeks prior to activity commencing

Relevant person	Ongoing consultation requirement	Timing
	Update AHO of progress, changes to the intended operations including if activity start or finish date changes.	
AMSA - JRCC	Vessel Contractor to issue notification of activity for promulgation of radio navigation warnings, including: • type of activity; • area of operation: geographical coordinates of the survey location; • any exclusion zones required; • period that warning will cover (start and finish date); • vessel details including name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone numbers), contact details and calls signs; • any other information that may contribute to safety at sea; and • CGG and vessel Contractor contact person. Update AMSA JRCC of progress, changes to the intended operations including if activity start or finish date changes.	48 – 24 hrs prior to activity commencing
NOPSEMA	Regulatory notification of start of activity.	10 days prior to activity commencing
relevant persons who have requested vessel location information.	SMS or email messaging undertaken where requested by relevant person.	During activity
NOPSEMA	Regulatory notification of cessation of activity.	Within 10 days of activity completion

5.1.7.3 Management of objections and claims

If any objections or claims are raised during ongoing consultation these will be substantiated via evidence such as publicly available credible information and/or scientific or fishing data. Where the objection or claim is substantiated, where applicable, it will be assessed as per the CGG risk assessment process and controls applied where appropriate to manage impacts and risks to ALARP and an acceptable level. Relevant persons will be provided with feedback as to whether their objection or claim was substantiated, and if not why, and if it was substantiated, how it was assessed and if any controls were put in place to manage the impact or risk to ALARP and an acceptable level.

If a change to the activity or controls adopted during the MSS occurs as a result of relevant person consultation, including the provision of evidence regarding an impact or risk to commercial fishing due to the survey, the change will be managed in accordance with CGG's Management of Change process (Section 9.2).

5.2 Consultation results

Three EPs for this activity have been previously accepted by NOPSEMA, one that was developed and submitted by 3D Oil in 2020 for a survey to occur during 2021, and two developed and submitted by CGG for a survey to occur in either 2022 or 2023 and 2024 or 2025. This EP describes the relevant person engagement that has occurred in the development of this revised EP, which took place between June and September of 2025. Further information detailing the consultation undertaken during the development of previous EPs, including objectives, methodology, and outcomes can be found in those EPs.

CGG has provided all relevant persons identified in the course of preparing this EP sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities, and time to provide feedback to CGG any objections or claims about the seismic survey. CGG has discharged its duty under regulation 25. CGG considers that consultation under regulation 25 is complete.

5.2.1 Relevant persons for this EP

This section lists the relevant persons that were identified following the processes outlined in Section 5.1.

Firstly, the list of relevant persons created during the development of previous EPs was reviewed to determine if any existing relevant persons were no longer relevant (e.g., if a fisher was no longer actively fishing in the area). Then CGG followed the method outlined in Section 5.1.2 to determine if there were any new relevant persons for this EP.

The outcome of the review resulted in three new relevant persons added to the project relevant person database. The list of those persons or organisations assessed as relevant and persons or organisations CGG chose to contact and the associated assessment of relevance is set out in the table below.

Table 5-9 Assessment of Relevance

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Commonwealth and WA State Government Departments or Agencies – Marine			
Australian Border Force - Maritime Border Command	Responsible for coordinating maritime security. Deters and prevents illegal activities in the Australian Marine Domain.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). ABF's functions may be relevant to the activity as there are proposed vessel activities.	Yes
Australian Communications and Media Authority (ACMA)	Australian government agency responsible for the regulation of radio communications and telecommunications.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). Relevant person to obtain information in relation to subsea cables or if predicted impact to subsea cables.	Yes
Australian Fisheries Management Authority (AFMA)	Responsible for managing Commonwealth fisheries	CGG has applied its methodology for 'Government departments / agencies – marine' under OPGGS (E) Regulation 25(1)(a). Activity is within a Commonwealth fishery area. AFMA expects petroleum operators to consult directly with fishing operators or via their fishing association body about all activities and projects which may affect day to day fishing activities.	Yes
Australian Hydrographic Office (AHO)	Responsible for maritime safety and Notices to Mariners	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). AHO's functions may be relevant to the activity as there are proposed vessel activities.	Yes
Australian Maritime Safety Authority (AMSA) Joint Rescue Coordination Centre (JRCC)	Responsible for maritime safety, adherence to advice, protocols, regulations.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). AMSA JRCC's functions may be relevant to the activity as there are proposed vessel activities.	Yes
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	Administers, implements and enforces the *Biosecurity Act 2015*. The Department requests to be consulted where an activity has the potential to transfer marine pests.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). DAFF – Biosecurity's (formerly DAWE) functions may be relevant to the proposed activities in the Planning Area in the prevention of introduced marine species.	Yes
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	Responsible for implementing Commonwealth policies and programs to support agriculture, fishery, food and forestry industries	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). DAFF – Fisheries' (formerly DAWE) functions may be relevant to the activity as the Planning Area overlaps the management boundaries of the North West Slope and Trawl Fishery, Western Tuna and Billfish Fishery, Western Skipjack Tuna Fishery and Southern Bluefin Tuna Fishery. The North West Slope and Trawl Fishery are active in the Planning Area.	Yes
Department of Biodiversity, Conservation and Attractions (DBCA)	Responsible for managing WA's parks, forests and reserves to achieve wildlife conservation and provide sustainable recreation and tourism opportunities.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). The proposed activity Planning Area does not overlap WA parks, forests or reserves. Activities have the potential to impact marine tourism in the Planning Area.	Yes
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Responsible for implementing Commonwealth policies and programs to support climate change, sustainable energy use, water resources, the environment and our heritage. Administers the *Underwater Cultural Heritage Act 2018* in collaboration with the States, Northern Territory and Norfolk Island, which is responsible for the protection of shipwrecks, sunken aircraft and other types of underwater heritage and their associated artefacts in Commonwealth waters.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). DCCEEW's (formerly DAWE) functions may be relevant to the proposed activities in the Planning Area as there are potential environmental impacts from the proposed activity. There are known Maritime Cultural Heritage features overlapping the Planning Area.	Yes

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Director of National Parks (DNP)	Responsible for the management of Commonwealth parks and conservation zones.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). DNP's functions may be relevant to the activity as DNP requires an awareness of activities that occur within AMPs, and an understanding of potential impacts and risks to the values of parks (NOPSEMA guidance note: N-04750-GN1785 A620236, June 2020). Titleholders are required to consult DNP on offshore petroleum and greenhouse gas exploration activities if they occur in, or may impact on the values of marine parks, including where potential spill response activities may occur in the event of a spill (i.e. scientific monitoring).	Yes
Department of Defence - Defence Estate and Infrastructure Group	Manage the development, maintenance and disposal of the Defence estate, including unexploded ordinance (UXO).	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). DoD's functions may be relevant to the activity as potential UXO may exist within the Planning Area.	Yes
Department of Industry, Science and Resources (DISR) (formerly DISER)	Department of relevant Commonwealth Minister.	Required to be consulted under OPGGS (E) Regulation 25(1)(a).	Yes
Department of Mines, Industry Regulation and Safety (DMIRS)	Department of relevant State Minister	Required to be consulted under OPGGS (E) Regulation 25(1)(b).	Yes
Indigenous Land and Sea Corporation	Statutory authority providing assistance for acquiring and managing rights and interests in land, salt water and freshwater country.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). Indigenous Land and Sea Corporation's functions may be relevant to the activity as the Planning Area is adjacent to a number of coastal Native Title areas.	Yes
National Offshore Petroleum Safety Environment Management Authority (NOPSEMA)	Regulator for health and safety, structural (well) integrity and environmental management for all offshore oil and gas operations and greenhouse gas storage activities in Commonwealth waters, and in coastal waters where regulatory powers and functions have been conferred.	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). NOPSEMA's functions are relevant to the activity as they are the regulator for the offshore oil and gas industry.	Yes
National Native Title Tribunal (NNTT)	Commonwealth government authority responsible for administering the *Native Title Act 1993* (Cth) across multiple functions including reviews, mediations, and determinations for Native title applications, and Indigenous land use agreements (ILUAs)	CGG has applied its methodology for 'Government departments / agencies' under OPGGS (E) Regulation 25(1)(a). NNTT's functions may be relevant to the activity as the Planning Area is adjacent to a number of coastal Native Title areas.	Yes
Commonwealth Commercial fisheries and representative bodies			
North West Slope and Trawl Fishery	Commonwealth commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery overlaps the Planning Area and has been active in the Planning Area within the last 5 years.	Yes
Southern Bluefin Tuna Fishery	Commonwealth commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). Although the fishery overlaps the Planning Area it has not been active in the Planning Area within the last 5 years. CGG does not consider that the proposed activity will present a risk to licence holders given the majority of Australian catch has been concentrated in south-eastern Australia since 1992 (Patterson et al., 2022). Effort is concentrated in the Great Australian Bight and no catch or effort from the SBTF occurred in WA in the last 5 years. See Section 4.3.4.1.	No
Western Skipjack Fishery	Commonwealth commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). Although the fishery overlaps the Activity Area and Planning Area, it has not been active in the Planning Area within the last 5 years. CGG does not consider that the activity will present a risk to licence holders, given the fishery spans the Australian Fishing Zone west of Victoria and the Torres Strait. The fishery is not currently active and no fishing has occurred since 2009 (Patterson et al., 2022). In addition, interactions are not expected given the species' pelagic distribution fishing methods for species fished by licence holders.	No

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Western Tuna and Billfish Fishery	Commonwealth commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). Although the fishery overlaps the Activity Area and Planning Area, it has not been active in the Activity Area or Planning Area within the last 5 years. CGG does not consider that the activity will present a risk to licence holders, given fishing methods for species fished by licence holders. Future interactions are not expected given the species' pelagic distribution.	No
Commonwealth Fisheries Association (CFA)	Represents the interests of commercial fishers with licences in Commonwealth waters	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). CFA's functions may be relevant to the activity as the North West Slope and Trawl Fishery is active in the Planning Area.	Yes
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Represents the interests of the Southern Bluefin Tuna Fishery and Western Skipjack Fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The Southern Bluefin Tuna Fishery has been assessed as not relevant to the proposed activity. As the peak representative body for the Southern Bluefin Tuna Fishery, the ASBTIA has also been assessed as not relevant, as requested by ASBTIA once provided information regarding the activity. CGG has provided information to the ASBTIA at its discretion in line with Section 5.3.6 on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted, which can be through the relevant fishing industry associations.	No
Tuna Australia	Represents the interests of the Western Tuna and Billfish Fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The Western Tuna and Billfish Fishery has been assessed as not relevant to the proposed activity. As the peak representative body for the Western Tuna and Billfish Fishery, Tuna Australia has also been assessed as not relevant. CGG has provided information to Tuna Australia at its discretion in line with Section 5.3.6 on AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted, which can be through the relevant fishing industry associations.	No
Pearl Producers Association (PPA)	Peak representative organisation of The Australian South Sea Pearling Industry, with members in Western Australia and the Northern Territory	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The Pearl Oyster Managed Fishery has been assessed as relevant to the proposed activity as the management area for the fishery does overlap the Planning Area. As the peak representative body for the Pearl Oyster Managed Fishery, the PPA has also been assessed as relevant.	Yes
State Commercial fisheries and representative bodies			
Pilbara Fish Trawl (Interim) Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery is active within the Activity and Planning Areas.	Yes
Pilbara Trap Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery is active within the Activity and Planning Areas.	Yes
Pilbara Line Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery overlaps the Activity Area but has not been active in the Activity Area in the last 5 years. The fishery has been active within the Planning Area within the last 5 years.	Yes
Northern Demersal Scalefish Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery is active within the Activity and Planning Areas.	Yes
Mackerel Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). The fishery is active within the Activity and Planning Areas, although there is very limited fishing effort in the Activity Area and the survey will occur outside of the peak fishing period.	Yes
Sea Cucumber Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery management area overlaps the Activity Area. However, since the fishery is shore-based in waters < 5 m deep the proposed survey is not expected to overlap with the actual activities of this fishery.	No
Marine Aquarium Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery overlaps the Activity Area, but the fishery has not been active within the Activity Area or Planning Area in the last 5 years and the proposed survey is not expected to overlap with the actual activities of this fishery.	No
Specimen Shell Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery overlaps the Activity Area, but the fishery has not been active within the Activity Area or Planning Area in the last 5 years and the proposed survey is not expected to overlap with the actual activities of this fishery.	No

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Nickol Bay Prawn Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery overlaps the Activity Area, but the fishery has not been active within the Activity Area or Planning Area in the last 5 years and the proposed survey is not expected to overlap with the actual activities of this fishery.	No
Northern Shark Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery partially overlaps the Activity Area, however the fishery has not been active since 2008. Therefore, the proposed survey is not expected to impact the activities of this fishery.	No
Pearl Oyster Managed Fishery	State commercial fishery	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). This fishery partially overlaps the Activity Area and has been active within the Planning Area in the last 5 years.	Yes
Western Australian Fishing Industry Council (WAFIC)	Represents the interests of commercial fishers with licences in State waters.	CGG has applied its methodology for 'Commercial fisheries (Commonwealth and State) and peak representative bodies' under OPGGS (E) Regulation 25(1)(d). WAFIC's functions may be relevant to the activity as the peak representative body for State fisheries.	Yes
Recreational marine users and representative bodies			
Local recreational marine users	Dive, tourism and charter operators	CGG has applied its methodology for 'Recreational marine users and representative bodies' under OPGGS (E) Regulation 25(1)(d). Local recreational marine users utilize areas overlapping the Planning Area including Eighty-mile Beach and the Rowley Shoals. Activities have the potential to impact the dive, tourism and charter operator's' functions, interests or activities due to the location of activities and there has been recorded charter effort in the Planning Area in the past 5 years.	Yes
Recfishwest		CGG has applied its methodology for 'Recreational marine users and representative bodies' under OPGGS (E) Regulation 25(1)(d). Activities have the potential to impact recreational fishers' functions, interests or activities due to the location offshore and there has been recorded charter effort in the Planning Area in the past 5 years.	Yes
Marine Tourism WA	Represents the interests of marine tourism in WA.	CGG has applied its methodology for 'Recreational marine users and representative bodies' under OPGGS (E) Regulation 25(1)(d). Activities have the potential to impact recreational fishers' functions, interests or activities due to the location offshore and there has been recorded charter effort in the Planning Area in the past 5 years.	Yes
WA Game Fishing Association	Represents the interests of game fishers in WA.	CGG has applied its methodology for 'Recreational marine users and representative bodies' under OPGGS (E) Regulation 25(1)(d). Activities have the potential to impact game fishers' functions, interests or activities due to the location offshore and there has been recorded charter effort in the Planning Area in the past 5 years.	Yes
Kimberly Marine Tourism Association	Represents the interests of marine tourism in the Kimberley.	CGG has applied its methodology for 'Recreational marine users and representative bodies' under OPGGS (E) Regulation 25(1)(d). Activities have the potential to impact tourism operators functions, interests or activities due to the location offshore and there has been recorded charter effort in the Planning Area in the past 5 years.	Yes
Titleholders and Operators			
3D Oil Limited	Titleholder or Operator	CGG has applied its methodology for 'Titleholders and Operators' under OPGGS (E) Regulation 25(1)(d). Titleholder or Operator's permit areas overlap the Planning Area.	Yes
INPEX Browse E&P Pty Ltd	Titleholder or Operator	CGG has applied its methodology for 'Titleholders and Operators' under OPGGS (E) Regulation 25(1)(d). Titleholder or Operator's permit areas overlap the Planning Area.	Yes
Santos WA Northwest Pty Ltd	Titleholder or Operator	CGG has applied its methodology for 'Titleholders and Operators' under OPGGS (E) Regulation 25(1)(d). Titleholder or Operator's permit areas overlap the Planning Area.	Yes
Shell Australia	Titleholder or Operator	CGG has applied its methodology for 'Titleholders and Operators' under OPGGS (E) Regulation 25(1)(d). Titleholder or Operator's permit areas overlap the Planning Area.	
Pathfinder Energy Pty Ltd	Titleholder or Operator	CGG has applied its methodology for 'Titleholders and Operators' under OPGGS (E) Regulation 25(1)(d). Titleholder or Operator's permit areas overlap the Planning Area.	Yes
Peak Industry Representative bodies			
AEP (formerly APPEA)	Represents the interests of oil and gas explorers and producers in Australia.	CGG has applied its methodology for 'Peak Industry Representative bodies' under OPGGS (E) Regulation 25(1)(d). APPEA's responsibilities are identified as having an intersect with CGG's planned activities in the Planning Area.	Yes
Traditional Custodians and nominated representative corporations			

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Gogolanyngor Aboriginal Corporation (GAC)	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The GAC is a Registered Native Title Body Corporates (RNTBC) for the Bindanbur and Jabirr Jabirr/Ngumbarl Bindunbur native title claims, which do not overlap the Planning Area but are coastally adjacent to it.	Yes
Karajarri Traditional Lands Association (Aboriginal Corporation) (KTLA)	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Karajarri native title claims do not overlap the Planning Area. The claims are coastally adjacent to the Planning Area, which the KTLA is the RNTBC for.	Yes
Kariyarra Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Kariyarra native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which the Kariyarra Aboriginal Corporation is the RNTBC for.	Yes
Kunin Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Rubibi Community native title claim does not overlap the Planning Area. The claim is adjacent to the Planning Area, which the Kunin Aboriginal Corporation is the RNTBC for. Although the claim does not contain any coastline, it lies <200 meters from the coast.	Yes
Ngarluma Aboriginal Corporation (NAC)	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Ngarluma/Yindjibarndi native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which NAC and the Yindjibarndi Aboriginal Corporation are the Registered Native Title Body Corporates for.	Yes
Nimanburr Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Bindunbur native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which the Nimanburr Aboriginal Corporation and the GAC are the RNTBC for.	Yes
Nyangumarta Karajarri Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Nyangumarta-Karajarri native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which the Nyangumarta Karajarri Aboriginal Corporation is the RNTBC for.	Yes
Nyangumarta Warrarn Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Nyangumarta native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which the Nyangumarta Warrarn Aboriginal Corporation is the RNTBC for.	Yes
Nyul Nyul PBC Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Nyangumarta native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which the Nyangumarta Warrarn Aboriginal Corporation is the RNTBC for.	Yes
Wanparta Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Ngarla native title claims do not overlap the Planning Area. The claims are coastally adjacent to the Planning Area, which the Wanparta Aboriginal Corporation is the Registered Native Title Body Corporate for.	Yes
Yawuru Native Title Holders Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Rubibi Community native title claim does not overlap the Planning Area. The claim is adjacent to the Planning Area, which the Yawuru Native Title Holders Aboriginal Corporation is the RNTBC for. Note that this is a separate area to the Rubibi Community native title claim for which the Kunin Aboriginal Corporation is the RNTBC for.	Yes
Yindjibarndi Aboriginal Corporation	Representative Aboriginal Corporation	CGG has applied its methodology for 'Traditional Custodians and Nominated Representative Corporations' under OPGGS (E) Regulation 25(1)(d). The Ngarluma/Yindjibarndi native title claim does not overlap the Planning Area. The claim is coastally adjacent to the Planning Area, which NAC and the Yindjibarndi Aboriginal Corporation are the Registered Native Title Body Corporates for.	Yes
Native Title Representative Bodies			
Kimberley Land Council (KLC)	Native Title Representative Body	CGG has applied its methodology for 'Native Title Representative Bodies' under OPGGS (E) Regulation 25(1)(d). KLC is the Native Title Representative Body for the Kimberley region of Western Australia. As such, they are not a Prescribed or Registered Native Title Body Corporate but exist to assist native title claimants and holders.	Yes
Yamatji Marlpa Aboriginal Corporation (YMAC)	Native Title Representative Body	CGG has applied its methodology for 'Native Title Representative Bodies' under OPGGS (E) Regulation 25(1)(d). YMAC is the Native Title Representative Body for the Yamatji and Pilbara regions of Western Australia. As such, they are not a Prescribed or Registered Native Title Body Corporate but exist to assist native title claimants and holders.	Yes

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Historical cultural heritage groups or organisations			
Western Australian Museum	Manages 200 shipwreck sites of the 1,500 known to be located off the Western Australian coast.	CGG has applied its methodology for 'Historical cultural heritage groups or organisations' under OPGGS (E) Regulation 25(1)(d). There are no known shipwrecks overlapping the Planning Area which the Western Australian Museum may be responsible for. In the event that a shipwreck or other artefact is discovered, CGG will notify the relevant authority as per the notifications outlined in Section 9.	No
Other non-government groups or organisations			
Conservation Council of WA (CCWA)	Non-government organisation	CGG has applied its methodology for 'Other non-government groups or organisations' under OPGGS (E) Regulation 25(1)(d). CGG has assessed that CCWA's public website material and feedback demonstrates an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes
The Wilderness Society	Non-government organisation	CGG has applied its methodology for 'Additional persons' and 'Other non-government groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine The Wilderness Society's relevance for the proposed activity. CGG has assessed The Wilderness Society's public website material and feedback, with the latter demonstrating an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes
World Wildlife Fund for Nature (WWF)	Non-government organisation	CGG has applied its methodology for 'Additional persons' and 'Other non-government groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine WWF's relevance for the proposed activity. CGG has assessed that WWF's public website material does not demonstrate an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation. CGG chose to contact WWF at its discretion in line with Section 5.1.2.	No
Save Our Songlines	Non-government organisation	CGG has applied its methodology for 'Additional persons' and 'Other non-government groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine Save Our Songlines' relevance for the proposed activity. CGG has assessed The Save Our Songlines group's public website material and feedback to other, similar activities in the region, with the latter demonstrating an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes
Research institutes and local conservation groups or organisations			
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Research institute	CGG has applied its methodology for 'Research institutes and local conservation groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine CSIRO's relevance for the proposed activity. There is no known research being undertaken by CSIRO that intersects within the Planning Area. CGG chose to contact CSIRO at its discretion in line with Section 5.1.2.	Yes
Australian Institute of Marine Science (AIMS)	Research institute	CGG has applied its methodology for 'Research institutes and local conservation groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine AIMS's relevance for the proposed activity. There is no known research being undertaken by AIMS that intersects within the Planning Area. CGG chose to contact AIMS at its discretion in line with Section 5.1.2.	Yes
University of Western Australia (UWA)	Research institute	CGG has applied its methodology for 'Research institutes and local conservation groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine UWA's relevance for the proposed activity. There is no known research being undertaken by the UWA that intersects within the Planning Area. CGG chose to contact UWA at its discretion in line with Section 5.1.2.	Yes
Western Australian Marine Science Institution (WAMSI)	Research institute	CGG has applied its methodology for 'Research institutes and local conservation groups or organisations' under OPGGS (E) Regulation 25(1)(d) to determine WAMSI's relevance for the proposed activity. There is no known research being undertaken by WAMSI that intersects within the Planning Area. CGG chose to contact WAMSI at its discretion in line with Section 5.1.2.	Yes
Care For Hedland Environmental Association	Non-government organisation	During the course of preparing the 2024 EP, Care for Hedland Environmental Association self-identified, provided comment on the Sauropod 3D MSS EP and requested to be included in ongoing consultation for the EP. CGG has assessed that Care For Hedland Environmental Association's public website material and feedback demonstrates an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes

Person or Organisation	Summary of responsibilities and/or functions, interests or activities	Assessment of relevance	Relevant person
Environs Kimberley	Non-government organisation	During the course of preparing the 2024 EP, Environs Kimberley self-identified, provided comment on the Sauropod 3D MSS EP and requested to be included in ongoing consultation for the EP. CGG has assessed that Environs Kimberley's public website material and feedback demonstrates an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes
Other			
Individuals of local communities	Members of the public with interest in the activity	During the course of preparing previous versions of the EP, a number of individual members of the public self-identified, provided comment on the EP and asked to be included in ongoing consultation. CGG has applied its methodology for 'Additional persons' under OPGGS (E) Regulation 25(1)(d). CGG has assessed that individual's feedback demonstrates an interest with the potential risks and impacts associated with planned activities in accordance with the intended outcome of consultation.	Yes

5.2.1.1 First Nations people relevant to this EP

The land and Sea Country adjacent to the Planning Area of activities set out in this EP are the traditional lands of multiple groups of First Nations peoples. The coastline adjacent to the Planning Area includes the Port Hedland area, Eighty Mile Beach and the Broome/Dampier Peninsula area.

The recognised representative Registered Native Title Prescribed Body Corporates (RNTPBCs or PBCs) of the part of Dampier Peninsula adjacent to the EMBA are the Nyul Nyul, Nimanburr and Gogolanyngor (Marshall 2020). The Nyul Nyul, Nimanburr and Jabirr Jabirr/Ngumbarl people were granted native title in mid-2018 over an area of approximately 12,000 square kilometres on the Middle Dampier Peninsula in Western Australia's Kimberley region (NNTT 2023a, 2023b & 2023c). The land and Sea Country of the Nyul Nyul, Nimanburr and Jabirr Jabirr/Ngumbarl native title areas lie adjacent to the Planning Area of activities set out in this EP.

The Yawuru people are the traditional owners of the lands and waters in and around Rubibi (the town of Broome) from Bangarangara to the yalimban (south) to Wirrjinmirr (Willie Creek) to the guniyan (north), and banu (east) covering Roebuck Plains and Thangoo pastoral leases, in the Kimberley region of northern Western Australia (Nyamba Buru Yawuru 2020, NNTT 2023d).

Native title determinations for the lands and waters in and adjacent to Eighty Mile Beach have been made for the Karajarri, Nyangumarta and Ngarla people (NNTT 2023e, 2023f, 2023g, 2023h, 2023i). 'The Dreaming' is a key concept in connecting Aboriginal people and their environment. Stories, songlines and sites are embedded within the Eighty Mile Beach and Cape Keraudren areas and remain a powerful spiritual force for the Karajarri, Nyangumarta and Ngarla people (DPW 2014). The PBCs responsible for managing the Native Title Determinations along Eighty Mile Beach are the Nyangumarta Warrarn Aboriginal Corporation, Nyangumarta Karajarri Aboriginal Corporation, Karajarri Traditional Lands Association and the Wanparta Aboriginal Corporation.

The Kariyarra, Ngarla, and Njamal people are recognised as the Traditional Custodians of the Port Hedland area (Town of Port Hedland 2023). The Ngarla and Kariyarra people have been granted Native Title areas that include areas of coastline and Sea Country (NNTT 2023i, 2023j). The PBCs responsible for managing these Native Title areas are the Wanparta Aboriginal Corporation and Kariyarra Aboriginal Corporation, respectively.

CGG has consulted with each of these Aboriginal Corporations to understand their particular values and sensitivities of sea country. Any information provided is included in the Sensitive Information appendix of this EP.

The RATSIBs identified for the land and Sea Country adjacent to the Planning Area for this project are the Kimberley Land Council (KLC) and the Yamatji Marlpa Aboriginal Corporation (YMAC).

During consultation with each of the relevant persons identified above, CGG asked the representative bodies and the Native Title Representative Bodies if they were aware of any other relevant parties who may be affected by the survey, were aware of any people, who in accordance with Indigenous tradition, may have spiritual and cultural connections to the environment that may be affected by the activity that have not yet been afforded the opportunity to provide information that may inform the management of the activity and if they had any information they wished to provide on cultural features and/or heritage values within the activity area. This question was posed to all relevant persons consulted in the June 2025 round of letters, via the project activity website (which was advertised to the public via social media as described in Section 5.2.2), and through email correspondence.

During the 2023 round of consultation, The Karajarri Traditional Lands Association advised that CGG should also consult with the persons from the Nyangumata-YMAC group. CGG already considered the two Nyangumata groups and YMAC as relevant persons for this activity.

CGG enabled individuals to self-identify as a relevant person for the purposes of consultation for this EP in response to broad capture consultation activities including social media and newspaper advertisements as described in Section 5.2.2.

5.2.1.2 Commercial fisheries and fishers relevant to this EP

Section 4.4.4 presents a review of Commonwealth and WA state managed commercial fisheries with the licence to operate within the Operational Area and/or EMBA. Table 4-11 presents those fisheries that have historical effort that overlaps the Operational Area and/or EMBA and concludes which fishers are therefore relevant to this EP. Table 5-9 above demonstrates the results of the approach to identifying commercial fisheries as relevant persons for the purposes of consultation under regulation 25, following the method described in Section 5.1.2.4.2.2.

5.2.2 Provision of information and sufficient time

The OPGGS(E) Regulations require titleholders to give each relevant person sufficient information to allow the relevant person to make an informed assessment of potential effects on their functions, interests or activities from the activities in the EP. Provision of information is responsive and adaptive to the individual needs and circumstances of the relevant persons seeking the information.

CGG has undertaken reasonable efforts to provide relevant persons with sufficient information to assess the potential impacts of the survey on their functions, interests and activities. This has included:

- CGG established a dedicated survey website to promote awareness of the survey, provide background information and provide details for concerned parties to make contact.
- CGG provided information on the survey via social media and local public advertisements.
- An initial formal relevant person consultation letter containing background information on the proposed survey, the consultation process and contact details for relevant persons to communicate any issues or concerns or to receive further information, was provided to both representative bodies for dissemination and individual relevant persons as they were identified (Appendix C).
- As relevant person objections and claims were identified, a second formal relevant person consultation letter was distributed (Appendix C). The second information package covered information on the outcomes of the impact assessment, noise modelling and a summary of the control measures adopted by CGG to reduce potential impacts.
- Information in the second relevant person consultation letter was tailored to the particular relevant person group they were sent to. Information was tailored for each relevant person category and the associated environmental values and sensitivities and activity impacts or risks as outlined in Tables 5-4 and 5-5.
- If relevant persons requested further information that was not covered in the formal relevant person consultation letters, it was provided to them.
- Relevant persons were responded to individually, and responses were tailored to the functions, interests and activities of the relevant person.
- CGG used a variety of means to contact relevant persons on multiple occasions to confirm they had received information that had been sent out and to prompt or encourage direct feedback on their objections and concerns.

Key approaches to providing sufficient information are set out in Section 5-9. Information which is provided to relevant persons for the purposes of consultation on this EP is detailed in Appendix C.

CGG has employed a diverse range of techniques throughout each of the consultation periods from 2021 to 2025 to allow relevant persons to become aware of the proposed activity and how it may affect their functions activities or interests, and understand their ability to provide feedback. The combination of meetings, traditional print media, social media and face-to face information sessions was adapted to the audience, so that it provides a wide-ranging opportunity to consult.

Initial relevant person consultation consisted of an information sheet and map of the Operational and Acquisition Areas (refer to the Sensitive Matters Report) distributed by email and post to relevant persons on 28th May 2021. The information presented in the information sheet was a general overview of the survey including location, extent, survey design and environmental setting. Proposed changes to the activity description, including source array and activity timing, were detailed. The proposed management measures, many of which were agreed through previous consultation with relevant persons, were also included where possible. A specific fisheries factsheet was sent to relevant persons with commercial fishery interests. Relevant persons were provided with a dedicated email address and phone number for the project to respond to the consultation documents.

The dedicated email address also aided in the tracking and recording of relevant person and titleholder communication. Some relevant persons were contacted directly regarding information specific to the proposed activity that may potentially impact on the relevant person. Follow-up emails were completed as required following the distribution of the consultation information on 5th July 2021 to relevant persons that had not yet responded to consultation.

Following the decision to delay commencement of the MSS and revise the accepted EP, the relevant person consultation process described above was repeated with an information sheet and map of the Operational and Acquisition Areas distributed by email and post to relevant persons on 20th June 2022. Information presented in the information sheet included details of the revision along with a general overview of the proposed survey. The dedicated email address used during development of the accepted EP also aided in the tracking and recording of relevant person and titleholder communication. Follow-up emails were completed as required on the 22nd July 2022 to those relevant persons who had not responded to the initial contact.

A decision was made to delay commencement of the MSS and revise the accepted EP. The relevant person consultation process described above was repeated again with an information sheet and map of the Operational and Acquisition Areas

distributed by email and post to relevant persons on 2nd June 2023 (letter E010). Information presented in the information sheet included details of the revision along with a general overview of the proposed survey. Relevant persons were requested to inform CGG if they had any requirements in how information would be provided to them during the course of consultation for this EP. A dedicated email address was used once again to aid in the tracking and recording of relevant person and titleholder communication. Follow-up calls and emails were completed as required to those relevant persons who had not responded to the initial contact.

Following initial contact, CGG travelled to Port Hedland and Broome in June of 2023. This trip was advertised to relevant persons through notification letters, phone calls, boat ramp posters, emails and targeted social media campaigns (please see the Sensitive Information Report for these documents). During this trip CGG visited relevant person businesses to allow the opportunity to discuss the proposed survey.

CGG hosted community information sessions at public venues in both Port Hedland (20 June 2023) and Broome (22 June 2023). CGG created social media posts, which advertised and described each of the Community Consultation Sessions that CGG organized in Port Hedland and Broome. From 16 June 2023, CGG commenced a geotargeted sponsored social media campaign (Appendix C), which targeted areas that are within or coastally adjacent to the EMBA for the proposed activities. The campaign brought the proposed activity to the attention of persons who may be interested and advised persons or organisations on how they can find out about CGG's proposed activities by visiting CGG's website. The reach of this campaign is shown in Appendix C, providing the opportunity to consult via a reach to 948 persons across various regions.

Once CGG had received feedback as to how relevant persons wished to be consulted, a follow up project letter was sent to relevant persons in August of 2023. Information in the second relevant person consultation letter was tailored to the relevant person group they were sent to (letters E011-E016).

CGG travelled to Broome in August of 2023 for two weeks to allow more flexibility in meeting times for relevant persons so that the provided information, and any other objections or claims, could be discussed. This trip was advertised to relevant persons through notification letters, phone calls, emails and geo-targeted social media campaigns with a reach to 1,690 persons. During this trip CGG visited relevant person businesses to allow the opportunity to discuss the proposed survey, to confirm that the relevant persons were receiving the project information, and asking if the relevant persons wished to receive the information in any other way, or know of anyone else that CGG should be speaking to about the project.

A decision was made to delay commencement of the MSS and revise the accepted EP. The relevant person consultation process described above was repeated again with an information sheet and map of the Operational and Acquisition Areas distributed by email and post to relevant persons on 24th June 2025 (letters E019 – E021). Information presented in the information sheet included details of the revision along with a general overview of the proposed survey. Relevant persons were requested to inform CGG if they had any requirements in how information would be provided to them during the course of consultation for this EP. A dedicated email address was used once again to aid in the tracking and recording of relevant person and titleholder communication. Follow-up calls and emails were completed as required to those relevant persons who had not responded to the initial contact.

CGG created social media posts and published newspaper advertisements to announce the commencement of public consultation (Appendix C). The campaign brought the proposed activity to the attention of persons who may be interested and advised persons or organisations on how they can find out about CGG's proposed activities by visiting CGG's website.

Once CGG had received feedback as to how relevant persons wished to be consulted, a follow up project letter was sent to relevant persons in August of 2025. Information in the second relevant person consultation letter was tailored to the relevant person group they were sent to (letters E022-E024).

5.2.3 Merit assessment

CGG considered relevant person responses and assessed the merits and relevance of objections and claims about the potential adverse impact of the proposed activity set out in the EP, in accordance with the intended outcome of consultation (see Section 5).

The merit assessment undertaken for this EP is found in Appendix C. A summary of the key issues and concerns raised by relevant persons during consultation, including an assessment of the merits of objections and claims are provided in Appendix C. Full copies of the consultation records are included in the Sensitive Matters Report. Table 5-10 provides a summary of consultation undertaken for this EP that resulted in CGG adopting additional control measures.

Copies of the full text of any response by all relevant persons have been provided to NOPSEMA as a Sensitive Information Report under Regulation 26 of the OPGGS(E).

5.2.4 Measures implemented in response to consultation

CGG has undertaken an assessment of the merit of any objections or claims by relevant persons. Where concerns, objections or claims have been raised by relevant persons, these have been addressed in the assessment of environmental impacts and risks (Section 7 and Section 8). Where relevant persons have provided additional information on the existing environment relevant to the EP, these have been added to the relevant sections of the existing environment description in Section 4. Relevant persons have been informed about how the issues have been assessed and any relevant controls that will be adopted to reduce the potential impacts and risks to ALARP and acceptable levels. A summary of consultation with relevant persons during the 2025 consultation period that has led to changes to the EP, including CGG adoption of additional controls, is provided in Table 5-10. Changes to the EP resulting from previous rounds of consultation can be found in Table 5-10 of the previously accepted version of the EP (CGG 2024).

Table 5-10 Summary of Consultation with relevant persons during the 2025 consultation period resulting in changes to the EP.

Commonwealth and WA State Government Departments or Agencies		
Australian Maritime Safety Authority (AMSA)		
CGG considers it has discharged its obligations under OPGGS (E) Regulation 25 by providing consultation materials and conducting various forms of engagement as set out in **Section 5.2** and below. **Summary of information provided and record of consultation:** • On 2 June 2023, CGG emailed AMSA with an update on the proposed activity (Appendix C) and provided an updated Consultation Information Sheet. • On 24 June 2025, CGG emailed AMSA with an update on the proposed activity (Appendix C) and provided an updated Consultation Information Sheet. • On 3 July 2025, AMSA thanked CGG for its consultation regarding the Sauropod 3D MSS project in WA-527-P off the Kimberley coast and provided a vessel traffic plot for the area, noting the presence of heavy and local vessel traffic. AMSA explained a number of notification requirements that they requested CGG follow including to the JRCC and the AHO. AMSA reminded CGG of its obligations under COLREGs, including proper use of lights, shapes, and AIS settings. Additionally, AMSA advised CGG to evaluate and implement collision avoidance measures and referred them to AMSA's spatial data portals for further traffic data and customised information requests. • On 3 July 2025, CGG acknowledged AMSA's feedback and expressed appreciation for the information provided. CGG confirmed that the required information would be submitted within the requested timeframes. They also offered to provide further details or answer any questions if needed.		
Summary of Feedback, Objection or Claim	***CGG's Assessment of Merits of Feedback, Objection or Claim and its response***	***Environment Plan Changes***
Request by AMSA for standard notifications to AHO no less than four weeks before operations with details relevant to operations, and the JRCC 24-28 hours before operations commence, and for the duration of the project.	CGG has assessed this feedback as valid. CGG will adopt all of the proposed controls requested by AMSA.	The requested controls for notifications and updates will be included in the EP, that the survey vessels will use the appropriate lights and shapes and that a vessel traffic plot showing Automatic Identification System data will be used for EP planning. Minor revisions were made to the Notifications & Reporting section of the EP (Section 9.12) to reflect the most up to date notification requirements and contact details as per the information provided by AMSA.
Commonwealth Commercial fisheries and representative bodies		
None		
State Commercial fisheries and representative bodies		
None		
Recreational marine users and representative bodies		
None		
Titleholders and Operators		
None		
Peak Industry Representative bodies		
None		
Traditional Custodians and nominated representative corporations		
None		
Historical cultural heritage groups or organisations		
None		
Other non-government groups or organisations		
None		
Research institutes and local conservation groups or organisations		
None		
Other		
None		

6 Environmental Risk Assessment Methodology

6.1 Introduction

Regulations 21(5) and 21(6) of the OPGGS(E) Regulations require CGG to identify, analyse and evaluate the risks and potential environmental impacts associated with the Sauropod 3D MSS.

CGG's impact and risk management process is based on the principles, framework and processes defined by the International Standards Organization (ISO) 31000:2009 Risk Management – Principles and Guidelines (Figure 6-1). The following sections describe the steps in the risk management process, including the legislative framework, approach taken to identify and evaluate potential impacts associated with the activity and risk treatment (control) measures that will be adopted to reduce the impacts and risks to as low as reasonably practical (ALARP) and to an acceptable level.

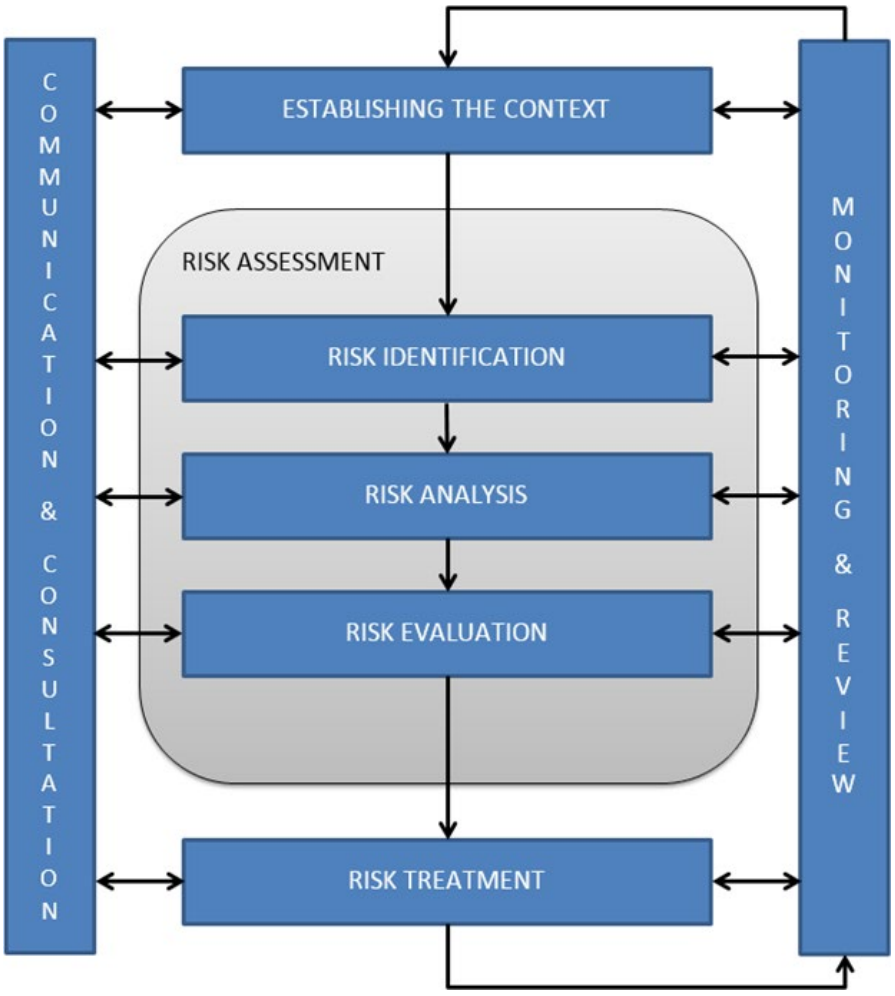


Figure 6-1 – AS/NZS ISO 31000 – Risk Management Methodology

6.2 Communication and consultation

Communication and consultation with internal and external stakeholders take place during all stages of the risk management process. The ISO 31000:2009 standard requires effective stakeholder communication and consultation in order to ensure that those accountable for implementing the risk management process (namely, CGG and any appointed contractors), and relevant persons understand the basis on which decisions are made, and the reasons why particular actions are required. This is also consistent with NOPSEMA's guidance.

The OPGGS Act and OPGGS(E) Regulations are guiding principles that underpin the process of external relevant person communication and consultation in the development of EPs. NOPSEMA's guideline "Consultation in the course of preparing an environment plan" (N-04750-GL2086) outlines how the regulations relate to EPs and its recommendations have been followed herein.

CGG is committed to consulting with relevant persons who may be affected by the activity, to identify and understand any concerns and issues, to mitigate impacts and risks highlighted in meritorious submissions and to openly communicate the process with the relevant persons. Input from relevant persons will help to inform the preparations for and execution of the Sauropod 3D MSS as appropriate. The process of relevant person engagement is described in Section 5.

6.3 Establishing the context

The purpose of establishing the context in the risk management process is to define the external and internal parameters to be considered when managing risk and to define the risk criteria. This requires assessment of the external and internal environments in which CGG seeks to achieve its objectives.

The external context comprises the description of the activity (Section 3), the physical, biological and socio-economic environments (Section 4) and associated potential environmental impacts and risks specific to the nature and scale of the activity (Sections 7 and 8), the legislative framework, applicable management plans, standards and guidance (Section 0) and the perceptions and values of external relevant persons (Section 5).

The internal context relates to CGG's culture, processes, structure and strategy, and includes anything within the organisation that can influence the way in which environmental risk is managed. CGG's commitment to minimising environmental harm and to operating and maintaining a safe and healthy work environment for its employees, contractors and project partners is reflected in its corporate HSE Policy (Appendix A) and HSE management framework (Section 9).

6.4 Impact and risk assessment

The environmental impact and risk assessment process uses a systematic, evidence-based approach to evaluate and interpret the impacts and risks associated with its activity and the potential for harm to physical, biological, human and cultural receptors. The environmental impacts and risks associated with the Sauropod 3D MSS have been assessed using the following steps:

- Definition of the activity (Section 3) and identification of associated aspects and hazards with potential for environmental harm (i.e. physical, chemical or biological entity or incident which induces an adverse response or impact e.g. operation of airguns)
- Identification of the environmental values within the area that may be affected by the activity, i.e. the environmental context of the activity (Section 4), including intangible cultural heritage and totemic species, as described in 4.4.8.6.
- Identification of aspects of the activity with potential for environmental harm (e.g. underwater noise, light, seabed disturbance) in the context of its nature and scale and location (Section 7)
- Definition of acceptable levels for each impact and risk (Section 7 and 8)
- Identification of impacts from routine aspects and risks from unplanned/accidental events, and the inherent impact or risk (Sections 7 and 8)
- Identification of the 'decision context' and 'assessment technique' relevant to the impact or risk (Section 6.7.1)
- Identification of control measures to be implemented for each aspect in order to reduce the impacts and risks to ALARP (Section 6.7.2)
- Determination of the residual risk of each environmental impact and risk with identified control measures adopted (Section 6.9)
- Determination of whether the residual risk is acceptable
- In the event that an impact or risk is not considered acceptable, further practical control measures are considered and adopted until the impacts and risk are considered ALARP and acceptable (Section 6.8).

6.4.1 First Nations cultural features and heritage values

As described in Section 4.4.8 and summarised in Table 4-18 the marine environment affected by Sauropod MSS activities may include cultural features and heritage values of importance to First Nations peoples. As such, potential impacts and risks to these features and values associated with MSS activities must be managed to ALARP and acceptable levels. CGG has undertaken a robust process to identify and describe First Nations cultural features and heritage values using the best available information; a combination of literature review and relevant persons consultation. Although there remains some uncertainty as to the spatial extent and nature of First Nations cultural features and heritage values, the majority of those features and values that were identified are located in nearshore environments, beyond the extent of the EMBA, e.g. seagrass, reefs and dugongs. In addition, a robust process has been applied to ensure that all reasonably practicable control measures have been adopted to manage potential impacts and risks from planned/unplanned events to ALARP and acceptable levels for all identified values and sensitivities of the marine environment, including those that hold cultural importance. For those fauna groups that may be affected by the planned MSS activity that hold known totemic value or other cultural significance such as marine mammals, turtles and fish it was considered that the adopted control measures will be effective in ensuring that biologically important behaviour that may be of cultural importance can continue.

6.5 Hazards, impact and risk identification

Information used in identifying the impact and risks associated with the activity has been obtained from the following sources:

- CGG's description of the location, timing of survey and activities to be undertaken in acquiring seismic data (e.g. airgun discharges, sail lines)
- An understanding of general vessel activities/operations during seismic surveys and the potential threats and hazards to relevant persons and the marine environment and where appropriate, terrestrial environments
- Literature reviews on the environmental sensitivity of the receiving environment with respect to species' presence, "biological calendars", habitat distribution and location of environmentally sensitive areas (breeding, migration, resting areas); identification of environmental values at risk within and adjacent to the Acquisition Area;
- Feedback from relevant persons (onshore and marine) to understand socio-economic activities that may be affected by the proposed activity.

The identified environmental impacts and risks associated with activities proposed under this EP are listed below and assessed within Sections 7 to 8:

- Impacts (expected to occur during planned events)
  - Noise emissions – seismic source
  - Cumulative impacts from seismic surveys
  - Noise emissions: vessel, helicopter and mechanical equipment
  - Physical presence: disruption/ interference with other marine users
  - Discharge: treated sewage, grey water and putrescible waste
  - Discharge: drains, deck and bilge water
  - Artificial light emissions: vessels
  - Atmospheric emissions: vessels and mechanical equipment
- Risks (not expected to occur during routine operations)
  - Hydrocarbon and chemical spills
  - Hydrocarbon spill – vessel collision
  - Hydrocarbon spill – bunkering
  - Chemical spill: single point failure
  - Physical presence: entanglement / collision with marine fauna
  - Physical presence: loss of equipment
  - Discharge: loss of hazardous or non-hazardous solid waste

– Introduction of invasive marine species: ballast water and biofouling.

6.6 Impact and risk analysis and evaluation

The hazards for each potential environmental aspect were identified using a qualitative assessment process in accordance with the methods and principles described by the ISO 31000:2018 Risk Management – Principles and Guidelines (2018), and Standards Australia Handbook HB 203:2012, Managing Environment-related Risk (2012). Some useful definitions from the ISO guidelines and the associated Handbook on Environmental Risk Management – Principles and Process (Standards Australia 2006), are included in Table 6-1.

Table 6-1 - Risk Management Terms

Term	Synonymous terms	Meaning
Stressor	Source of risk Hazard Environmental aspect	Physical, chemical or biological entity or incident, which induces an adverse response or impact.
Impact	Effect Consequence	Change to the environment, adverse or beneficial, relating to an organisation's activities. May be defined in terms of severity of consequences
Consequence	Outcome Impact	Impact of an event or incident e.g. a loss, injury or concern. May be expressed qualitatively or quantitatively.
Likelihood	Probability Frequency Qualitative likelihood	The series of 'conditional probabilities' or 'conditional likelihoods' for the chain of events leading to an impact, need to be factored into determining final likelihood of environmental impact occurring.
Risk		Considered in terms of environmental consequences of a given severity, and the likelihood of that particular consequence occurring.
Residual risk		Risk remaining when controls are in place.

The Sauropod 3D MSS impact and risk assessment is based on the evaluation of impacts and risks that are credible, realistic and appropriate to the nature and scale of the activity, and the values and sensitivities of the environment that may be affected (EMBA).

Each impact and risk associated with the planned seismic activity has been evaluated by determining the consequences or effects, including the extent, duration, timing and potential for recovery (Table 6-2 and Table 6-3), and assessing the likelihood or probability that those consequences may occur (Table 6-4). Potential maximum quantities released, time-scale of release, biological exposure and sensitivities, and regulatory requirements were considered in determining the consequence of the impact/risk. The likelihood of the effect or consequence is based largely on professional judgement of the conditional likelihoods leading to the effect, including the presence of the stressor (impact/risk), the exposure of receptors to the stressor and the sensitivity of the receptors to the stressor. The outcome of this evaluation provides the 'inherent' impact or risk ranking, i.e. the impact/risk without the application of control measures. The shaded region of the risk matrix signifies the tolerability of the risk ranking.

Table 6-2 - Definition of Consequence Terms

Term	Meaning
Localised	Operational Area extent
Extensive / Medium scale	Within Oil EMBA extent
Regional / Large scale	Northern Carnarvon Basin extent
Short-term	Days to weeks
Medium term	<12 months

Long-term	>12 months

Table 6-3 – Definition of consequence

Category		Environment	Socio-economic
0	Negligible	Full recovery expected in days to weeks	No or very limited effect on commercial and/or recreational users
1	Minor	Minor disruption and temporary effect (days) on individuals within a protected species, including impacts on health, critical habitats, or critical behavioural processes. No overall threat to populations. Localised scale (immediate area) and temporary effect on other habitats/communities. No effects on ecosystem function. Full recovery expected in days to weeks	Minor disruption, localised scale (immediate area) and temporary effect (days) on commercial and/or recreational users
2	Moderate	Moderate disruption and short-term effect (weeks) on a proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Localised scale and short-term effect (weeks) on other habitats/communities No effects on ecosystem function. Recovery in months to 1 year.	Moderate disruption, localised scale and short-term effect (weeks) on commercial and/or recreational users
3	Severe	Moderate disruption and effect (months) on a significant proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Localised scale and medium-term effect (months) on other habitats/communities. No effects on ecosystem function. Recovery >1 to 3 years.	Moderate disruption and effect (months) on commercial and/ or recreational users.
4	Major	Major disruption and medium to long-term effect (years) on a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Injury or death of individuals of a protected species. Medium scale and medium-term effect (years) on other habitats/communities. Effects are at an ecosystem function level. Recovery >3 to 10 years.	Major disruption and medium to long-term effect (years) leading to loss of commercial and/or recreational use
5	Catastrophic	Extensive disruption and long-term effect (decades) on a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Injury or death of a significant proportion of a protected species population. Large scale and long-term effect (decades) on other habitats/communities. Effects are at an ecosystem function level. Recovery >10 years.	Extensive disruption and long-term effect (decades) leading to loss of commercial and/or recreational use.

Table 6-4 – Definition of Likelihood

Category		Definition/experience (history of occurrence)	Probability
A	Rare	Almost impossible / unheard of in the industry	Event occurs once within 10 years
B	Unlikely	Could occur but would not be expected / has occurred once or twice in the industry	Event occurs once within 5 years
C	Possible	Might occur at some point / has occurred many times in the industry but not before within CGG	Event occurs once a year
D	Likely	Will probably occur at some point / has occurred frequently within the company	Event occurs monthly
E	Almost Certain	Expected to occur in most circumstances / has occurred at the location	Event occurs weekly

All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 6-5). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable (i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High and Very High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

Table 6-5 - CGG Modified Risk Matrix

Consequence		**Likelihood**				
		A	B	C	D	E
		Rare	Unlikely	Possible	Likely	Almost certain
0	Negligible					
1	Minor					
2	Moderate					
3	Severe					
4	Major					
5	Catastrophic					

Term	**Definition**
Low	No effect, or those that are beneath levels of perception, within normal bounds of variation. Good industry practice (including legislation and standards) have been applied. Acceptable without further reduction measures being required.
Medium	Acceptable (tolerable), providing that it can be shown that all practicable control measures have been implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, with continual review of these measures and any potential new ones. Deemed to be “as low as reasonably practical” (ALARP) and acceptable.
High	Undesirable, CGG management decision required to accept risks and proceed. Additional control measures are required to be considered and implemented, if the cost is not grossly disproportionate to the environmental benefit gained, to prevent or reduce the impact/risk to ALARP and an acceptable residual level.
Very High	Unacceptable (intolerable) and may require re-design of project and/or its parameters, additional control measures are required to be implemented (regardless of cost) to prevent or reduce the impact/risk to ALARP and be acceptable.

6.7 Impact and risk treatment

The treatment of the inherent impacts and risks identified in the assessment process requires application of control measures to reduce them to ALARP and acceptable levels. CGG has taken the following approach for each of the identified impacts and risks during the assessment:

- Determination of inherent risk (potential risk) without controls
- Identification of appropriate control measures aligned with the decision type
- Demonstration of ALARP (and determination of the residual risk)
- Demonstration of acceptable level of impact or risk
- Determination of residual risk rating (including controls aligned with decision type).

6.7.1 Decision context and assessment techniques

CGG applies the Oil and Gas UK (OGUK) (2014) Guidance on Risk Related Decision Making (Figure 6-2) to determine the assessment technique applied for each impact or risk. CGG has considered previous impact and risk assessments for similar activities, review of relevant published studies (peer reviewed and grey literature) and relevant person consultation concerns/feedback. Wherever possible, site-specific and activity-specific data has been used in the impact/risk assessment; however, in order to address areas of uncertainty, a precautionary approach has been taken and a conservative or "worst case" approach has been applied where there is uncertainty in the level of harm.

The extent to which identified relevant persons have an interest in the decision depends upon the nature of the impact/risk (e.g. magnitude, complexity, uncertainty) and their perception of the impact/risk. The values, views, attitudes, perceptions and concerns of relevant persons consulted for the Sauropod 3D MSS have been used in the determination of the decision context. Relevant person concerns have been assessed for merit and adopted control measures (where relevant) are summarised in each impact and risk section.

Once the decision context is established for the impact/risk, this determines the assessment technique to use to identify appropriate control measures. The arrows in the Figure 6-2 show the assessment technique(s) likely to be needed to make the decision. Good practice forms the basis of the assessment for all decision contexts. Moving from decision context A to B to C increases the relevance for additional assessment techniques and the role these play in the identification of control measures and decision-making.

- Good Practice: in accordance with recognised guidelines, standards and control measures that are used to manage well-understood impacts and risks arising from activities. This also includes control measures required to meet legislative requirements, codes and standards, including guiding principles such as the principles of ESD as defined in the EPBC Act.
- Engineering (or Environmental) Impact and Risk Assessment: this method may involve application of a range of techniques such as engineering analysis (e.g. underwater sound modelling), impact/risk assessment, cost benefit analysis, professional judgement.
- Precautionary Approach: this method requires uncertainty in the analysis to be addressed by using conservative assumptions that may result in a control measure being more likely to be adopted.

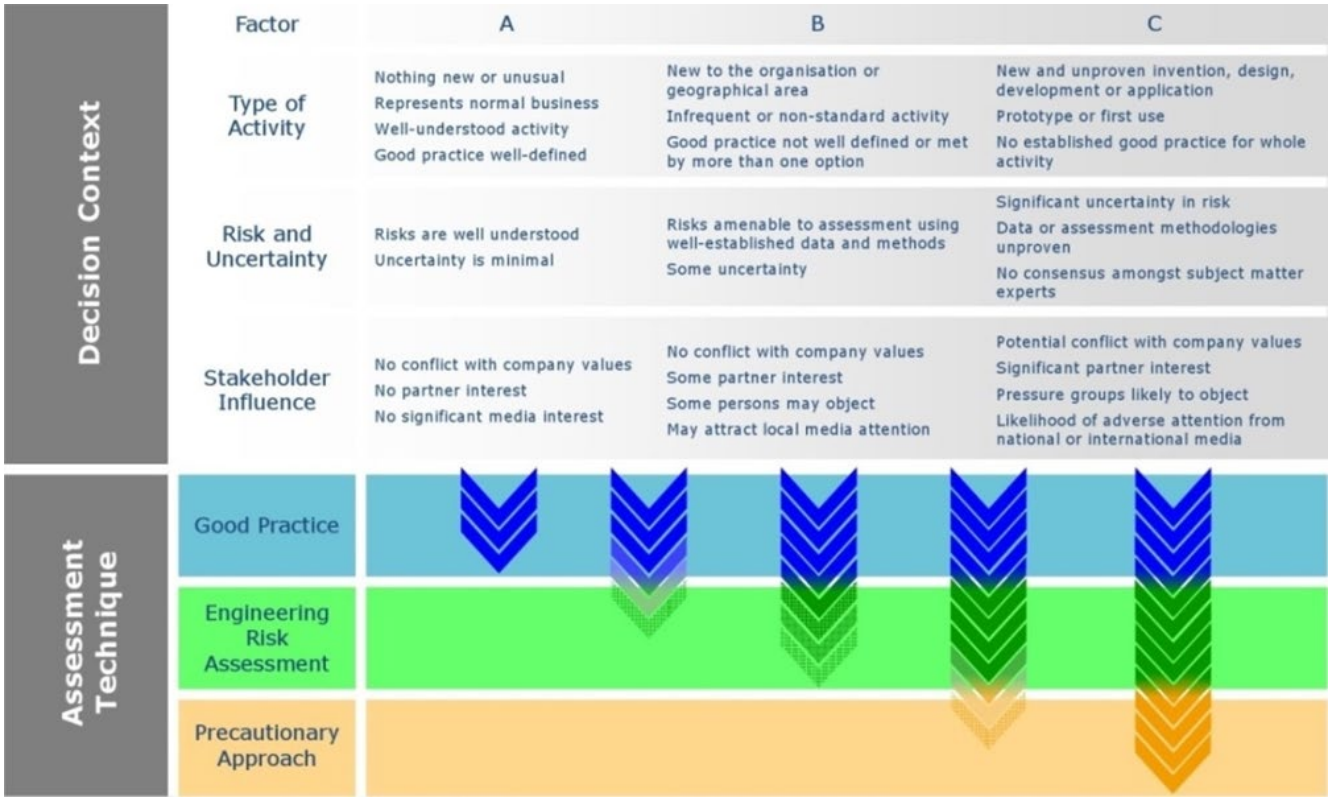


Figure 6-2 - Risk Related Decision Support Framework (OGUK 2014)

6.7.2 Hierarchy of Control Measures

CGG has established a hierarchy of controls in accordance with their impact and risk management process as part of their HSE Management System (Table 6-6). Although commonly used in the evaluation of occupational health and safety hazard control, the hierarchy of controls philosophy is also a useful framework to evaluate potential environmental controls to ensure reasonable and practicable solutions have not been overlooked.

Table 6-6 – Hierarchy of Controls

Control type	Description
Eliminate	Selection of method based on appropriate design, elimination of methods with higher risks, e.g. eliminating seabed damage from anchors by using dynamically positioned vessels.
Substitute	Replace with a lower risk situation, e.g. use gel-filled streamers instead of fluid-filled streamers.
Reduce	Reduce the impact/ risk, e.g. soft-starts during operation of the seismic source to encourage marine fauna to move out of the area, thereby reducing exposure to elevated noise levels.
Engineering/Isolation	Engineer out the impact/risk, e.g. automatic flotation devices to aid in recovering lost streamers.
Administration	Provide instructions, procedures or training to reduce the risk, e.g. use of procedures for management of risks for refuelling at sea, waste management and marine fauna interactions, training of crew through environmental inductions.
Protective	Use appropriate protective equipment, (including emergency response and contingency planning), when other control measures are not practical or have not totally removed the hazard.

6.8 Demonstration of ALARP

Regulation 21(5)(c) of the OPGGS (E) Regulations require that where significant effects are identified, details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable (ALARP) and an “acceptable level”, must be included in the EP. Risk treatment involves a process of selecting additional control measures for reducing impact and risks that have not been demonstrated to be ALARP during the risk analysis and evaluation processes, and then establishing whether the residual impact/risk can be deemed acceptable. In the case of higher order impacts or risks, it is also expected that reasonable effort has been used to identify and evaluate alternative, additional, and improved control measures that may further reduce impacts and risks (NOPSEMA Guideline N-4750-GL1721).

Ideally, the control measures adopted during the assessment should bring the residual impact/risk to a low level and broadly acceptable region. All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 6-5). Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable (i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High or Very High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

However, if the residual impact/risk remains at the medium level, CGG must determine if the impact or risk has been reduced to ALARP. If CGG identify additional control measures that can be implemented without the cost being grossly disproportionate to the benefit of impact or risk reduction, then these additional controls are adopted. If it is considered that the impact or risk is sufficiently low, ALARP has been reached and no further development of control measures is practicable, or if the costs of implementing further controls are grossly disproportionate to the environmental benefit, then the residual impact/risk is deemed to be acceptable.

If a residual impact/risk is high or very high, then this is determined as an unacceptable impact or risk and requires additional control measures to reduce to ALARP. It is important to note that to maintain an impact or risk as ALARP, ongoing action is required to ensure the integrity of control measures is maintained. Therefore, the emphasis on feedback and continuous improvement is a key feature of the management of impacts/risks to ALARP.

Additional control measures for the ALARP demonstration have been identified using the decision methods described below. Where the residual impact/risk is low, good industry practice (including recognised guidelines and standards) has been assessed to determine if additional control measures are appropriate. Where the residual impact/risk is medium, good practice and engineering (or environmental) assessment methods have been considered in introducing additional controls to reduce the impact/risk further. Where the residual impact/risk is high or very high, then additional control measures have

been developed from a combination of good practice, assessment, and a precautionary approach. The latter precautionary approach requires conservative assumptions to be made in the development of additional control measures where there is uncertainty in the process.

Once additional control measures have been identified, each has been assessed on its merits of impact/risk reduction and the proportionality of the sacrifice associated with each measure. This assessment considers the practicality, effectiveness, and the cost benefit of implementing the control measure, as described below.

6.8.1 Practicability

Additional control measures were assessed to demonstrate whether the impact or risk could be further reduced, or if the impact or risk level is ALARP. Treatments considered by CGG to be reasonably practicable have been implemented, while those considered to be not reasonably practicable have not been implemented, e.g. the cost, time and effort required to implement the measure is grossly disproportionate to the environmental benefit gained.

6.8.2 Effectiveness

CGG's QHSE and SD Risk Management Guidance Note requires that the effectiveness of control measures must be assessed before they are implemented. Determination of effectiveness is subjective and thereby based on professional judgement, considering:

- Availability – will the control exist and be available when and where you need it?
- Reliability – will the control work as it was designed and intended?
- Impact – what will be the scale of effect if this control works perfectly?
- Duration – what will be the duration or time that the control will have its effect?

6.8.3 Cost Benefit Analysis

The estimated cost criterion consisted of a qualitative assessment by people familiar with the practicalities of implementing the control measures, to evaluate and rate the estimated cost impact of the additional control measure. Monetary values were not quantified; however, the cost was qualitatively ranked as follows:

- High – Very significant cost associated with the implementation of this measure and the cost may be prohibitive or not warranted based on the potential benefit gained. The level of cost is likely to compromise the Sauropod 3D MSS objectives and viability.
- Medium – Significant cost associated with implementation of this measure, however it is not considered prohibitive, when compared to the potential risk reduction benefit.
- Low – No significant cost associated with implementation of this measure.

The expected net benefit of the additional control measure in reducing either the likelihood or the consequence of the impact or risk, beyond that achieved by the previously identified control measures was evaluated on a qualitative basis. If a control measure reduced the potential impact or risk significantly, but did not change the residual risk ranking, it may still be considered as a net benefit and a contribution to reaching ALARP.

The potential for each additional control measure to generate negative environmental impacts, health and safety issues or operational risks was considered. Where effects were considered to negate the potential benefit partially or fully, the control measure was not considered for implementation, as it had no net benefit and contribution to reaching ALARP.

Where the benefit (i.e. reduction in impact or risk) of an additional control measure was considered grossly disproportionate to the cost of implementation or the effect on survey efficacy, the control measure was not accepted. As such, the control measures presented in the impact and risk assessment constitute only those that were deemed to result in a reasonable, practicable and effective reduction in the likelihood or consequence of an impact or risk becoming realised, and thereby demonstrating ALARP whilst achieving the objectives of the survey.

6.9 Residual Impact Ranking

The residual impact and risk ranking process is undertaken to assess the effect of control measures in mitigating the inherent risk levels. It follows the identification of the decision context type, ALARP process and establishing appropriate control measures.

Residual risk rankings were based on re-assessment of the likelihood and consequence of the impacts with the mitigating controls in place. Residual risk was assigned using CGG's risk matrix in Table 6-5. All identified impacts and risks associated with the activity were analysed and evaluated in accordance with CGG risk matrix. The coloured region signifies the tolerability of the risk criteria Environmental impact and risks ranked as low or medium are generally considered ALARP and acceptable (provided that it can be shown that all practical impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked high are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual risk to ALARP and Acceptable.

6.10 Demonstration of Acceptability

Regulation 21(5)(c) of the OPGGS(E) Regulations requires a demonstration that residual environmental impacts and risks are of an acceptable level. Acceptance is often represented as an inverted triangle (Figure 6-3), where the level of risk increases from a low risk or "broadly acceptable region" through a "tolerable region" (if impacts/risks are demonstrated to be higher, but ALARP) and then to an "unacceptable region". These principles have been adopted in CGG's definitions of acceptability:

- Low: Good industry practice (including legislation and standards) has been applied and the impact/risk is acceptable without further reduction measures being required. Further effort towards impact/risk reduction is not reasonably practicable without sacrifices (costs, loss of opportunities, or loss of technical quality) grossly disproportionate to the impact/risk reduction benefit.
- Medium: Acceptable (acceptable / tolerable), providing that it can be shown that all practicable control measures have been implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, with continual review of these measures and any potential new ones.
- High (undesirable): CGG management decision required to accept impacts/risks and proceed. Additional control measures are required to be considered and implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, to prevent or reduce the impact/risk to ALARP and be acceptable.
- Very high (unacceptable / intolerable): May require re-design of project and/or its parameters, additional control measures are required to be implemented (regardless of sacrifice) to prevent or reduce the impact/risk to ALARP and be acceptable.

CGG's model for demonstrating acceptable levels of impacts and risks for the Sauropod 3D MSS is based upon the criteria described in Table 6-7. Using the appropriate criteria from Table 6-7, acceptable levels of impact were defined prior to conducting the evaluation of individual impacts and risks in Section 7 and 8. However, not all the criteria for acceptance in Table 6-7 will apply to defining levels of acceptability for all impacts and risks assessed within this EP. CGG has therefore distinguished between higher and lower order environmental impacts and risks.

Higher order impacts/risks are generally more complex and include those where the environment or receptor affected is protected/threatened, vulnerable to the impact/risk, not widely distributed, or where there is uncertainty in the effectiveness of adopted control measures. Such impacts/risks relevant to the MSS include underwater noise from seismic operations, accidental oil spill (due to vessel collision) and physical interaction with other marine users. It is expected that reasonable effort has been used to identify and evaluate alternative, additional, and improved control measures that may further reduce impacts and risks (NOPSEMA Guideline N-4750-GL1721). Lower order impacts include atmospheric emissions, routine discharges, light emissions, accidental loss of materials, introduced marine species and fuel spills.

Following demonstration that all reasonable and practicable control measures have been adopted to reduce the impacts and risks to ALARP, the pre-defined acceptable levels of impact have been compared with the residual levels of impact and risk. If the residual impact levels lie within the boundaries of the pre-defined acceptable levels, the impact or risk is considered acceptable.

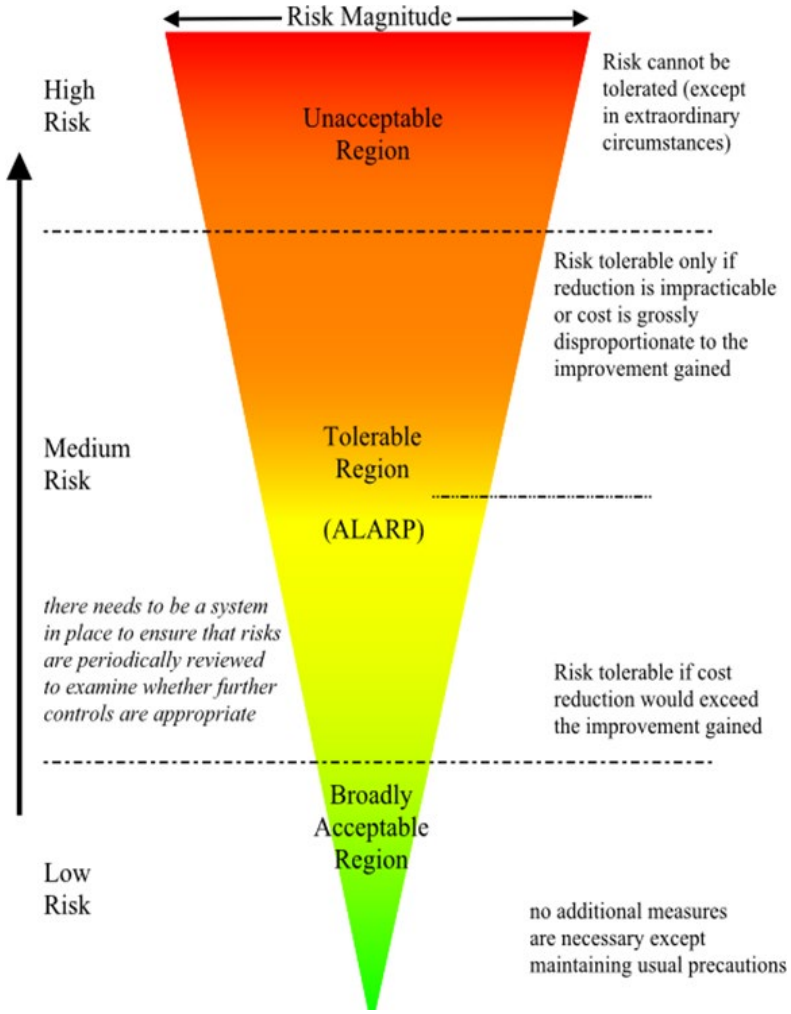


Figure 6-3 - Approach to Demonstrating ALARP and Acceptable Levels (Reg 13(5)(c))

Table 6-7 - Criteria for Defining Acceptable Levels of Impact

Criteria for acceptance	Criteria	
Internal	CGG Policy	Alignment with CGG's Environment Policy and the environmental management system for the Sauropod 3D MSS described in Section 9.
	Company Standards/ Systems	CGG impact/risk matrix defines 'low risk' as acceptable, 'medium risk' as acceptable providing ALARP has been demonstrated, 'high risk' as undesirable (i.e. requiring ALARP demonstration and decision to accept based on CGG management decision), and 'very high risk' as unacceptable (Table 6-5). As such, have all reasonable and practical control measures been adopted to reduce the risk or impact without sacrifices being disproportionate to the benefit of the risk reduction?

Criteria for acceptance	Criteria	
External	Values and Sensitivities of the Natural Environment	The proposed management of the impact/risk is aligned with species-specific or protected area management plans/conservation advice actions or conservation objectives.
		The proposed management of the impact/risk is aligned with the identified conservation and cultural values for the existing environment.
		Is the effect on the environment or receptor localised, short-term and recoverable?
		Have potential impacts to environmental values or sensitivities been assessed as local, regional (and if applicable global) level in terms of population level and long-term effects? As such, are adopted controls appropriate and adequate in avoiding such effects and thereby reducing risks to ALARP.
	Relevant persons Expectations	Concerns raised during relevant person consultation have been assessed for their merits and control measures developed, if appropriate, to manage those concerns.
		There are no outstanding merited concerns that have not been assessed.
Legislation and Other	Legal Requirements	The impact/risk is being managed in accordance with existing Australian or international legislation, conventions and/or standards, such as MARPOL 73/78, AMSA Marine Orders, and Marine Notices, Policy Statements (refer to Section 2).
Industry Standards	Industry Standards and Best Practices	The impact/risk is being managed in accordance with industry good practice (APPEA Code of Environmental Practice and IAGC guidelines), and national and international standards (ISO 31000:2018 Risk Management, Standards Australia / Standards New Zealand Risk Management Guidelines) APPEA Code of Environmental Practice and IAGC guidelines.
Ecological Sustainability Development (ESD)	ESD Application	Aligned with the principles of Ecological Sustainable Development (ESD), including application of the precautionary, integration, intergenerational, biodiversity and valuation principles, and/or how uncertainty has been reduced.

6.11 Environmental Performance Outcomes and Standards

Regulation 5 of the OPGGS(E) Regulations provides definitions for the following:

- Environmental performance outcome: A measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks of the activity will be of an acceptable level.
- Environmental performance standard: A statement of the performance required of a control measure.

Environmental performance outcomes, standards and measurement criteria for each aspect of the activity that has the potential to cause adverse environmental impacts or risks are detailed in the assessments presented in Section 7 and 8. Environmental performance will be measured and reported against these standards and measurement criteria, as part of CGG's commitment to continuous improvement of environmental, health and safety performance as described in Section 9.

6.12 Monitoring and review

Ongoing monitoring and review are essential to ensure the impact and risk assessments within this EP remain relevant. Introduction of new impacts/risks due to changes in the activity or context, changes in the consequence of impacts/risks, and maintaining effectiveness of adopted controls are addressed in CGG's Management of Change procedure described in Section 9.

7 Environmental Risk Assessment – Planned Events

This section presents the evaluation of the environmental impacts and risks completed for planned / routine aspects of the Sauropod 3D MSS using the methodology described in Section 6, as required by OPGGS (E) Regulations 21(5) and 21(6). A summary of the residual rankings for all impacts and risks identified and assessed in this Section is provided in Table 7-1. Where there has been a decrease in the level of predicted impact or no change, the assessment has not been revised apart from to update project details.

This section also presents the environmental performance outcomes, performance standards and measurement criteria for each of the identified environmental impacts and risks. These terms are defined as follows:

- Environmental Performance Outcome (EPO) – a measurable level of performance required for the management of the environmental aspects of the activity to ensure the environmental impacts or risks will be of an acceptable level
- Environmental Performance Standard (EPS) – a statement of performance required of an adopted control measure
- Measurement Criteria – defines the measure by which environmental performance will be measured to determine whether the EPO has been met.

Table 7-1 – Environmental Impact Ranking Summary

Impact/Risk	EP Section No.	Residual Risk		
		Consequence	Likelihood	Risk Ranking
Noise Emissions: Seismic Source	7.1	Moderate (2)	Unlikely (B)	Medium
Noise Emissions: Cumulative Seismic Sound	7.2	Moderate (2)	Rare (A)	Low
Noise Emissions: Vessels, Helicopter and Mechanical Equipment	7.3	Negligible (0)	Rare (A)	Low
Physical Presence: Disruption/Interference with Other Marine Users	7.4	Minor (1)	Unlikely (B)	Low
Discharge: Treated Sewage, Grey Water and Putrescible Waste	7.5	Minor (1)	Rare (A)	Low
Discharge: Drains, Deck and Bilge Water	7.6	Negligible (0)	Rare (A)	Low
Artificial Light Emissions: Vessels	7.7	Negligible (0)	Rare (A)	Low
Atmospheric Emissions: Vessels and Mechanical Equipment	7.8	Negligible (0)	Rare (A)	Low

7.1 Noise emissions: Seismic source

The months and methods in which seismic data will be acquired during the proposed MSS remain unchanged from those described in the CGG Sauropod MSS EP accepted by NOPSEMA on the 16th February 2022. Assessment of potential noise impacts in the accepted EP were based on modelling of seismic noise attenuation completed in 2020 for an earlier accepted MSS EP for the same area (the 3D Oil Sauropod MSS EP), which was based on a larger seismic array. Comparison of survey parameters for the earlier and current EPs is provided below and in Table 7-2, with results of noise attenuation modelling for the larger array described in Appendix D::

- The seismic source that will be used in the survey is lower volume, decreased from 3090 in^3 to 2820 in^3
- The source array produces lower sound energy levels
- The wider spacing of the sail-lines reduces the number of sail-lines and reduces ensonification between the lines and cumulatively for the survey.
- The survey area, shot interval and line orientation have not been changed (Table 7-2).

The impact assessment and subsequent management of impacts (controls) for seismic noise emissions presented here for the proposed MSS is based on that for the larger seismic array described in Appendix D, which is a conservative approach to assessing the effects of noise emissions because the potential for impacts is lower but the same level of mitigation and management will be applied, and the net environmental risk is reduced. In addition, Jasco Applied Sciences who completed the original acoustic modelling report provided in Appendix D, was engaged to compare noise emissions from the original 3,090 in^3 and 2,820 in^3 arrays at the source and propagation from locations modelled for the 2020 MSS EP (Appendix E:). This study confirms that the smaller array produces lower noise levels at the source (Table 7-3).

Table 7-2 The Difference Between the Seismic Source Acoustic Parameters to be Used in the Sauropod 3D MSS and Those Used in the Impact Assessment.

Survey Parameter	CGG Revised Survey	Previously Accepted Sauropod EP Survey
Length of sail lines	83 km	83 km
Time to traverse a sail line	~10 hours	~10 hours
Orientation of sail lines	North–south	North–south
Distance between sail lines	675 m – 716 m	450 m
Turn radius	5,200 m	3500 m
Seismic vessel sail line speed	4.5 knots	Modelled at 4.4 knots
Turn time	4 h	Modelled at 5.2 h
Shot point interval	12.5 m (5.4 seconds)	12.5 m (5.4 seconds)
Seismic Source		
Type	Airgun / three arrays, which will be discharged alternately	
Size	2820 in^3	3090 in^3
Pressure	2,000 psi	2,000 psi
Sound source tow depth	Modelled at 6 m	Modelled at 6 m
Streamers		
Number	12	12
Streamer length	7050 m	7000 m
Distance from seismic vessel bow to tail buoy	7800 m	7525 m
Distance between streamers	112.5 m	75 m

Table 7-3 Far-field Source Level Specifications for the 3090 in^3 and 2820 in^3 Sources with a 6 m Tow Depth. Source Levels are for a Point-like Acoustic Source with Equivalent Far-field Acoustic Output in the Specified Direction. Sound Level Metrics are Per-pulse and Unweighted

Total volume (in^3)	Direction	Peak source SPL (LS,pk; dB re 1 µPa m)	Per-pulse source SEL (LS,E; dB 1 µPa2m2s) 10–25,000 Hz
3090	Broadside	249.4	225.1
2820		248.8	224.5
3090	Endfire	245.7	223.3
2820		244.8	223.0
3090	Vertical	255.0	228.2
2820		254.9	227.9

Sound propagation modelling of per pulse fields was conducted at the sites in Figure 7-1 to compare energy emission between the 3090 in^3 and 2820 in^3 arrays across the survey area. Figure 7-2 to Figure 7-5 show the results of the per pulse fields at each site for both SEL and SPL metrics. These figures clearly show the energy emission of both arrays is very similar or slightly lower for the smaller array at all modelling sites, in both SEL and SPL metrics. Furthermore, since the line spacing in this survey is greater, the SEL_{24h} sound field will be smaller due to the additional propagation loss between sail lines.

These data demonstrate the sound that will be produced during the seismic survey will not be greater than the noise prediction that underpins the impact assessment and will generally be lower. As a result, the impact assessment in this EP and the management controls that will be implemented are applicable to the seismic noise emissions generated during this survey.

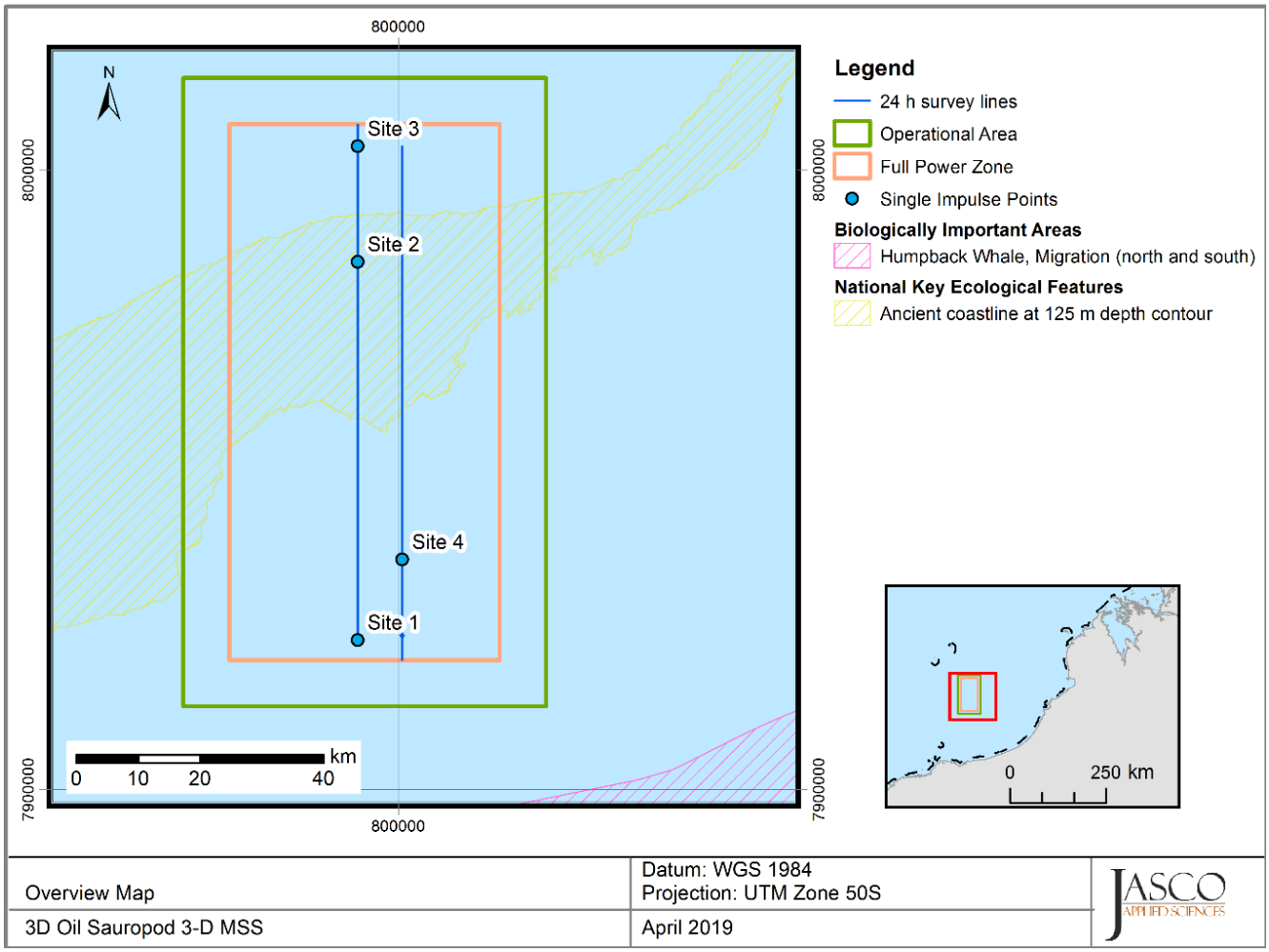


Figure 7-1 — Modelling Sites for Per-pulse Fields for Comparison Between the 3090 in^3 and 2820 in^3 Arrays

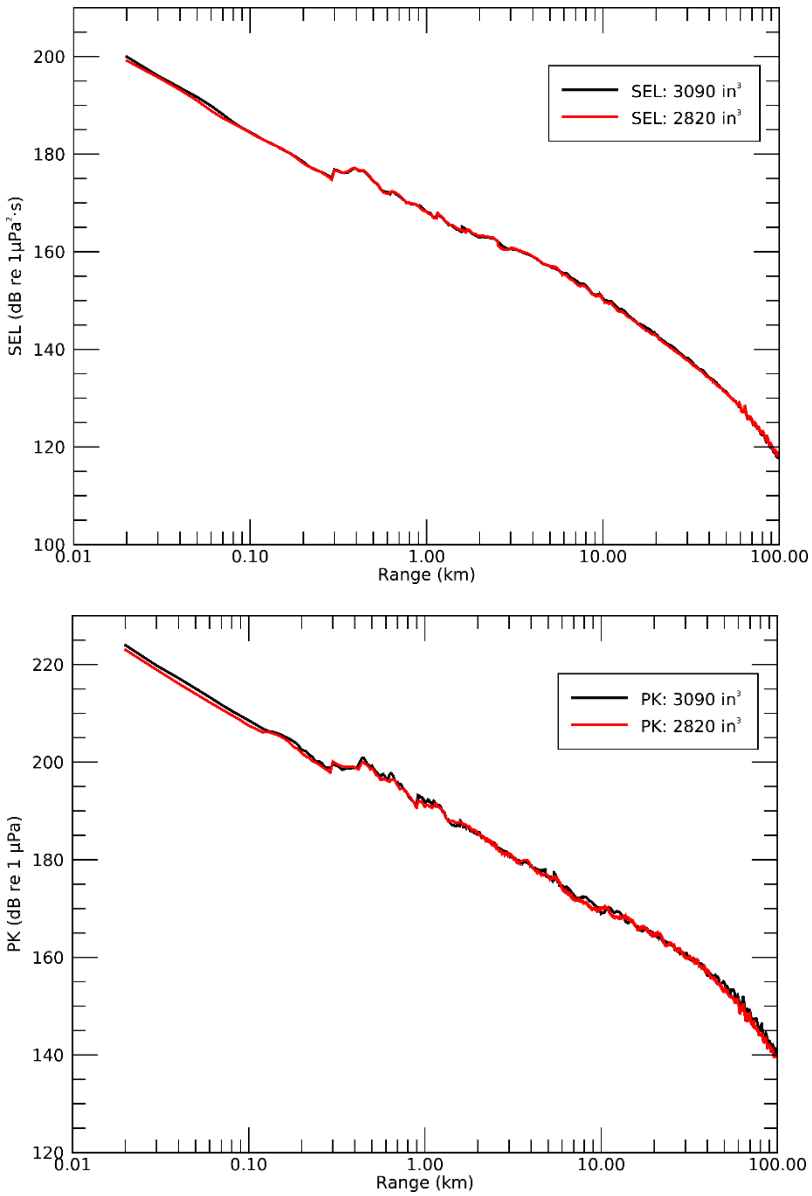


Figure 7-2 — Site 1: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in³ and 2820 in³ Arrays

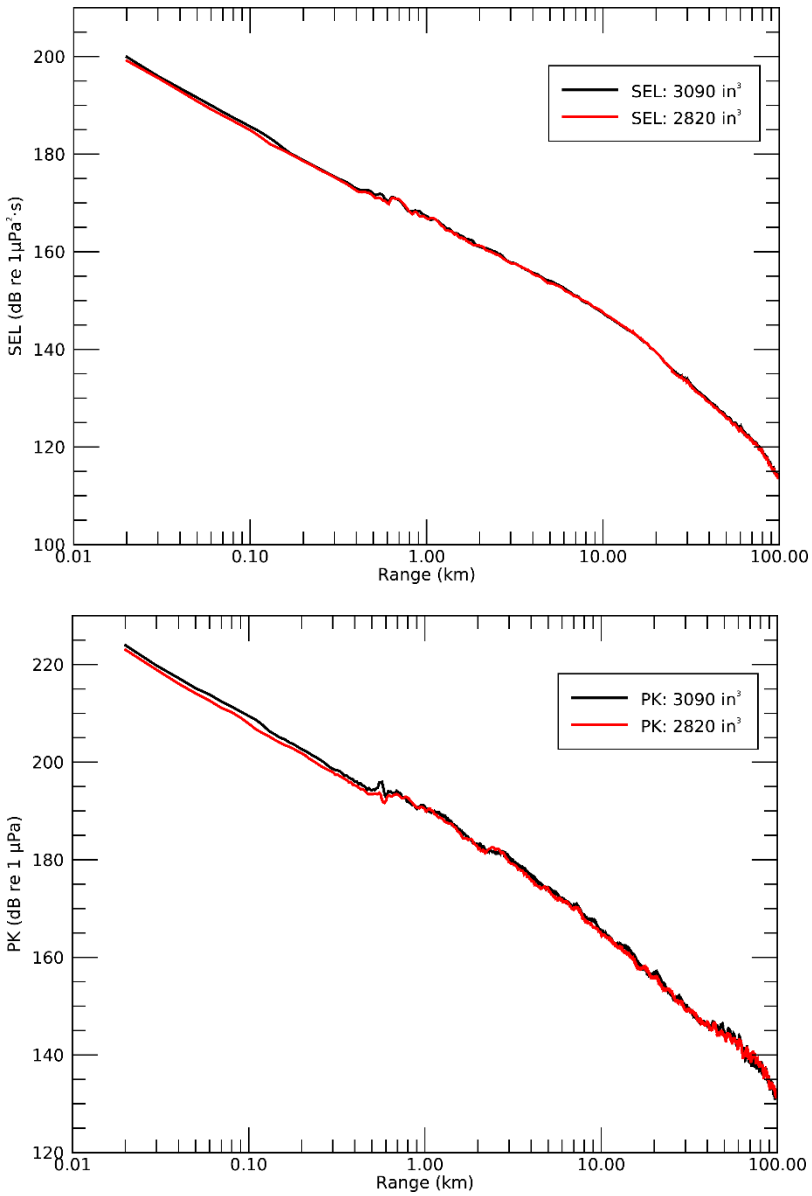


Figure 7-3 — Site 2: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in^3 and 2820 in^3 Arrays

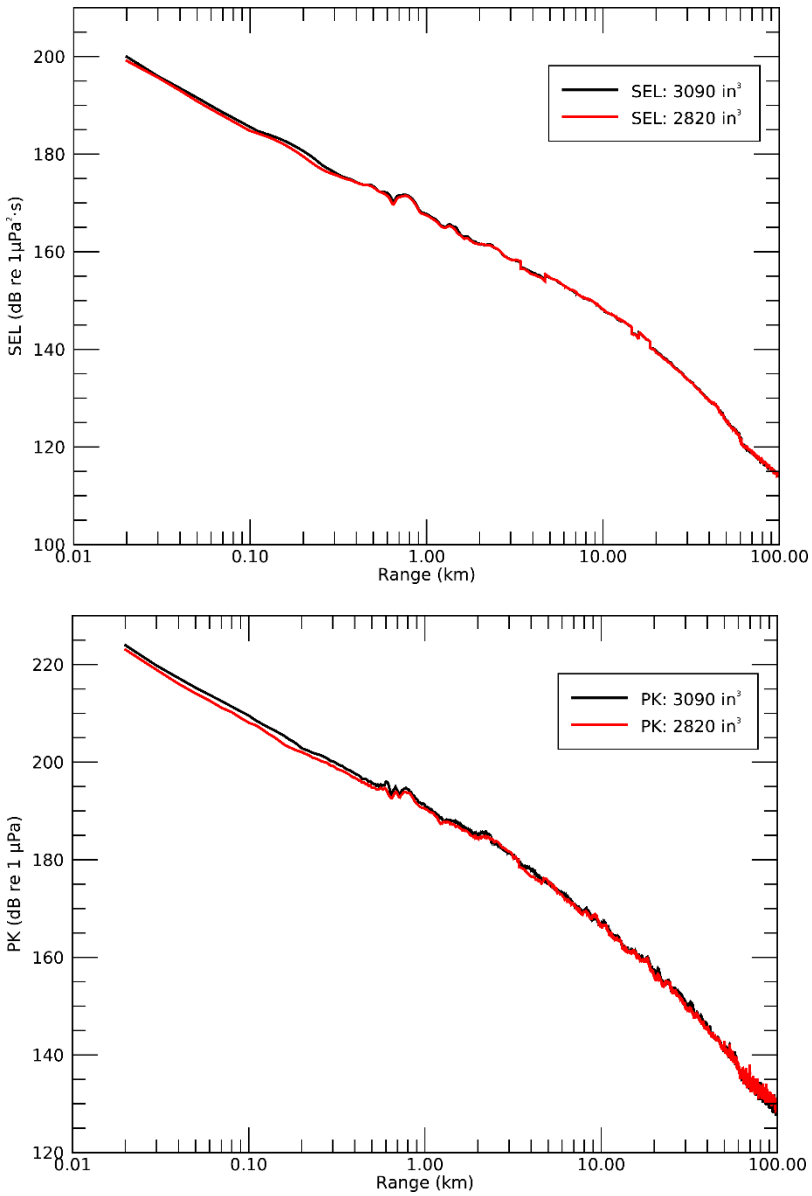


Figure 7-4 — Site 3: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 in³ and 2820 in³ Arrays

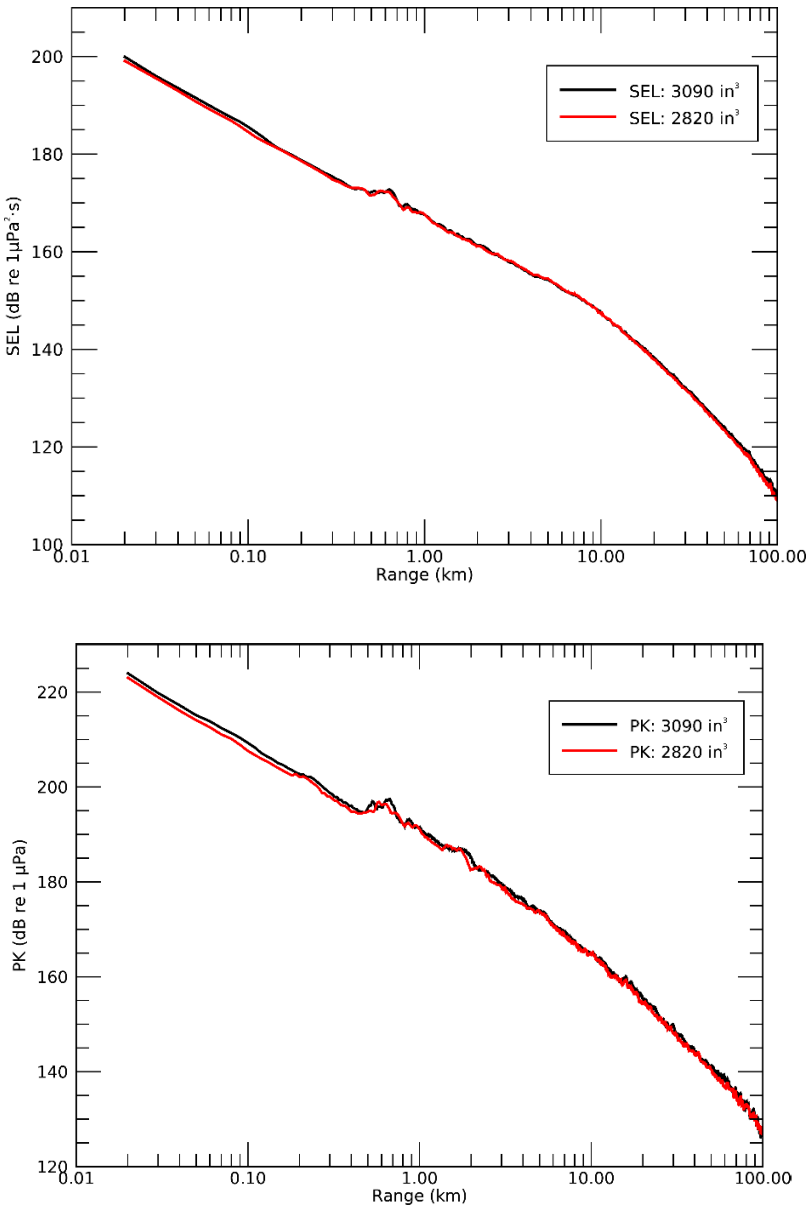


Figure 7-5 Site 4: Maximum-over-depth SEL (top) and SPL (bottom) Predicted for the 3090 and 2820 in^3 Arrays

7.1.1 Source of Impact/Risk

Generation of noise from the seismic source has the potential to cause physical effects and behavioural disturbance to marine fauna.

This impact assessment is based on the noise emissions from an airgun array with a maximum capacity of 3,090 in^3, towed at a water depth of 5–10 m. Noise emission estimates are based on shot intervals of approximately 5.4 seconds as the vessel transits along planned survey lines within the Acquisition Area. This impact assessment is based on a theoretical seismic source that is larger and slightly louder than the source that will be used in the survey.

Underwater noise can affect marine fauna in three main ways:

- By causing direct physical effects on hearing or other organs. Hearing loss may be temporary (temporary threshold shift – TTS), or permanent (PTS), with PTS usually considered to represent a form of injury

- Through disturbance leading to behavioural changes or displacement of fauna. The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation
- By masking or interference with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey).

3D Oil commissioned JASCO Applied Sciences to undertake numerical acoustic modelling to predict the source levels and transmission losses from a single seismic pulse and multiple seismic pulses emitted from within the Acquisition Area. The modelling results (Quijano and McPherson 2020; Appendix D:) have been used in the following impact and risk evaluation to estimate the potential distances over which different receptors may be affected. The modelling is described in further detail below.

7.1.1.1 Receptors

The following receptors may potentially be impacted by noise emissions from the seismic source:

- Cetaceans
- Marine reptiles
- Seabirds
- Fishes and elasmobranchs
- Benthic invertebrates
- Zooplankton
- Fish spawning
- Commercial fisheries
- Marine protected areas
- Tourism and recreation
- First Nations cultural features and heritage values.

7.1.2 Seismic Sound Source

Seismic sound is characterised by high energy pulses of low frequency sound. The frequency of the sound produced from each seismic pulse is primarily less than 2 kHz, with the highest levels at frequencies in the range of 10-500 Hz (McCauley 1994).

A 3,090 in^3 seismic source was modelled by JASCO Applied Sciences (JASCO) to determine acoustic source levels using their Airgun Array Source Model (Appendix D:) as the basis for the impact assessment. The modelling predicted the 3,090 in^3 seismic source to produce far-field source levels up to a maximum of 255 dB re 1 µPa.m (SPL_{pk}) and per-pulse source sound exposure levels (SEL) of 228-231 dB re 1 µPa2m^2s (at 0–2,000 Hz) in the vertical direction beneath the array.

The rate of sound attenuation from the seismic source is dependent on local sound propagation characteristics, including sea water temperature and salinity profiles, water depth, bathymetry and the geoacoustic properties of the seabed (McCauley 1994). While the seismic pulses are directed downwards, horizontal propagation may be detected over long distances due to the high intensity and low frequency properties of the sound source. Acoustic modelling of sound propagation from the seismic source is presented below.

7.1.2.1 Sound Source Verification

In 2018, a measurement program was conducted to validate the source signature predictions of JASCO's Airgun Array Source Model (McPherson *et al.* 2018). The validation program measured source levels for four airgun arrays including a 3,090-cui array. The measurement program was conducted in 80 m water depth off the northern coast of Australia, with an array passing directly over the recorder on the sea floor. The sound source verification process determined that the maximum measured SPL_{pk} for the 3,090-cui array was 221.7 dB re 1µPa. The measurement study results were used to validate modelled far-field source levels through a comparison between the measured received sound levels and predicted received sound levels at a real receiver point in the far-field of the source. The predictions were made using a wavenumber integral model coupled to the airgun source model. The program measured received sound levels in the endfire, broadside and vertical directions, and the results showed good agreement with the modelling results (McPherson *et al.* 2018). This

study is therefore considered to provide validation of the modelled source signatures for the 3,090-cui array for this impact assessment.

7.1.3 Acoustic Modelling

3D Oil commissioned JASCO to model the source levels and sound propagation at four locations that were representative of the different water depths, bathymetry and seabed properties within the Acquisition Area (Quijano and McPherson 2020; Appendix D:). The objective of this acoustic modelling study was to evaluate the effects of sound on marine fauna including cetaceans, marine reptiles, fishes, elasmobranchs, benthic invertebrates and zooplankton, and on socio-economic receptors such as commercial fisheries, marine protected areas and tourism and recreational activities. Modelling considered a 3,090 in^3 seismic source, towed at a 5–10 m depth behind the survey vessel. As described in Section 7.1 the source planned to be used for this survey is a maximum 2,820 in^3 array, however the impact assessment and subsequent management of impacts (controls) for seismic noise emissions is presented for the larger seismic array, as modelled assessed in the previously accepted 3D Oil Sauropod MSS EP (see modelling in Appendix D:).

A specialised airgun array source model was used to predict the acoustic signature of the seismic source, and complementary underwater acoustic propagation models were used in conjunction with the modelled array signature to estimate sound levels over a large area around the source. Single-impulse sound fields were predicted at defined locations within the Acquisition Area, and accumulated sound exposure fields were predicted for one representative scenario for likely survey operations over 24 hours.

The modelling methodology considered source directivity and range-dependent environmental properties in each of the areas assessed. Estimated underwater acoustic levels are presented as sound pressure levels (SPL), zero-to-peak pressure levels (SPL_{pk}), peak-to-peak pressure levels ($SPL_{pk\text{-}pk}$), and either single-impulse (i.e. per-pulse) or accumulated sound exposure levels (SEL) as appropriate for different noise effect criteria. Particle motion metrics were predicted at all four modelled locations. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied to all modelling.

The analysis considered the distances away from the seismic source at which relevant effects thresholds or sound levels were reached.

Contours of the modelled underwater sound fields have been computed, sampled either as the maximum value over all modelled depths (maximum-over-depth: MOD) or at the sea floor for each of the four single-pulse locations, and for the one cumulative SEL_{24h} scenario. The modelled distances for each of the sound exposure thresholds are computed from these contours. Two distances relative to the source are reported for each sound level:

1. R_{max} - the maximum range to the given sound level over all azimuths
2. R95% - the range to the given sound level after the 5% farthest points were excluded.

The difference between R_{max} and R95% depends on the source directivity and the non-uniformity of the acoustic environment. In some environments a sound level contour might have small anomalous isolated fringes in which case the literal use of R_{max} can overestimate the area of the region exposed to such effects. In these instances R95% is considered more representative. In environments that have bathymetric features that affect sound propagation then the R95% neglects to account for these and therefore R_{max} might better represent the region of effect in specific directions. For this impact assessment the R_{max} values have been considered, in order to be conservative.

7.1.4 Sound Exposure Thresholds

The levels of acoustic exposure that may result in injury or behavioural changes in marine fauna is an area of increasing research. Due to differences in experimental design, methodology and units of measure, comparison of studies to determine sound exposure thresholds can be difficult. On assessment of the available science, thresholds have been defined for informing the impact assessment, and interpreting the numerical noise modelling. These sound exposure thresholds are discussed for each receptor in Section 7.1.5. The criteria have been selected on the basis that they include internationally recognised standard thresholds, thresholds suggested by the best available science, and sound levels presented in the scientific literature for species with no suggested thresholds.

Noise thresholds have been defined for both the per-pulse sound energy released, as well as the total sound energy (accumulated) that marine fauna are subjected to over a defined period of time. For recent regulatory assessments of seismic surveys, the period of total sound energy integration (i.e. accumulation) has been typically defined as 24 hours; hence, this was the period used for modelling and in this assessment. For fish this period is based on available research (Popper *et al.* 2014) which found fish experiencing TTS in hearing recovered to normal hearing levels within 18 to 24 hours,

and for marine mammals the period is required to be either 24 hours or the length of the activity, whichever is shorter (NMFS 2018).

Importantly, the 24-hour accumulated sound metric reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. More realistically, marine mammals and many fish (pelagic and some demersal) would not stay in the same location or at the same range for 24 hours. Popper *et al.* (2014) discuss the complications in determining a relevant sound exposure period of mobile seismic surveys, as the levels received by the receptor change between impulses due to the mobile source. For marine mammals and many fish, sound exposures at the closest point to the seismic source are the primary exposures contributing to a receptor's accumulated level (Gedamke *et al.* 2011). Hence, thresholds based on a 24-hour exposure period are considered to be a conservative measure of potential effect.

7.1.4.1 Particle Motion

The particle motion component of sound is also relevant to the assessment of potential impacts to marine fauna. Acoustic particle motion refers to the physical motion caused by a sound wave within the water, seabed or other medium. Unlike pressure, particle motion is directional in nature, although the actual to-and-fro particle displacements that constitute sound are extremely small, in the order of nanometres (Popper and Hawkins 2018). Particle motion can be described in terms of particle displacement (m), velocity (m/s), or acceleration (m/s^2) (Popper *et al.* 2014; Carroll *et al.* 2017). Alternatively, it is sometimes expressed in dB with respect to a reference value of displacement (dB re 1 pm), velocity (dB re 1 nm/s) or acceleration (dB re 1 µm/s^2) (Nedelec *et al.* 2016).

Particle motion is important because marine invertebrates and most fishes are primarily sensitive to particle motion rather than sound pressure and, therefore, particle motion is the most relevant metric for perceiving underwater sound by invertebrates and most fish species (Popper and Hawkins 2019). However, there is currently limited information available to quantify the particle motion sensitivity of fishes and invertebrates. It is complex and challenging to directly measure particle motion compared to sound pressure, hence most research is presented in the context of sound pressure or exposure levels instead of particle motion (Carroll *et al.* 2017; Popper and Hawkins 2018). Therefore, while the assessment of seismic noise impacts in this EP considers the role of particle motion and its effect on fishes and invertebrates, the acoustic modelling and impact threshold criteria are based upon sound pressure and sound exposure metrics.

It should be noted that particle motion is most relevant close to the source where it is the dominant component of a sound wave, while pressure will dominate a sound wave propagating over distance (Radford *et al.* 2012; Morley *et al.* 2014; Nedelec *et al.* 2016; Popper and Hawkins 2018). Sound pressure levels received at increasing distance from a source do not, therefore, provide a reliable representation of particle motion. Organisms that are sensitive only to particle motion have typically been found to be sensitive only at close range where these particle motions are greatest (Popper *et al.* 2014; Edmonds *et al.* 2016; Popper and Hawkins 2018).

7.1.5 Details of Impacts and Risks

7.1.5.1 Cetaceans

7.1.5.1.1 Species Sensitivity and Sound Exposure Thresholds

Physiological impacts such as physical damage to the auditory apparatus, e.g., loss of hair cells or permanently fatigued hair cell receptors, can occur in marine mammals when they are exposed to intense or moderately intense sound levels and could cause permanent or temporary loss of hearing sensitivity. While the loss of hearing sensitivity is usually strongest in the frequency range of the emitted noise, it is not limited to the frequency bands where the noise occurs but can affect a broader hearing range. This is because animals perceive sound structured by a set of auditory bandwidth filters that proportionately increase in width with frequency.

Exposure to sufficiently intense sound may lead to an increased hearing threshold in any living animal capable of perceiving acoustic stimuli. If this shift is reversed and the hearing threshold returns to normal, the effect is called a temporary threshold shift (TTS). The onset of TTS is often defined as threshold shift of 6 dB above the normal hearing threshold (Southall *et al.* 2007). If the threshold shift does not return to normal, the residual shift is called a permanent threshold shift (PTS). PTS is hearing loss from which marine fauna do not recover (permanent hair cell or receptor damage). PTS is considered injurious in marine mammals.

Threshold shifts can be caused by acoustic trauma from a very intense sound of short duration, as well as from exposure to lower-level sounds over longer time periods (Houser *et al.* 2017). Injury to the hearing apparatus of a marine animal may

result from a fatiguing stimulus measured in terms of SEL, which considers the sound level and duration of the exposure signal. Intense sounds may also damage the hearing apparatus independent of duration, so an additional metric of SPL_{pk} is needed to assess acoustic exposure injury risk.

The sound exposure thresholds applied for cetaceans in the acoustic modelling study, and in this impact assessment, are summarised in Table 7-4, and are explained in more detail in the acoustic modelling report (Appendix D:). Frequency weighting is also explained in Appendix A.3 of Appendix D:. The peak pressure levels (SPL_{pk}) and frequency-weighted accumulated sound exposure levels (SEL) presented in Table 7-4 are from the 'U.S. National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) in marine mammals'. The marine mammal behavioural threshold presented in Table 7-4 is based on the current interim U.S. National Marine Fisheries Service (NMFS) (NMFS 2014) level of 160 dB re 1 µPa SPL for impulsive sound sources.

In October 2024, NOAA released an Updated Technical Guidance (NMFS 2024) which provided a new set of sound exposure thresholds for the onset of PTS and TTS (Table 7-5). Additionally, the updated guidance adopts the marine mammal hearing group terminology from Southall et al. (2019), whereby mid-frequency (MF) cetaceans are now considered high-frequency (HF), and HF cetaceans are now grouped as very high-frequency (VHF). The revised thresholds have higher SPL_{pk} thresholds for low-frequency (LF) cetaceans and are therefore considered less conservative. However, a LF cetacean weighting function that has been included in the new thresholds demonstrates better sensitivity at the lower end of the spectrum, and therefore it is possible that despite less conservative thresholds for impulsive noise than NMFS (2018), impact ranges may be larger. For HF and VHF cetaceans, the SEL_{24h} thresholds are higher and therefore are considered less conservative. There has been no new modelling completed to account for this change in thresholds, however the implications have been considered. Given the noise modelling uses the NMFS (2018) thresholds, the marine mammal hearing group terminology (LF, MF, HF cetaceans) is used below.

In marine mammals, the onset level and growth of TTS is frequency specific, and depends on the temporal pattern, duty cycle and the hearing test frequency of the fatiguing stimuli. Sounds generated by seismic airguns, pile-driving and mid-frequency sonars have been tested directly and proven to cause noise-induced threshold shifts in marine mammals at high received levels. There is, however, considerable individual difference in all TTS-related parameters between subjects and species tested so far. There are no published data on the sound levels that cause PTS in marine mammals. The NMFS (2018; 2024) criteria incorporate the best available science to estimate PTS onset in marine mammals from sound energy (SEL_{24h}), or very loud, instantaneous peak sound pressure levels. Hence, PTS effects in marine mammals should be viewed as theoretical, as they have never actually been demonstrated in either captive or wild animals.

Table 7-4 – Unweighted SPL, SEL_{24h}, and SPL_{pk} Thresholds for Acoustic Effects on Cetaceans

Hearing Group	**NMFS (2014)**	**NMFS (2018)**			
	Behaviour	**PTS onset thresholds* (received level)**		**TTS onset thresholds* (received level)**	
	Unweighted SPL (dB re 1 µPa)	**Weighted SEL_{24h} (dB re 1 µPa2·s)**	**SPL_{pk} (dB re 1 µPa)**	**Weighted SEL_{24h} (dB re 1 µPa2·s)**	**SPL_{pk} (dB re 1 µPa)**
Low-frequency (LF) cetaceans	160	183	219	168	213
Mid-frequency (MF) cetaceans		185	230	170	224
High-frequency (HF) cetaceans		155	202	140	196

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset.

Table 7-5 Unweighted SPL and Updated SEL_{24h} and SPL_{pk} Thresholds for Acoustic Effects on Cetaceans

Hearing Group	**NMFS (2014)**	**NMFS (2024)**			
	Behaviour	**PTS onset thresholds* (received level)**		**TTS onset thresholds* (received level)**	
	Unweighted SPL (dB re 1 µPa)	**Weighted SEL_{24h} (dB re 1 µPa2·s)**	**SPL_{pk} (dB re 1 µPa)**	**Weighted SEL_{24h} (dB re 1 µPa2·s)**	**SPL_{pk} (dB re 1 µPa)**
Low-frequency (LF) cetaceans	160	183	222	168	216

Hearing Group	NMFS (2014)	NMFS (2024)			
	Behaviour	PTS onset thresholds* (received level)		TTS onset thresholds* (received level)	
	Unweighted SPL (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 µPa2·s)	SPL_{pk} (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 µPa2·s)	SPL_{pk} (dB re 1 µPa)
High-frequency (HF) cetaceans		193	230	178	224
Very high-frequency (VHF) cetaceans		159	202	144	196

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset.

7.1.5.1.2 Impact Assessment

The type and scale of the effect of seismic sound on cetaceans will depend on a number of factors including the level of exposure, the physical environment, the location of the animal in relation to the sound source, how long the animal is exposed to the sound, the exposure history, how often the sound repeats (repetition period) and the ambient sound level. The context of the exposure plays a critical and complex role in the way an animal might respond (Gomez *et al.* 2016; NMFS 2016). Without appropriate control measures in place, noise emissions from the seismic source have the potential to impact cetaceans by causing changes to hearing (PTS and TTS) as a result of high sound levels at close range to the seismic source, or behavioural disturbance impacts.

As described in Section 4.3.6 the humpback whale migration BIA is located approximately 15 km south of the Operational Area. The breeding, nursing and calving BIA for humpback whales along the Kimberley coastline is located 255 km east of the Operational Area. However, the proposed timing for acquisition of the Sauropod 3D MSS (January to May) means that there will be no overlap with either the northbound or southbound migration of humpback whales through the region (June to October; refer Table 4-10).

The Pygmy Blue Whale migration BIA passes along the shelf edge at depths between 500 m and 1,000 m. The migration BIA is located 72 km from the Operational Area. Acquisition of the survey may overlap the commencement of the northbound migration (April), but avoids the southbound migration period for Pygmy Blue Whales in the region (October - December; refer Table 4-10). Possible foraging areas for the Pygmy Blue Whale have been identified as off Exmouth and Scott Reef and Perth Canyon (Gill pers. comm, cited in DoE 2015; Thums et al. 2022), the closest area being approximately 400 km distant from the Operational Area. Hence, there is a possibility of isolated individuals transiting through the Operational Area during the start of the northern migration in the region. However, satellite tagging and passive acoustic data indicates only minor use of continental shelf waters and limited foraging by migrating pygmy blue whales along the northwest coast where the Operational Area is located (Thums et al. 2022).

As summarised in Table 4-10, there is the possibility that a number of other cetacean species may be present in the Operational Area during acquisition of the survey (e.g. Bryde's, Fin, Sei, Killer and Sperm whales, Spotted bottlenose dolphin). The presence of these cetacean species within the Operational Area during acquisition of the survey is likely to be limited to occasional transit of isolated individuals or small pods.

No high-frequency (HF) cetaceans are likely to be present in the Operational Area and surrounding waters, and accordingly the impact assessment is focused on low-frequency (LF) cetaceans (baleen whales) and mid-frequency (MF) cetaceans (toothed whales and dolphins). It is noted that while Dugongs were identified as potentially occurring in the EMBA through a PMST search, they are not expected to occur in or around the Operational Area due to the absence of suitable shallow water habitats. Impacts to Dugongs as a result of underwater sound from the seismic source are therefore not expected and are not addressed in this assessment.

Table 7-6 presents the results of the acoustic modelling study for maximum predicted R_{max} distances to PTS (injury), TTS and behavioural response thresholds (NMFS 2014; 2018) for cetaceans, and the spatial extent (area) of these zones of potential impact (where relevant), for all modelled scenarios (four single impulse sites and one multiple pulse scenario). The results for the thresholds applied for cetacean PTS and TTS consider both single-pulse SPL_{pk} and multiple-pulse SEL_{24h}. In accordance with NMFS (2018) recommendations the longest distance associated with either metric is required to be applied for an impact assessment.

Table 7-6 – Maximum Predicted Horizontal Distances (R_{max}) To PTS (Injury), TTS and Behavioural Response Thresholds in Cetaceans, for All Modelled Scenarios

Hearing Group	Sound Exposure Threshold (Frequency Weighted)	R_{max} Distance (Km)
PTS		
LF-cetaceans	219 dB re 1 µPa (SPL_{pk})	0.03
	183 dB re 1 µPa2.s (SEL_{24h}) #	0.63
MF-cetaceans	230 dB re 1 µPa (SPL_{pk})	0.02
	185 dB re 1 µPa2.s (SEL_{24h}) #	-
TTS		
LF-cetaceans	213 dB re 1 µPa (SPL_{pk})	0.06
	168 dB re 1 µPa2.s (SEL_{24h}) #	15.4
MF-cetaceans	224 dB re 1 µPa (SPL_{pk})	0.02
	170 dB re 1 µPa2.s (SEL_{24h}) #	-
Behavioural Response		
LF-cetaceans MF-cetaceans	160 dB re 1 µPa (SPL)	8.36

The model does not account for shutdowns. A dash indicates that the threshold is not reached.

7.1.5.1.2.1 Instantaneous PTS and TTS

As shown in Table 7-6, instantaneous PTS and TTS impacts (based on the single pulse (SPL_{pk}) metric) to LF-cetaceans (such as Pygmy Blue Whales) are predicted to be constrained to within 30 m and 60 m of the seismic source, respectively. For MF-cetaceans (such as sperm whales and killer whales) instantaneous PTS and TTS impact are predicted to occur within 20 m only.

These distances are well within the precaution and shutdown zones identified in Section 7.1.7 and therefore instantaneous impact is not considered likely because the airgun array will only be started after the observation zone has been thoroughly searched by MFOs and if cetaceans have escaped detection, will not be exposed to full power because the airgun array will be started on low power (soft-start). This is likely to alert cetaceans to the disturbance and encourage them to move away before full power is achieved. Should cetaceans come within the shutdown zone of the airguns on full power, the airgun array will be powered down.

7.1.5.1.2.2 Cumulative PTS and TTS

As discussed above, the 24-hour SEL is a cumulative metric that reflects the dosimetric (measured dose) impact of noise levels over a period of 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position and therefore is used as a conservative basis of this impact assessment. As shown in Table 7-6, cumulative PTS and TTS impacts to LF-cetaceans (such as Pygmy Blue Whales) are predicted to be constrained to within 0.63 km and 15.4 km of the seismic source, respectively. This zone of potential TTS effects does not overlap the migration BIA for Pygmy Blue Whales (Table 4-5). For MF cetaceans, the SEL_{24h} threshold was not exceeded.

As above, a LF cetacean weighting function that has been included in the new NMFS (2024) thresholds demonstrates better sensitivity at the lower end of the spectrum, and therefore it is possible that impact ranges may be larger. However, even if the range to TTS onset was doubled to ~30 km, this would still be well within the distance to the Pygmy Blue Whale migration BIA (72 km) and there would be no impact to whales in the BIA.

More realistically, whales would not stay in the same location or at the same range from the seismic source for 24 hours. This would particularly be the case for an animal migrating through offshore waters that do not represent critical foraging habitat or a narrow restricted migratory pathway, as is the case of the Sauropod Operational Area which is 72 km distant from the migratory BIA (Figure 4-11). Therefore, a reported radius for SEL_{24h} criteria does not mean that a whale travelling within this radius of the source will experience PTS or TTS, but rather that an animal could be exposed to the sound levels associated with these effects if it remained in that range for 24 hours (Quijano and McPherson *et al.* 2019).

A tagging study of blue whales showed that migrating individuals can travel 50 to 100 km per day (Double *et al*, 2012). This equates to an average swimming speed of 2-4 km/hr over a 24-hour period. A tagging study of southern right whales found that individuals have a maximum swimming speed of 7.2 km/hr (Childerhouse *et al.* 2010). Finally, Mate *et al* (1997) found that tagged northern right whales had a mean migration speed of 3.5 km/hr. Based on this evidence and for the purpose of

detailing this impact, it is reasonably assumed that blue whales in the proximity of the seismic vessel will be traveling at a mean speed of 3 km/hr. In comparison, the seismic vessel will be traveling at around 4.5 knots (8 km/hr).

Migrating Pygmy Blue Whales will be generally moving perpendicular to the survey lines, so it can conservatively be assumed the vessel is effectively stationary to the Pygmy Blue Whale movement if they are present. Therefore, given sound levels from the seismic source will only exceed the PTS SEL_{24hr} metric for LF cetaceans for up to 0.63 km from the vessel, the whale could only remain in the area around the vessel where sound levels were sufficient to elicit a 24-hour cumulative exposure response for less than an hour.

Similarly for cumulative exposure TTS, sound levels from the seismic source will exceed the TTS SEL_{24hr} metric for LF cetaceans for up to 15.4 km from the vessel. A whale is expected to pass through the ensonified area (up to approximately 30 km) in approximately 10 hours. Given the proposed controls including observation, soft-start and shutdown procedures implemented in accordance with EPBC Act Policy Statement 2.1, the risk of TTS is reduced.

7.1.5.1.2.3 Behavioural Response

The predicted maximum distance to the NMFS (2014) marine mammal behavioural threshold (single-pulse 160 dB re 1 µPa SPL), for both LF and MF-cetacean, is approximately 8.4 km, across all water depths modelled (refer Table 7-6). The survey is not anticipated to significantly inhibit the migration of Pygmy Blue Whales since the ensonified area only overlaps a small proportion of their known distribution area.

There are no known foraging areas within the vicinity of the proposed survey, with the closest possible foraging area identified to be approximately 400 km distant from the Operational Area. The potential for PTS or TTS effects from single impulse or cumulative sound exposures does not extend to the Pygmy Blue Whale migration BIA, which is located is located 72 km to the north of the Operational Area. Therefore, no injury or hearing impairment is expected to occur to Pygmy Blue Whales, and sound levels received in the BIA from the seismic survey will be well below levels associated with behavioural impacts. Therefore, Pygmy Blue Whales will continue to utilise their migration route without injury or displacement. The proposed timing of the Sauropod 3D MSS (between January and May) also mostly avoids the Pygmy Blue Whale migration periods, with the exception of April/May when some Pygmy Blue Whales may be migrating north towards Indonesia (Table 4-10).

The potential impacts of noise emissions from the seismic source on cetaceans during acquisition of the Sauropod 3D MSS are considered to be slight and short-term, and most likely limited to temporary behavioural changes (avoidance) in individuals.

7.1.5.1.3 Summary

Based on the timing and duration of the survey, the absence of critical habitats for any species of cetacean (i.e. feeding, breeding, calving areas) or a constricted migratory pathway within the Operational Area and surrounding waters, and the control measures proposed, predicted noise levels from seismic acquisition are not considered likely to cause injury (PTS/TTS) effects or disturb foraging activity for Pygmy Blue Whales or any other species of large whale that may be present within or adjacent to the Operational Area.

7.1.5.2 Marine Reptiles

7.1.5.2.1 Species Sensitivity and Sound Exposure Thresholds

Hearing has been studied in only a few individual marine turtles. Turtles have been shown to respond to low frequency sound, with indications that they have the highest hearing sensitivity in the frequency range 100–700 Hz.

Thresholds of 232 dB re 1 µPa (SPL_{pk}) for PTS effects and 226 dB re 1 µPa (SPL_{pk}) for TTS effects (Finneran *et al.* 2017), were applied for this impact assessment. A behavioural response threshold of 166 dB re 1 µPa SPL (NSF 2011), along with a sound level associated with an increased level of behavioural response of 175 dB re 1 µPa (SPL) (Moein *et al.* 1995; McCauley *et al.* 2000a, 2000b; NSF 2011) were also applied for this impact assessment.

Sea snake responses to seismic survey sound emissions are not well studied and thus conservatively assumed to be similar to that of turtles as described above.

7.1.5.2.2 Impact Assessment

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017) identifies acute noise interference from anthropogenic noise sources, such as seismic surveys, as a threat to the WA stocks of Green, Flatback, Loggerhead, Hawksbill and Olive ridley turtles in the North West Shelf, Pilbara and Browse Basin regions (refer Table 4-8).

Without appropriate control measures in place, noise emissions from the seismic source have the potential to impact marine reptiles (turtles and sea snakes) by causing changes to hearing (PTS and TTS) as a result of high sound levels at close range to the seismic source, or behavioural disturbance impacts.

As described in Section 4.3.8, there are several BIAs for turtle species in the region, including those along the coastline and around offshore islands. The closest BIA is at least 15 km from the Operational Area. No foraging, internesting, or nesting BIAs overlap with the Operational Area. The proposed timing for acquisition of the Sauropod 3D MSS (between January and May) means that there will be overlap with the nesting and breeding seasons for Green, Flatback, Loggerhead, Hawksbill and Olive ridley turtles in the region (October to March; refer Table 4-10). Hence, there is a low probability of isolated individuals transiting through the Operational Area during acquisition of the survey.

At least 20 species of sea snake occur within the region, and two threatened sea snake species (the Short-nosed sea snake and Leaf-scaled sea snake) were identified in the EPBC Act Protected Matters Database search as having the potential to occur in the Operational Area and surrounding waters. No coral reefs or shoals occur within or in close proximity to the Operational Area, and therefore sea snakes are expected to occur in very low numbers, if at all.

Table 7-7 presents the results of the acoustic modelling study for maximum predicted R_{max} distances to PTS, TTS and behavioural response thresholds in turtles for all modelled scenarios (four single impulse sites and one multiple pulse scenario).

Table 7-7 – Maximum Predicted Horizontal Distances (R_{max}) To PTS (Injury), TTS and Behavioural Response Thresholds in Turtles, for All Modelled Scenarios

Hearing Group	Sound Exposure Threshold	Distance R_{max} (Km)
PTS	232 dB re 1 µPa (SPL_{pk})	0.02
TTS	226 dB re 1 µPa (SPL_{pk})	0.02
Behavioural response	175 dB re 1 µPa (SPL)*	1.2
	166 dB re 1 µPa (SPL)#	5.1

Threshold for turtle behavioural response to impulsive noise (NSF 2011).

* Threshold for turtle behavioural response to impulsive noise (Moein *et al.* 1995).

As shown in Table 7-7, the Finneran *et al.* (2017) SPL_{pk} turtle injury (PTS) and TTS threshold criteria of 232 dB re 1 µPa (PTS) and 226 dB re 1 µPa (TTS) were not exceeded at a distance greater than 20 m from the centre of the seismic array. Because the array is not a point source (measuring approximately 14 × 8 m in the horizontal plane), the actual effect range from the edge of the array will be less than 20 m. The NMFS criterion (NSF 2011) for behavioural effects in turtles (166 dB re 1 µPa SPL) could be exceeded within a distance of approximately 5 km of the operating array, and the Moein *et al.* (1995) criterion of 175 dB re 1 µPa (SPL) could be exceeded within 1.2 km of the array.

7.1.5.2.3 Summary

As described above, at the closest point, the Operational Area is located at least 95 km from the nearest nesting BIA for turtles (Flatback turtle nesting BIA adjacent to Eighty Mile Beach), and at least 105 km from the foraging BIA for Green, Flatback and Loggerhead turtles adjacent to the Dampier Peninsula (refer Figure 4-13). At the closest point, the Operational Area is located at least 60 km from the 'Habitat Critical' for Flatback turtles adjacent to Eighty Mile Beach (Figure 4-14). To the north of the Operational Area there are no BIAs or 'Habitat Critical' for marine turtles surrounding the Rowley Shoals.

The potential impacts of noise emissions from the seismic source on marine turtles during acquisition of the Sauropod 3D MSS are considered to be slight and short-term, and restricted to temporary behavioural changes (avoidance) in any isolated individuals that may transit the area in close proximity to the operating seismic source. Based on the timing and duration of the survey, the separation distances to BIAs and 'Habitat Critical' areas, and the control measures proposed, predicted noise levels from seismic acquisition are not considered likely to cause PTS effects, displace any individuals from the internesting BIA or 'Habitat Critical' areas, or result in any ecologically significant impacts at a population level for any species of turtle that may be present within or adjacent to the Operational Area during the survey.

Sea snake responses to seismic survey sound emissions are not well studied and are thus conservatively assumed to be similar to that of turtles. Sea snakes tend to occur in shallow coastal waters or coral reef habitat and are not expected to be common in the Operational Area. Therefore, impacts are likely to be limited to occasional disturbances to transient individuals. The potential consequence to sea snake populations is considered to be not significant.

7.1.5.3 Seabirds

As described in Section 4.3.9, eight threatened, twelve migratory, and four marine birds were identified by a search of the EPBC Act Protected Matters Database as potentially occurring in the Operational Area. Seabird species that spend the majority of their lives within the region breed at locations along the coast of Australia and at offshore islands, including at the Lacepede Islands and the Rowley Shoals. The Operational Area overlaps a breeding and foraging BIA for the White-tailed tropicbird, and a breeding BIA for the Lesser frigatebird.

Impacts to foraging seabirds have not been observed previously during seismic surveys. Only birds diving and foraging within the Operational Area have the potential to be exposed to increased sound levels generated by the operating seismic source while diving for small pelagic fishes near the sea surface. Such behaviours may result in a startle response during diving. Birds resting on the surface of the water in proximity to the seismic vessel have limited potential to be affected by sound emissions underwater due to the limited transmission of sound energy between the water/air interface but may be startled by seismic pulses in close proximity to the seismic source. However, given the likely avoidance response from fish and other prey species in waters immediately surrounding the seismic source, birds are unlikely to forage near the operating seismic source. In the unlikely event that birds dive and forage near the seismic source, this is likely to only affect individual birds, resulting in a startle response with the affected birds expected to move away from the area as a result. The consequence of this is expected to be negligible and impacts at a population level are extremely unlikely to occur. Lesser frigatebirds and White-tailed tropicbirds will not be displaced from the wider areas of the breeding and foraging BIAs.

7.1.5.4 Fishes and Elasmobranchs

7.1.5.4.1 Species Sensitivity and Sound Exposure Thresholds

The most relevant metric for perceiving underwater sound for most fish species is particle motion but, with the exception of a few species (Popper and Fay 2011; Popper *et al.* 2014), there is an almost complete lack of relevant data on particle motion sensitivity in fishes (Popper and Hawkins 2018). The majority of fish species detect sounds from below 50 Hz up to 500–1,500 Hz. A smaller number of species can detect sounds to over 3 kHz, while a very few species can detect sounds to well over 100 kHz. The critical issue for understanding whether an anthropogenic sound affects hearing is whether it is within the hearing frequency range of a fish and loud enough to be detectable above background ambient noise. For this impact assessment, it is assumed that all fishes can detect signals below 500 Hz and so can 'hear' the seismic source.

The auditory capabilities of fishes vary depending upon the auditory structures in the inner ear (otoliths surrounded by an epithelium of hair cells) and, if present, the swim bladder (Finneran and Hastings 2000; Nedwell *et al.* 2004). Otoliths are sensitive only to particle motion, while the swim bladder may provide an indirect route for sound pressure to reach the inner ear. The other main mechano-reception system in fish is the lateral line system, which runs along the side of the body of fishes and is more pronounced in some groups of fishes than others. The lateral line system responds to particle motion produced in the near field of a sound source, as well as to tiny water currents set up by the fishes' own motion (Nedwell *et al.* 2004). Therefore, all fish are sensitive to the particle motion component of sound, which is more dominant than sound pressure at close range from a sound source, while some more specialised fishes with a swim bladder involved in their hearing are sensitive to sound pressure and are capable of detecting less intense noise and a wider range of frequencies compared to less-specialised groups of fish (Popper *et al.* 2014; Hawkins and Popper 2017; Carroll *et al.* 2017).

In marine fishes, the connection with the swim bladder and ability to detect sound pressure is understood to be present to some varying degree in the families Clupeidae (e.g. herrings, sardines, pilchards and shads), Gadidae (e.g. true cods such as Atlantic cod and Whiting), and some nearshore / reef species relevant to tropical Australia, including some species in the families Pomacentridae (e.g. Damsel fishes and Clown fishes), Holocentridae (Soldierfishes and Squirrelfishes) and Haemulidae (e.g. Grunters and Sweetlips) (Nedwell *et al.* 2004; Braun and Grande 2008; Popper *et al.* 2014; Salgado-Kent *et al.* 2016; Popper and Hawkins 2018, 2019). However, the vast majority of marine fish species do not have this hearing specialisation.

Many fish species possess a swim bladder or other gas-filled cavity but do not have a connection with their hearing. This is true of the various demersal snapper, emperor, cod and grouper species that occur in the Operational Area that are targeted by the demersal scalefish fisheries.

Fish species that lack a gas-filled cavity altogether, include elasmobranchs (e.g. sharks and rays), some flat fishes, some tunas, and mackerels (Casper *et al.* 2012; Popper *et al.* 2014). This is true of the sharks, mackerel species and some tuna species that may occur in the Operational Area, including Spanish mackerels and other mackerel species targeted by the Mackerel Managed Fishery.

Therefore, the modelling study (Quijano and McPherson 2020; Appendix D:) assesses the ranges for quantitative threshold criteria for potential mortality/injury and hearing impairment based on the Popper *et al.* (2014) guidelines, and considered both SPL_{pk} and SEL_{24h} metrics for both water column and sea floor associated with mortality/PMI and impairment in the following groups:

- I - Fish without a swim bladder (also appropriate for sharks in the absence of other information)
- II - Fish with a swim bladder that do not use it for hearing
- III - Fish that use their swim bladders for hearing
- Fish eggs and fish larvae.

The sound exposure thresholds applied for fishes and elasmobranchs (sharks and rays) in the acoustic modelling study, and in this impact assessment, are summarised in Table 7-8, and explained in more detail in the acoustic modelling report (Appendix D:).

Note that the following assessment focusses primarily on impacts to fishes. The assessment of impacts to fish eggs and larvae is addressed in more detail in the assessment of impacts to zooplankton in Section 7.1.5.6. The assessment of impacts to fish spawning and recruitment success as a result of behavioural effects in fishes and impacts to eggs and larvae is subsequently assessed in Section 7.1.5.7.

Table 7-8 – Sound Thresholds for Seismic Sound Exposure for Fish, Fish Eggs and Larvae, Adapted from Popper *et al.* (2014)

Type of animal	Mortality and Potential mortal injury	Impairment Recoverable injury	TTS	Masking	Behaviour
Fish: No swim bladder (particle motion detection)	219 dB SEL_{24h} or 213 dB SPL_{pk}	216 dB SEL_{24h} or 213 dB SPL_{pk}	186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} or 207 dB SPL_{pk}	203 dB SEL_{24h} or 207 dB SPL_{pk}	186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or 207 dB SPL_{pk}	203 dB SEL_{24h} or 207 dB SPL_{pk}	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate (I) High (F) Moderate	(N) High
Fish eggs and fish larvae	210 dB SEL_{24h} or 207 dB SPL_{pk}	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Peak sound level (SPL_{pk}) dB re 1 µPa; SEL_{24h} dB re 1µPa2·s. All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist. Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

7.1.5.4.1.1 Mortality / Injury likely to cause mortality

It is noted that while thresholds for fish mortality have been included for consideration in this assessment based on the Popper *et al.* (2014) guidelines, no studies to date have demonstrated direct mortality of adult fish in response to airgun emissions, even when fired at close proximity (within 1–7 m) (DFO 2004; Boeger *et al.* 2006; Popper *et al.* 2016; Carroll *et al.* 2017). Although some fish deaths have been reported during cage experiments, these were more likely caused by experimental artefacts of handling or confinement stress (Hassel *et al.* 2004, as cited in NSW DPI 2014). For free-swimming fish that are able to move away from seismic sources as they approach, the potential for lethal physical damage from airgun emissions is even further nullified. However, reef or bottom-dwelling fish that show greater site attachment may be less inclined to flee from a seismic sound source and experience greater effects as a consequence.

Despite mortality being a possibility for fish exposed to airgun sounds, Popper *et al.* (2014) do not reference an actual occurrence of this effect. In Popper *et al.* (2014) pile driving data was used as a proxy as the research to date had not identified a threshold level where mortality has been observed. Since the publication of that report, newer studies have further examined the question of possible mortality. Popper *et al.* (2016) adds further information to the possible levels of impulsive seismic airgun sound to which adult fish can be exposed without immediate mortality. They found that the two fish species in their study (Pallid sturgeon and Paddlefish), with body masses in the range 200–400 g, exposed to a single shot of a maximum received level of either 231 dB re 1 µPa (SPL_{pk}) or 205 dB re 1 µPa2·s (SEL), remained alive for seven days after exposure and that the probability of mortal injury did not differ between exposed and control fish. They also found no difference in injuries between fish exposed closest to the source compared to those further away. Thus, this study, using an actual seismic source, did not show mortality at a level higher than the mortality, potential mortal injury and recoverable injury to the threshold of 207 dB re 1 µPa (SPL_{pk}) applied in this impact assessment.

ERM (2017) conducted a detailed literature review of potential fish mortality and physical injury as a result of exposure to seismic sources. Only three studies of the 23 reviewed observed direct mortality of exposed fish:

- Booman *et al.* (1996) – at received levels (RL) of 241-231 dB SPL_{pk}
- Weinhold and Weaver (1972) – at RL of 234 dB SPL_{pk}
- Matishov (1992) – at RL of 220 dB SPL_{pk}.

In each case mortalities occurred to caged fish that were constrained within very close proximity to the airguns (2 m). The results of the Matishov (1992) study should be treated with some caution, given the lack of detail provided for this experiment.

Eleven other studies did not observe mortality effects or injury likely to result in mortality, at RL levels ranging from 246-220 dB SPL_{pk}. Fanta (2004) found no mortality or physical damage in coral reef fishes exposed in cages to RL ranging from 235-215 dB SPL_{pk}. The relevance of the findings of this study are regarded as high, given that the RL were measured and that the experiment involved exposure of 15 different fish species to a full commercial seismic array (3,090 cui) at a minimum exposure distance of 45 m. Wardle *et al.* (2001) did not observe any mortality or physical damage in free-ranging temperate reef fish exposed to RL of 218 dB SPL_{pk}, at a minimum exposure distance of 5.3 m. Again, the relevance of the results of this experiment is regarded as high, in that the RL were measured rather than estimated.

Based on the above studies, the Popper *et al.* (2014) thresholds of 207 and 213 dB re 1 µPa (SPL_{pk}) applied in this impact assessment for mortality, mortal injury and recoverable injury in fishes are potentially conservative.

7.1.5.4.1.2 TTS

Temporary hearing impairment (TTS) can occur due to fatigue and temporary changes to the epithelium (hair cells) of the inner ear and/or damage to auditory nerves innervating the ear, which has the potential to occur in some fishes exposed to intense sound pressures for prolonged periods of time (Smith *et al.* 2006; Popper *et al.* 2014; Liberman 2015).

After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure (e.g., Popper and Clarke 1976; Scholik and Yan 2001; Amoser and Ladich 2003; Smith *et al.* 2004a; 2004b; 2006; 2011; Popper *et al.* 2005; 2007). While experiencing TTS, fishes may have a decrease in fitness in terms of communication, detecting predators or prey, and/or assessing their environment."

The impact threshold of 186 dB re 1 µPa2·s proposed by Popper *et al.* (2014) in Table 7-8 is based on exposure of a freshwater fish species with a connection between the swim bladder and inner ear (more specialised hearing than the demersal and pelagic fish species likely to occur in the Sauropod 3D MSS Operational Area). Fish that showed TTS recovered to normal hearing levels within 18–24 hours. Given that reliable auditory frequency weightings have not been defined for the three categories of fish in the way they have been for cetaceans (Section 7.1.6.1), the 186 dB re 1 µPa2·s SEL_{24h} criteria in Table 7-8 includes a level of conservatism as:

- The types of fish that are likely to occur in the Sauropod 3D MSS Operational Area do not possess a direct connection between the swim bladder and the inner ear; they are therefore sensitive primarily to particle motion rather than sound pressure and may be less sensitive than the types of fish upon which the 186 dB re 1 µPa2·s threshold is derived
- Modelled SELs are based on broadband sounds and may therefore account for more sound energy associated with frequencies that are not within the auditory ranges of the fish species likely to occur in the Sauropod 3D MSS Operational Area.

- The main contribution of sound energy to the onset of TTS will occur over just a few hours when the source is at the closest point of approach; the 24-hour modelled accumulation period accounts for additional sound energy accumulated while the seismic source is at greater distances and potentially not audible to fishes.

It is also noted that many of the available studies on TTS are based on captive fish, whereas free-swimming fishes in the wild are likely to make some effort to avoid the intense sound pressures that contribute the most to the onset of TTS. If TTS does occur, the effects are temporary and will recover.

7.1.5.4.1.3 Behavioural Effects

Behavioural effects of noise on fish will vary depending on the circumstances of the fish, hearing sensitivity, the activities in which it is engaged, its motivation, and the context in which it is exposed to sounds (Hawkins and Popper 2017). Responses may include avoidance behaviours, startle reactions, increased swimming speed, change in orientation, change in position in the water column, changes to schooling behaviour (e.g. tightening of school structure), and temporary avoidance of an area (Simmonds and MacLennan 2005; McCauley *et al.* 2000a; Fewtrell and McCauley 2012; Popper *et al.* 2014; Carroll *et al.* 2017). Changes in movement patterns may also temporarily divert efforts away from feeding, egg production and spawning success (Hawkins and Popper 2017). The potential extent and duration of behavioural effects based on studies of seismic exposure are summarised below.

A degree of caution should be given when interpreting behavioural studies, given that many are conducted on captive fish, which may not provide an accurate representation of responses in free-swimming fish in the wild (Popper *et al.* 2014; Salgado Kent *et al.* 2016; Carroll *et al.* 2017). Behavioural studies are also highly subjective. Extrapolation of observed effects on fishes should also be undertaken with caution (Carroll *et al.* 2017). This is particularly the case given that many exposure experiments report received sound pressure levels or sound exposure levels, even though the most relevant metric for most fish species is particle motion (Popper and Hawkins 2018; Popper *et al.* 2019). Many exposure experiments are undertaken using a single airgun and it is not clear how transferrable the behaviours and received SPL/SEL levels are to a full commercial-sized seismic array, particularly if observed behaviours are in response to particle motion close to the sound source rather than to sound pressure.

Pearson *et al.* (1992) exposed captive demersal rockfish to multiple 10-minute periods of seismic sound from a seismic source towed at distances of less than 215 m, which is not representative of real-life exposures to a seismic survey. Schools of rockfish were observed to exhibit a ‘startle’ response (shudders, flexions of the body followed by rapid swimming) at sound levels above 200–205 dB re 1µPa SPL. An ‘alarm’ response (change in vertical position in the water column to be closer to the seabed, short-term post-exposure behavioural changes) was found to occur above approximately 180 dB re 1 µPa SPL, although it was suggested that some individuals may begin to exhibit subtle changes in behaviour and position in the water column at sound levels above 161 dB re 1µPa SPL. Changes in behaviour were found to return to normal before the end of the sound exposure or within just minutes of the sound ceasing, indicating only very short-term, transient effects and potential habituation to the disturbance.

Santulli *et al.* (1999) exposed caged European sea bass (a demersal species) to a 2,500 cubic inch seismic source. Limited response was observed at 2.5 km distance, a startle response was observed when the array was at a distance of approximately 800 m, but after passing within 180 m, fish behaviour appeared to return to normal within one hour.

The Scott Reef Study associated with the CGG Maxima 3D survey reported in McCauley *et al.* (2008) and Miller and Cripps (2013) and summarised in Salgado-Kent *et al.* (2016) included a component that examined how the behaviour of caged fish exposed to seismic signals changed. The study examined the effects to fish species in the Holocentridae family, which have adaptations linking the swim bladder to the otolith system of the inner ear, as well as to Bluestripe snapper, a demersal species without such a hearing adaptation, similar to the demersal species that are most likely to occur within the Sauropod 3D MSS Operational Area. Fish were exposed to either one or two passes of the active source at three distance categories (45–74 m, 105–131 m, 475–807 m). Alarm responses (including the startle response and behavioural avoidance) occurred within less than 200 m either side of the pass by, but responses were too infrequent to include in analyses. Less significant agitation levels (defined by changing swim direction) in Holocentridae increased with increasing received sound level above 155–165 dB re 1 uPa2.s SEL, but agitation levels did not seem to increase with increasing received sound levels for the less sensitive Bluestripe snapper (McCauley *et al.* 2008). Fish began to feed and behave normally again within 20 minutes after the passage of the seismic source (McCauley *et al.* 2008; Miller and Cripps 2013).

McCauley *et al.* (2000a, 2003) reported that trials involving captive fishes (of various species, including snappers, emperors, groupers, trevally, bream, herring and others) exposed to seismic sound showed a common ‘startle’ response (C-turns), 'alarm' responses (e.g. swimming faster, darting movements and sudden changes in school structure), or less obvious changes such as moving closer to the seabed or huddling closer together. Subtle responses such as moving closer to the seabed or changes in schooling behaviour were suggested to commence when sound levels exceeded approximately 147–

151 dB re 1 µPa2.s SEL. Similar behaviours in pink snapper and trevally were noted by Fewtrell and McCauley (2012) in response to comparable sound levels. These are minimal reactions that are likely to be an indication of awareness and perception of the sound rather than a response that could result in significant ecological impacts. More obvious startle and alarm responses were apparent in trials when received sound levels were in the order of 159–172 dB re 1 µPa2.s SEL. In situations where a behavioural response was observed, fishes were considered to have resumed normal behaviour within 4–31 minutes after cessation of the seismic activity (McCauley *et al.* 2000, 2003). Startle and alarm responses reduced with time, indicating some habituation to the sound. No statistically clear trends in physiological stress response were observed following exposure (McCauley *et al.* 2000, 2003).

Behavioural observations of two tropical snapper species and another coral reef fish species, Spadefish, in field enclosures before, during and after exposure to seismic sound showed that repeated exposure resulted in increasingly less obvious startle responses (Boeger *et al.* 2006). This is consistent with the potential habituation suggested by McCauley *et al.* (2000) and by Fewtrell and McCauley (2012).

McCauley and Salgado Kent (2007, cited in Santos Ltd 2018) observed the behaviour of Goldband snapper in fish traps in the Timor Sea using cameras placed inside the fish traps. A seismic vessel towed two 3,090 cubic inch seismic sources. Maximum signals reached at the closest trap to each seismic pass-by were 200, 202 and 212 dB re 1 µPa SPL_{pk-pk} (equivalent to approximately 194, 196 and 206 dB re 1 µPa SPL_{pk}). No dramatic behavioural responses of fish to the passing seismic source were observed. Fish generally displayed increased activity immediately after entering a trap presumably as they searched for a way out, with this activity reducing with time. Fish which had been in a trap for some time showed increased activity levels as the operating seismic source approached but were ‘quiet’ when the array passed at the point of closest approach.

The Australian Institute of Marine Science (AIMS), as part of the North West Shoals to Shore Research Program, completed a study of the potential behavioural effects of seismic sound exposure on red emperor, another key demersal species that occurs in the Operational Area and in the wider region. The results from this study show that there were no short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour, or movement of key fisheries species (Meekan *et al.* 2021).

Bruce *et al.* (2018) tagged Tiger flathead and two shark species, which were monitored during a seismic survey undertaken in Australian waters. Sharks moved freely in and out of the study area and exposed sharks did not show any indication of differences in behaviour or distribution compared with control areas. Minor behavioural effects were observed in exposed Tiger flathead, which increased their swimming speed during the seismic survey and changed daily movement patterns after the survey but showed no significant displacement. Overall, there was little evidence for consistent behavioural responses (Bruce *et al.* 2018).

Paxton *et al.* (2017) observed temperate reef fish, including snapper and grouper species, in 33 m water depths located 7.9 km from a seismic survey line using video recordings. The authors observed fish abundance and habitat use during the evening hours for three days prior to a seismic survey and then during the evening of the day when seismic activity occurred. The authors attempted to measure sound at two other reefs in closer proximity to the survey, but the hydrophones malfunctioned. No video recordings were made at the other reefs where hydrophone measurements were attempted. No hydrophone measurements were made at the reef where video recordings took place, but maximum sound levels were estimated to be in excess of 170 dB re 1 µPa SPL. Despite no clear visual evidence of behavioural responses in fishes during the seismic survey, the authors noted a 78% decline in abundance in the evening following the survey. No further recordings were made to assess when fish abundance returned to pre-exposure levels or how far they may have moved. Therefore, with limited data, it is not clear from this study if reduced abundance is attributed to the seismic sound or other natural factors such as tidal influence or food availability. However, the study may indicate a possible avoidance response and change in local abundance and distribution.

Some other studies looking at the behavioural response of sound pressure sensitive Gadidae and Clupeidae species, such as Whiting, Atlantic cod and Herring, have reported changes in vertical position in the water column, potential avoidance responses and short-term changes in distribution. Chapman and Hawkins (1969) observed that the depth distribution of free-ranging Whiting changed in response to an intermittently discharging stationary seismic source, which resulted in fish being exposed to an estimated SPL of 178 dB re 1 µPa. The fish school responded to the sound by shifting downward, forming a more compact layer at greater depth although temporary habituation was observed after one hour of continual sound exposure (Chapman and Hawkins 1969).

Hawkins *et al.* (2014) exposed free-swimming Sprat (a sound pressure sensitive Clupeidae species with a swim bladder connected to the inner ear) and Atlantic mackerel (a particle motion detecting species without a swim bladder) to playback of impulsive sound. Sprat schools were more likely to disperse laterally in response to received sound levels of approximately 135 dB re 1 µPa2.s SEL. Mackerel schools were more likely to alter their depth in the water column in response to

approximately 142 dB re 1 µPa2.s SEL. Hawkins *et al.* (2014) note how the two different species seemed to respond to the sound playback at similar sound levels despite the differences in sound sensitivity of the two species, but suggested that Mackerel were simply more "flighty" than Sprat and therefore more likely to react. The tests were also undertaken using low sound level playback in very close proximity to the schools of fish and it is not clear how relevant the sound pressure and SEL levels are in relation to Mackerel given that their response was likely driven by particle motion. The study location in a very small, enclosed, quiet, coastal sea lough, where fish were not accustomed to heavy disturbance from shipping and other intense sound sources is also very different from an open ocean location.

Slotte *et al.* (2004) monitored the effects of a 3,090 cubic inch seismic array on migrating Herring (Clupeidae) and Whiting (Gadidae), mapping their distribution and abundance in relation to the seismic survey lines. There was no significant evidence of immediate, near-field scaring reactions on the horizontal scale in response to acquiring survey lines, but there was some evidence that fish changed position in the water column, moving closer to the seabed. Some short-term changes in distribution were observed but were not statistically significant; fish consistently remained within the immediate vicinity of the survey area, but in a limited number of measurements there was an indication that fish abundance was lower near to the survey area and increased with distance out to a maximum range of 37 km. However, results were inconsistent and clear trends were not observed in all cases. Slotte *et al.* (2004) concluded that it was not possible to determine how much abundance and distribution were attributed to the seismic survey or to the fishes' natural migration patterns, food availability or other natural factors. Herring and Whiting were found to be abundant in the survey area again after a pause in seismic acquisition and monitoring of fishes for three to four days, indicating that if any displacement did occur as a result of seismic sound exposure, the displacement was temporary (i.e. less than 3–4 days) (Slotte *et al.* 2004). In similar studies, Engås *et al.* (1996) and Engås and Løkkeborg (2002) reported on the effects of seismic surveys on Atlantic cod and Haddock (Gadidae) and found that the abundance of fish was lower in the survey area compared with areas outside of the survey area, which the authors hypothesize may be the result of an avoidance response. Some differences in abundance were still detectable within the survey area five days after the survey was completed (Engås *et al.* 1996; Engås and Løkkeborg 2002).

Conversely, Peña *et al.* (2013) described the real-time behaviour of Herring schools exposed to a full-scale 3D seismic survey, observed using sonar. No changes were observed in swimming speed, swimming direction, or school size that could be attributed to a transmitting seismic vessel as it approached from a distance of 27 km to 2 km, over a six-hour period. The unexpected lack of a response to the seismic survey was interpreted as a combination of a strong motivation for feeding by the fish, a lack of suddenness of the onset of sound, and an increased level of tolerance to seismic pulses.

The following conclusions are made regarding behavioural effects to fishes, based on the literature above:

- Different fish may exhibit different behavioural responses when exposed to seismic survey noise, depending on their activities, motivation and the context in which they receive sound.
- Fishes may change position in the water column (i.e. move closer to the seabed) as a response to becoming aware of approaching seismic sound (generally observed in response to sound levels greater than 150 dB re 1 µPa2.s SEL or 160 dB re 1 µPa SPL, but this varies depending on hearing sensitivity and context) (e.g. Pearson *et al.* 1992; McCauley *et al.* 2000, 2003; Slotte *et al.* 2004; Fewtrell and McCauley 2012; Miller and Cripps 2013).
- Exposure to higher sound levels at close range to a seismic source may begin to result in more noticeable startle or alarm responses, such as changes in school structure, increased swimming speed and avoidance of the sound source (typically observed within hundreds of metres of the seismic source or in response to sound levels of approximately 150 dB re 1 µPa2.s SEL or 168–190 dB re 1 µPa SPL and varying depending on hearing sensitivity and context) (e.g. Simmonds and MacLennan 2005; McCauley *et al.* 2000, 2003; Fewtrell and McCauley 2012; Popper *et al.* 2014; Carroll *et al.* 2017).
- Many exposure experiments are undertaken using a single airgun and it is not clear how transferrable the behaviours and received SPL/SEL levels are to a full commercial-sized seismic array, particularly if observed behaviours are in response to particle motion close to the sound source rather than to sound pressure.
- Many studies indicate that fishes resume normal behaviour shortly after cessation of the acoustic disturbance (within minutes / less than an hour), with no evidence of long-term changes (e.g. Wardle *et al.* 2001; Pearson *et al.* 1992; Santulli *et al.* 1999; McCauley *et al.* 2000, 2003; Fewtrell and McCauley 2012; Miller and Cripps 2013; Meekan *et al* 2021).
- There is some evidence that fish may also tolerate gradual increases in sound levels and habituate to repeated sound exposures (Chapman and Hawkins 1969; McCauley *et al.* 2000; Boeger *et al.* 2006; Fewtrell and McCauley 2012; Peña *et al.* 2013).
- In other studies, there is some evidence that changes in distribution may persist for longer than the initial change in behaviour, i.e. position in the water column, schooling behaviours and swim speeds may return to normal relatively

quickly within minutes or hours, but their distribution may not return to normal for hours or days. Potential changes in distribution of fishes have been observed in some studies for approximately 5 days following sound exposure, although such changes are limited to studies that focused primarily on migrating sound pressure-sensitive types of fish with a swim bladder-ear connection (Clupeidae, Gadidae). These studies also acknowledge that it is difficult to attribute these changes in distribution directly to the seismic survey or to natural migration patterns, food availability or other natural factors (Slotte *et al.* 2004; Engås *et al.* 1996; Engås and Løkkeborg 2002).

Given the limited convergence in results from the available studies, the subjective nature of many assessments and the context under which fish received sound, the Popper *et al.* (2014) ANSI-Accredited Standards Committee Sound Exposure Guidelines for Fishes and Turtles determined that it is not possible to define exact sound level thresholds for changes in fish behaviours. Instead, Popper *et al.* (2014) applies relative risk criteria (Table 7-8). The criteria reflect the potential for substantial changes in behaviour for a large proportion of the animals exposed to a sound, which may alter distribution and moving from preferred sites for feeding and reproduction. These criteria do not include effects on single animals or small changes in behaviour such as a startle response or minor movements. As such, Popper *et al.* (2014) indicate that fish without a swim bladder or with no connection between the swim bladder and the inner ear may experience substantial changes in behaviour within tens or hundreds of metres of a seismic source. These peer-reviewed and accredited sound exposure criteria are reflected in CGG's risk assessment. It is acknowledged that some fishes with swim bladders may show varying levels of awareness of sound pressure at greater distances from the seismic source, but it is important to recognise changes in behaviour that may be of ecological significance from those that are not.

7.1.5.4.2 Impact Assessment

As described in Section 4.3, the Operational Area and surrounding waters represent habitat for a range of bony fishes (teleosts) and elasmobranchs (sharks and rays), including pelagic, demersal and benthic assemblages. These fish assemblages include species and stocks that are targeted by commercial fisheries in the region (e.g. Goldband snapper, Rankin cod, Red emperor, Spanish mackerel and Blue-spotted emperor). The Operational Area overlaps the Whale shark foraging BIA that extends northwards from North West Cape along the 200 m isobath.

The EPBC Protected Matters Search (refer Section 4.3) identified 31 pipefish, six seahorse, four pipehorse and one seadragon species within the Operational Area, which are listed marine species. Pipefish and seahorses occur in nearshore and coastal waters comprising suitable habitat, such as seagrass, mangrove, coral reef and sandy habitats around coastal islands and shallow reef areas. Due to the water depth range within the Operational Area (95–172 m) and absence of suitable habitat, pipefish and seahorses are unlikely to occur within the Operational Area and surrounding waters. Consequently, these listed marine species are not considered in this impact assessment.

The Operational Area also overlaps the ancient coastline at 125 m depth contour key ecological feature (KEF). Parts of this KEF, represented as rocky escarpment, are considered to provide biologically important habitat in an area predominantly made up of soft sediment. These areas of hard substrate may represent habitat for both demersal and benthic fish assemblages.

Without appropriate control measures in place, noise emissions from the seismic source have the potential to impact fishes and elasmobranchs by causing mortality / potential mortal injury (PMI), recoverable injury and hearing impairment (TTS and masking) as a result of high sound levels at close range to the seismic source, or behavioural disturbance impacts at greater distances.

Table 7-9 presents the results of the acoustic modelling study for maximum predicted R_{max} distances to mortality/potential mortal injury, recoverable injury and TTS thresholds in fishes in the Operational Area. Data are presented for both the water column (maximum over depth) and at the sea floor.

The following fish types have been identified for this assessment:

- Demersal fish species, including key commercial indicator species such as tropical snappers and emperors (families Lutjanidae and Lethrinidae)
- Pelagic fish species, including key commercial indicator species such as Spanish mackerel
- Whale sharks
- Fish assemblages associated with the ancient coastline at 125 m depth contour.

Table 7-9 – Maximum Predicted Distances (R_{max}) to Mortality/Potential Mortal Injury, Injury and TTS Thresholds for Fish, Fish Eggs and Larvae for Single-Pulse and SEL_{24h} Modelled Scenarios, For Both Water Column and at The Sea floor

Marine Fauna Group	Potential Impact	Sound Exposure Threshold	Water Column (Maximum-Over-Depth)		Sea floor	
			R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)
I - Fish: No swim bladder (incl. sharks)	Mortality/ potential mortal injury	219 dB re 1 µPa2·s (SEL_{24h})	0.03	9.75	-	-
		213 dB re 1 µPa (SPL_{pk})	0.06	NR*	0.08	NR*
	Recoverable injury	216 dB re 1 µPa2·s (SEL_{24h})	0.03	12.00	-	-
		213 dB re 1 µPa (SPL_{pk})	0.06	NR*	0.08	NR*
	TTS	186 dB re 1 µPa2·s (SEL_{24h})	2.81	720.12	2.79	715.75
II - Fish: Swim bladder not involved in hearing (particle motion detection)	Mortality/ potential mortal injury	210 dB re 1 µPa2·s (SEL_{24h})	0.03	12.44	-	-
		207 dB re 1 µPa (SPL_{pk})	0.13	NR*	0.19	NR*
	Recoverable injury	203 dB re 1 µPa2·s (SEL_{24h})	0.04	13.28	-	-
		207 dB re 1 µPa (SPL_{pk})	0.13	NR*	0.19	NR*
	TTS	186 dB re 1 µPa2·s (SEL_{24h})	2.81	720.12	2.79	715.75
III - Fish: Swim bladder involved in hearing (primarily pressure detection)	Mortality/ potential mortal injury	207 dB re 1 µPa2·s (SEL_{24h})	0.04	13.28	-	-
		207 dB re 1 µPa (SPL_{pk})	0.13	NR*	0.19	NR*
	Recoverable injury	203 dB re 1 µPa2·s (SEL_{24h})	0.04	13.28	-	-
		207 dB re 1 µPa (SPL_{pk})	0.13	NR*	0.19	NR*
	TTS	186 dB re 1 µPa2·s (SEL_{24h})	2.81	720.12	2.79	715.75
Fish eggs and larvae	Mortality/ potential mortal injury	210 dB re 1 µPa2·s (SEL_{24h})	0.03	12.44	-	-
		207 dB re 1 µPa (SPL_{pk})	0.13	NR*	0.19	NR*
	Injury	Popper *et al.* (2014) relative risk criteria#	(N) Moderate; (I) Low; (F) Low			
	TTS		N) Moderate; (I) Low; (F) Low			

A dash indicates that the threshold is not reached. * Not relevant. # Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

7.1.5.4.2.1 Demersal Fish Species

The various species of demersal snappers (Lutjanidae), emperors (Lethrinidae), rock cods and groupers (Serranidae) that are characteristic of the Operational Area do not possess a mechanical connection between the swim bladder and the ears and can be said to have mid to poor hearing ability (Tavolga and Wodinsky 1963; Higgs *et al.* 2006; Braun and Grande 2008; Engineering-Environmental Management, Inc. 2008; United States Department of the Navy 2008; Popper 2012; Caiger *et al.* 2012). Note that commercially targeted Rankin cod and other demersal rock cods are not true cods (Gadidae) and so are not considered to have the same specialised hearing sensitivity. Therefore, these species of fish are considered to belong to the group of fishes that are primarily sensitive to particle motion with some limited sensitivity to sound pressure (Group II fishes according to the Popper *et al.* 2014 classification in Table 7-8).

As shown in Table 7-9, the maximum predicted R_{max} distance to the injury threshold at the sea floor for the hearing group of fishes with swim bladders not involved in hearing (Group II, which would represent most demersal fish), is 190 m. The maximum predicted R_{max} distances to the injury thresholds for adult fish (with swim bladder), and fish eggs and larvae, in the water column is 130 m. Therefore, injury effects have the potential to occur to demersal fishes at or close to the sea floor within or adjacent to the Acquisition Area. However, as discussed above, the thresholds for mortality and injury are considered highly conservative. While injury or mortality to fishes in the immediate proximity of the seismic source is theoretically possible, free-swimming fishes such as the demersal species that are characteristic of the Operational Area are expected to be able to avoid the seismic source as it approaches their position or ramps up during soft starts. For example,

the demersal fish assemblages that are typical of the habitats in the Operational Area (predominantly snappers, emperors, cods and groupers), despite exhibiting particular habitat preferences and some fidelity to an area, can be found across a variety of habitats and are typically mobile with home ranges in the order of kilometres or tens of kilometres (Ovenden *et al.* 2004; Moran *et al.* 2004; Newman *et al.* 2008; Parsons *et al.* 2011; Harasti *et al.* 2015). Impacts to demersal fishes are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur.

Based on the maximum predicted R_{max} distances to the TTS threshold (approximately 2.8 km in the water column and at the sea floor; refer Table 7-9) individuals in demersal fish communities at or close to the sea floor within the Acquisition Area could experience TTS effects. The radii that correspond to SEL_{24h}r typically represent an unlikely worst-case scenario for SEL-based exposure since, more realistically, fishes would not stay in the same location or at the same range for 24 hours. Therefore, this method is highly conservative and a reported radius of SEL_{24h}r criteria does not necessarily mean that animals travelling within this radius of the source will suffer hearing impairment.

Popper (2018) in his review of TTS for the Santos Bethany 3D MSS, which considered similar demersal fish species as present in the Sauropod 3D MSS Operational Area, noted:

- It is highly unlikely that there would be physical damage to fishes as a result of the survey unless the animals are very close to the source (perhaps within a few metres).
- Most fishes in the Bethany region (and given the similarity in fish species, this also applies for the North West Shelf region), being species that do not have hearing specialisations, are not likely to have much (if any) TTS as a result of the Bethany 3D survey.
- If TTS takes place, its level is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity. Even if fishes do show some TTS, recovery will start as soon as the most intense sounds end, and recovery is likely to even occur, to a limited degree, between seismic pulses. Based on very limited data, recovery within 24 hours (or less) is very likely.
- Little is known about the behavioural implications of TTS in fishes in the wild. However, since the TTS is likely very transitory, the likelihood of it having a significant impact on fish fitness and survival is very low.

Therefore, it is possible that some demersal fishes may not avoid the approaching seismic source completely and some level of TTS is possible, but the effects are temporary and recoverable, and the potential for such effects to have significant implications on fish fitness and survival is low.

The majority of studies relevant to behavioural responses in demersal fish species (e.g. Pearson *et al.* 1992; Santulli *et al.* 1999; McCauley *et al.* 2000a; 2003; McCauley and Salgado Kent 2007, cited in Santos Ltd 2018; CGG 2011; Fewtrell and McCauley 2012; Miller and Cripps 2013; Bruce *et al.* 2018), indicate that exposure to a mobile seismic source and significant changes in behaviour are likely to be limited to durations of minutes or hours and occur within hundreds of metres of the seismic source as it passes.

Popper *et al.* (2014) suggest that the potential for significant behavioural impacts in the Group II category of fishes is high in the near-field (tens of metres), moderate at intermediate distances (hundreds of metres) and low in the far field (thousands of metres).

Therefore, fishes' awareness of the sound and any resultant behavioural responses may be limited to a few hours as the seismic source approaches from several kilometres away and passes, while significant startle or avoidance responses are more likely to be limited to a shorter period (less than an hour) when the seismic source passes close by. Consistent with the studies reviewed earlier in this section, behaviours may return to normal within less than an hour (sometimes just minutes) of the survey vessel passing.

Further, the implications for demersal fishes at a population level are expected to be limited. McCauley (1994) suggests that behavioural changes in fishes may only be localised and temporary, without significant repercussions at a population level. Hawkins and Popper (2016) highlight that some responses to artificial sound may have minimal or no consequences for populations. For example, short-term startle responses to sounds that rapidly diminish with repeated presentation, or that do not change the overall behaviour of fishes are unlikely to affect key life functions. In addition, anthropogenic sound events that are transient in nature, such as a seismic survey, and result in short-term impacts do not necessarily translate into long-term consequences to populations (Hawkins and Popper 2016). Most recently, Meekan *et al* (2021) demonstrated there were no short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour, or movement of several demersal fish species in the survey area.

7.1.5.4.2.2 Pelagic Fish Species

Most pelagic fishes likely to be present in the region would belong to the Suborder Scombroidei, (which includes all of the large, pelagic, fast-swimming fish species): Family Sphyraenidae (barracudas); Family Gempylidae (snake mackerels); Family Trichiuridae (cutlassfishes) Family Scombridae (mackerels and tunas); Family Xiphiidae (swordfishes); and Family Istiophoridae (billfishes).

Scombridae species are hearing generalists (narrower frequency range with higher auditory thresholds), in that some species, such as mackerels, do not possess a swim bladder (Group I fishes) while some species possess a swim bladder, but lack the mechanical connection to the inner ear and the otoliths (Group II fishes). As a group, they seem able to detect mid-range frequencies (~300-1,000 Hz).

As shown in Table 7-9, the maximum predicted R_{max} distance to the injury threshold in the water column for the hearing groups of fishes with swim bladders not involved in hearing (Groups II) and no swim bladder (Group I)), is 130 m and 60 m respectively (refer Table 7-9). The maximum predicted R_{max} distance to the TTS threshold for all fish hearing groups is ~2.8 km.

Large, pelagic, fast-swimming fish species such as mackerel, billfishes and tunas are highly unlikely to experience TTS effects as they can swim away from a seismic source. Individuals would have to remain within ranges of approximately 2.8 km of the operating seismic source for a full 24-hour period to be exposed to sound levels that could cause TTS. Pelagic fishes are most likely to exhibit a significant behavioural response (avoidance) by moving away from an operating seismic source that approaches within a few tens or hundreds of metres of them (Wardle *et al.* 2001).

7.1.5.4.2.3 Whale Sharks

The Operational Area overlaps the foraging BIA for Whale sharks that extends northeast from North West Cape across the North West Shelf (refer Figure 4-12). This BIA is centred on the 200 m isobath and Whale sharks are most likely to be present in the months of July to November. Therefore, given that the proposed timing of the survey does not coincide with this period, Whale sharks are not expected to be encountered frequently, although it is possible that occasional Whale sharks may be present in the Acquisition Area during the Sauropod 3D MSS. Given that there is no temporal overlap, no displacement of Whale sharks from foraging activities within the BIA is expected.

No sound exposure thresholds currently exist for acoustic impacts from seismic sources to sharks. As a conservative and precautionary approach, the Popper *et al.* (2014) exposure guidelines for fish with no swim bladder for injury (213 dB re 1 µPa (SPL_{pk}) and 219 dB re 1 µPa2·s (SEL_{24h})); and TTS (186 dB re 1 µPa2·s (SEL_{24h})), have been used for this assessment.

As shown in Table 7-9, the maximum predicted R_{max} distance to the injury threshold in the water column for the hearing group of fishes without swim bladders, is 60 m (refer Table 7-9). The maximum predicted R_{max} distance to the TTS threshold for this fish hearing group is ~2.8 km. Again, it is important to appreciate that individual whale sharks would have to remain within a range of approximately 2.8 km of the operating seismic source (which is also moving) for a full 24-hour period to be exposed to sound levels that could cause TTS.

It is expected that the potential effects to Whale sharks associated with acoustic noise will be the same as for other pelagic fish species, resulting in minor and temporary behavioural change such as avoidance. This aligns with Popper *et al.* (2014) guidelines, which detail that there is the potential for high risk of behavioural impacts in fish species near the seismic source (tens of metres) with the level of risk declining to low at thousands of metres from the seismic source.

Seismic noise has not been identified as a threat to Whale sharks (or other shark species identified that may be present in the region) in either the Approved Conservation Advice (TSCC 2015) or previously in force Whale Shark Recovery Plan 2005 – 2010 (DEH 2005). Noise pollution is not identified as a pressure to Whale sharks in the Marine Bioregional Plan for the NWMR (DSEWPaC 2012), or in the Ningaloo Coast: World Heritage nomination report (Commonwealth of Australia 2010).

7.1.5.4.2.4 Ancient Coastline At 125 M Depth Contour KEF

As shown in Table 7-9, the maximum predicted R_{max} distances to the mortality/injury thresholds of 213 dB re 1 µPa (SPL_{pk}) and 207 dB re 1 µPa (SPL_{pk}) at the sea floor for all hearing groups of fishes, and for fish eggs and larvae, range from 80-190 m. The maximum predicted R_{max} distance to the TTS threshold of 186 dB re 1 µPa2·s (SEL_{24h}) at the sea floor for all hearing groups of fishes, and for fish eggs and larvae, is 2.8 km.

The area of overlap between the ancient coastline at 125 m depth contour KEF and the Acquisition Area for the Sauropod 3D MSS is approximately 1,272 km^2, which represents approximately 8% of the designated area of the KEF. Given the maximum predicted R_{max} distances for mortality/injury and TTS effects of 190 m and 2.8 km, respectively, there is the potential for some fishes at the sea floor to experience mortality/injury and TTS effects. However, as discussed above, the

thresholds for mortality and injury are considered highly conservative. While injury or mortality to fishes in the immediate proximity of the seismic source is theoretically possible, free-swimming fishes such as the demersal species associated with the KEF are expected to be able to avoid the seismic source as it gradually approaches their position or ramps up during soft starts. For example, the demersal and pelagic fish assemblages that are expected to be present in the Acquisition Area are generally wide-ranging, free-swimming species. The demersal fish assemblages that are typical of the habitats in the Operational Area, including the KEF (predominantly snappers, emperors, cods and groupers), despite exhibiting particular habitat preferences and some fidelity to an area, can be found across a variety of habitats and are typically mobile with home ranges in the order of kilometres or tens of kilometres (Ovenden *et al.* 2004; Moran *et al.* 2004; Newman *et al.* 2008; Parsons *et al.* 2011; Harasti *et al.* 2015). Pelagic species of trevally as well as sharks and rays are also noted as occurring in the KEF, and these types of fishes are also highly mobile. Impacts to fishes associated with the ancient coastline at 125 m depth contour KEF are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur.

Any potential injury or TTS effects to Group I, II and Group III fishes, and to fish eggs and larvae, within the ancient coastline KEF are not likely to be ecologically significant at a population level for the following reasons:

- Limited spatial and temporal overlap with the KEF – approximately 8% of the total area of the KEF, and 60 days of seismic acquisition.
- The sound exposure thresholds applied are highly conservative and the criteria predicting the largest impact ranges (across all of the modelled sites and scenarios) have been utilised, providing further conservatism in the impact assessment.
- The area of potential impact assumes that the area will receive the same sound levels at the same time for the period of a survey, which is not the case. The received sound levels at a location will reduce and increase as the seismic vessel moves through the area during a survey.
- The area of potential impact for the assessed species is a low proportion of the area they are likely to inhabit. Thus, population effects are not likely as there is a significant proportion of the population that remains unaffected.
- The potential area of impact for fish TTS is assessed as being acceptable based on hearing loss (and subsequent decrease in fitness) being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Popper *et al.* (2005) reports that fish that showed TTS recovered to normal hearing levels within 18–24 hours.

As described above, the area of overlap between the Sauropod 3D MSS Acquisition Areas and the KEF is small (1,272 km^2, ~8%). The SPRAT profile for the ancient coastline at 125 m KEF states “Little is known about fauna associated with the hard substrate of the escarpment, but it is likely to include sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates”. There is little published information on the fish communities associated with the KEF but due to the presence of epibenthic communities associated with hard substrate, it was considered that some demersal and site-attached fish species may be present. A study by Santos for the portion of the KEF within the Keraudren 3D MSS area indicated that a consistent structurally complex seabed feature that may provide unique habitat for demersal and site-attached fish was not evident (Santos 2019). However, an area of high relief and greater demersal fish abundance and diversity was described in the 95 to 115 m depth range outside of the Keraudren survey area.

Based on the qualitative approach applied in Popper *et al.* (2014) the likelihood of behavioural effects occurring is assessed as high to moderate within tens or hundreds of metres of the seismic source. Fish communities at 125 m depth may therefore exhibit some temporary behavioural responses to noise emissions from the seismic source. The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered.

7.1.5.4.2.5 Summary

The potential impacts of noise emissions from the seismic source on fishes and elasmobranchs during the Sauropod 3D MSS are considered to be localised and have no lasting effects on populations. Impacts are primarily expected to be restricted to temporary changes, such as to fish behaviours and local distribution (e.g. avoidance). Such changes are recoverable and normal behaviours and distributions may return to normal within minutes, hours or days of exposure to the operating seismic source, based on available studies. Predicted noise levels from seismic acquisition are unlikely to cause mortality or injury to the mobile demersal and pelagic species that are likely to be present in the Operational Area. There is the potential for TTS effects in some fishes exposed in close proximity to the seismic acquisition, however, if TTS does occur the effects are temporary and will recover. Overall, the Sauropod 3D MSS is not expected to result in any ecologically significant impacts at a population level for any species of fishes that may be present within or adjacent to the Sauropod 3D MSS.

7.1.5.5 Benthic Invertebrates

7.1.5.5.1 Species Sensitivity and Sound Exposure Thresholds

Research is ongoing into the relationship between sound and its effects on benthic invertebrates, including the relevant metrics for both effect and impact. Marine invertebrates lack a gas-filled bladder and are unable to detect the pressure component of sound waves (Parry and Gason 2006; Carroll *et al.* 2017) or "hear" sound in the way that mammals and fish are able to. Instead, invertebrates detect sound by sensing the particle motion component of sound in water and seabed sediments through physiological structures such as sensory hairs, statocysts and muscles, and therefore detect sound at close range (McCauley 1994; Parry and Gason 2006; André *et al.* 2016; Roberts *et al.* 2016; Edmonds *et al.* 2016; Carroll *et al.* 2017; Popper and Hawkins 2018). Statocysts, found in a wide range of invertebrates, are utilised by animals to maintain their orientation, direct their movements through the water and may play a key role in controlling the behaviour responses of invertebrates to a wide range of stimuli. Although directly sensitive to particle motion and not to sound pressure, most available research on seismic impacts to invertebrates characterises received sound levels in terms of the sound pressure. Therefore, available literature suggests particle motion, rather than sound pressure, is a more important factor for benthic invertebrates such as crustacean and molluscs. Water depth and seismic source size are related to the particle motion levels at the sea floor, with larger arrays and shallower water being related to higher particle motion levels, thus more relevant to effects on crustaceans and molluscs (including bivalves) (Quijano and McPherson 2020).

A range of physiological responses have been identified in some studies; however, the received sound levels are typically at levels that would be received within tens or a few hundred metres from the sound source or have been from repeated exposure at the same sound levels, which is not typical of an actual seismic survey (Carroll *et al.* 2017; Edmonds *et al.* 2016; Salgado Kent *et al.* 2016; Webster *et al.* 2018).

Studies by Christian *et al.* (2003), DFO (2004) and Payne *et al.* (2007, 2008) have exposed crustaceans to seismic sound levels of approximately 197–237 dB re 1 µPa SPL_{pk-pk}. No acute or chronic lethal or sub-lethal effects were observed in the weeks to months following exposure, with the exception of Payne *et al.* (2007, 2008) who noted a decrease in serum enzymes and increases in food consumption in the weeks to months post exposure, which may indicate stress effects or potential osmo-regulatory disturbance.

Research undertaken by Day *et al.* (2016a, 2016b) over three years in Australian waters, exposed captive southern rock lobster *Jasus edwardsii* to multiple passes of a seismic source element in 10-12 m water depths. Maximum received sound exposures were 209-212 dB re 1µPa SPL_{pk-pk}, 186 to 190 dB re 1 µPa2.s per-pulse SEL, and SELcum of 192 to 199 dB re 1 µPa2.s. Exposed lobsters and control lobsters were sampled up to a year after exposure. The findings of the study are as follows:

- Exposure to seismic sound did not result in any mortalities to adult lobsters.
- The condition or development of eggs carried by female lobsters at the time of exposure, even at close proximity directly beneath the seismic source, were not affected.
- Some potential sub-lethal changes in adult lobsters were observed, including some long-term impairment to lobsters' statocysts, which was also linked to a short delay in the lobsters' ability to right themselves when upturned.
- Haemocyte count (indicative of immune response function) also showed some evidence of decline over time.

The significance of the seismic exposures and whether the sub-lethal effects may have wider ecological implications (e.g. ability to feed, avoid predators and resist disease) warrants further consideration. Day *et al.* (2016a, 2016b) reported that some of the control lobsters used in the experiments were collected from a marine reserve and were found to have a high level of pre-existing impairment to statocysts similar to that induced by the seismic exposure experiments. This statocyst impairment was considered to be the result of long-term exposure to shipping noise. Some experiments showed no significant differences in righting times between control and exposed lobsters, while in some instances the control lobsters demonstrated slower righting times than exposed lobsters. Lobsters with pre-existing statocyst impairment demonstrated the fastest righting times of all experiments, which Day *et al.* (2016a, 2016b) suggested may indicate that lobsters are able to adapt or compensate for long-term statocyst impairment. Therefore, the level of statocyst impairment resulting from seismic exposure is not clear. Monitoring of the lobster population at the same reserve where the lobsters with pre-existing statocyst impairment were taken from showed that the rock lobster population within the reserve was thriving and at carrying capacity (Green and Gardner 2009; Kordjazi *et al.* 2015). Therefore, the levels of statocyst impairment reported in the Day *et al.* (2016a, 2016b) study appear not to be impacting on the survival of the lobster population. Therefore, any population-level survivability effects from statocyst impairment are not significant and wider ecological implications are likely to be negligible.

Kosheleva (1992; cited in Parry and Gason 2006) identified no detectable effects to marine bivalves and gastropods (mussels and periwinkles) after exposure to a single seismic source element of source level 233 dB re 1 µPa at a distance of 0.5 m or greater from the source. Conversely, Matishov (1992; cited in Parry and Gason 2006) reported a single scallop shell splitting in a sample of three scallops, but this was located 2 m beneath a seismic source element and therefore exposed to maximum sources levels, which would not occur during the Sauropod 3D seismic survey.

Recent Australian studies (Przeslawski *et al.* 2016, 2018; Day *et al.* 2016b, 2017) have focussed on commercial scallops (*Pecten fumatus*). Przeslawski *et al.* (2016, 2018) examined the short-term impacts on scallops and other marine invertebrates from a 2,530 cubic inch seismic array and found no evidence of mortality or change in condition following exposure to a seismic survey. Analysis of images and samples revealed some site-specific differences in scallop abundance, size, condition and assemblages, but these were not related to seismic operations.

Day *et al.* (2016b, 2017) exposed scallops to maximum received sound exposures of up to 213 dB re 1µPa SPL_{pk-pk}, 181 to 188 dB re 1 µPa2.s per-pulse SEL, and SELcum of 188 to 198 dB re 1µPa2.s. The study also predicted ground acceleration of up to 37.57 m/s2. Day *et al.* (2016b, 2017) concluded that exposures did not result in any immediate mass mortalities, however, repeated exposures resulted in a chronic increase in mortality over timeframes of approximately four months post-exposure, though not beyond naturally occurring rates of mortality. Separate experiments undertaken in 2013 and 2014 yielded mortalities of 3.6–3.8% in control scallops (no seismic exposure), 9.4–11.3% mortality in scallops exposed to a single pass of the seismic source, 11.3–16.1% mortality in scallops exposed to two passes of the seismic source, and 14.8–17.5% mortality in scallops exposed to four passes of the seismic source. The mortality rates were at the low end of the range of naturally occurring mortality rates documented in the wild, which range from 11–51% with a six-year mean of 38% (Day *et al.* 2017). A third experiment in 2015 resulted in 100% mortality to both control scallops and exposed scallops, and accordingly was attributed to other causes and not to seismic exposure (Day *et al.* 2016b, 2017).

Sub-lethal effects to exposed scallops were also observed by Day *et al.* (2016b, 2017) indicating a compromised capacity for homeostasis and potential immunodeficiency over acute (hours to days) and chronic (months) time-scales after exposure. Exposures did not elicit energetically expensive behaviours (i.e. extensive swimming or long periods of valve closure), but scallops showed significant changes in some behavioural patterns during exposure (e.g. “flinch” response) and scallops showed an increase in recessing into sediment following exposure (Day *et al.* 2017).

Published sound exposure criteria do not currently exist for acoustic impacts to invertebrates but the available literature above provides an indication of the sound levels and distances within which some impacts may occur. A range of sound levels, from 202 dB re 1 µPa SPL_{pk-pk} to 212 dB re 1 µPa SPL_{pk-pk}, based on the findings of the Payne *et al.* (2008) and Day *et al.* (2016) studies, were applied in the acoustic modelling study and this risk assessment. The Payne *et al.* (2008) 202 dB re 1 µPa SPL_{pk-pk} is considered to be associated with no impacts to benthic crustaceans (such as prawns, scampi and lobsters), whereas the 209-212 re 1 µPa SPL_{pk-pk} thresholds could be associated with some level of sub-lethal effects in these animals (Quijano and McPherson 2020). A 213 dB re 1 µPa SPL_{pk-pk} level is considered as representative of levels that may result in sublethal effects and chronic mortality in molluscs and some other invertebrates based on Day *et al.* (2016b, 2017).

A sound level of 226 dB re 1 µPa SPL_{pk} was applied for sponges and corals, based on a study where corals received maximum sound pressure levels of 226-232 dB re 1µPa SPL_{pk-pk}, but no mortality, damage to soft tissue or skeletal integrity, visible signs of stress, change in abundance or community structure were detected immediately after, and up to four months following exposure (Heyward *et al.* 2018).

7.1.5.5.2 Impact Assessment

Whilst the Silver-lipped pearl oyster (*Pinctada maxima*) has been recorded at maximum water depths of 100 m, adults are mostly found in shallow waters (10–15 m) in inshore, coastal areas, and the species is targeted in the Pearl Oyster Managed Fishery out to water depths of approximately 30–40 m. Previous consultation with the Pearl Producers Association (PPA) has confirmed that there may be pearl oyster brood stock out to a depth of approximately 50 m, but any seismic survey activity in water depths in excess of 70 m was of no concern to the PPA with regards to potential impacts on adult shell (Santos 2019). Minimum water depths in the Acquisition Area for the Sauropod 3D MSS are approximately 95 m, and therefore all seismic acquisition will take place in water depths well outside the normal range for pearl oyster broodstock. In addition, a recent large-scale experiment found no consistent evidence of change in mortality or commercial productivity in silverlip pearl oysters (*Pinctada maxima*) exposed to a seismic source survey (Parsons *et al.* 2023). Potential impacts to adult pearl oyster have, therefore, not been considered as part of this impact assessment for benthic invertebrates.

Accordingly, the following benthic invertebrates have been identified for this assessment:

- Benthic invertebrate communities, including sponges and soft corals associated with the ancient coastline at 125 m depth contour KEF.

7.1.5.5.3 Sound Pressure

As described above, a range of sound exposure thresholds, from 202 dB re 1 µPa SPL_{pk-pk} to 212 dB re 1 µPa SPL_{pk-pk}, were applied in the acoustic modelling study for benthic crustaceans. Sound levels of 209-212 re 1 µPa SPL_{pk-pk} thresholds are potentially associated with some level of sub-lethal effects. As shown in Table 7-10, at a sound exposure threshold of 209 dB re 1 µPa SPL_{pk-pk}, maximum predicted R_{max} distance was 260 m. The maximum predicted R_{max} distance associated with the 213 dB re 1 µPa SPL_{pk-pk} level for sublethal effects and chronic mortality (Day *et al.* 2016b, 2017) is 156 m.

The sound level at the sea floor directly underneath the seismic source was estimated at all four modelling sites and compared to the sound level of 226 dB re 1 µPa SPL_{pk} for sponges and corals (Heyward *et al.* 2018). It was found that the level was not reached at any of the four sites.

Table 7-10 – Maximum Predicted Distances (R_{max}) to Effect Thresholds for Crustaceans at the Sea Floor

Sound Exposure Threshold (SPL_{pk-pk})	**R_{max} (m)**
213 dB re 1 µPa	156
212 dB re 1 µPa	179
211 dB re 1 µPa	204
210 dB re 1 µPa	234
209 dB re 1 µPa	260
202 dB re 1 µPa	709

As described above, the area of overlap between the ancient coastline at 125 m depth contour KEF and the Acquisition Area is 1,272 km^2, which represents ~8% of the designated area of the KEF. Given the maximum predicted R_{max} distance for impacts to invertebrates of 260 m, there is the potential for some invertebrates on the sea floor, including within the KEF, to experience sound levels that could result in some low-level, sub-lethal effects (e.g. impairment of reflexes, damage to statocysts and reduction in numbers of haemocytes). These sub-lethal effects could result in a reduction in fitness to some individuals. Chronic mortality may also occur in a small number of organisms within a maximum distance of 156 m from the source within the weeks and months following exposure.

At received noise levels of 209 dB re µPa (SPL_{pk-pk}) (Day *et al.* 2016a) did not observe any impacts to embryonic development, with hatched larvae found to be unaffected in terms of egg development, the number of hatched larvae, larval dry mass and energy content and larval competency (i.e. survival in adverse conditions); thus recruitment should be unaffected. Therefore, impacts at a population level due to reduced recruitment would be unlikely to occur.

7.1.5.5.4 Particle Motion

The acoustic modelling study included predictions of particle motion metrics at all four modelled locations, along the broadside directions, which were associated with the highest levels.

At the sea floor interface, crustaceans and bivalves are subject to particle motion stimuli from several acoustic or acoustically induced waves. These include the particle motion associated with an impinging sound pressure wave in the water column (the incident, reflected, and transmitted portions), substrate acoustic waves, and interface waves of the Scholte type. However, it is unclear which aspect(s) of these waves is/are most relevant to the animals, either when they normally sense the environment or their physiological responses to loud sounds so there is not enough information to establish similar criteria and thresholds as done for marine mammals and fish. Including recent research, such as Day *et al.* (2016a), current literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for an assessment. This includes the consideration of what particle motion levels lead to a behavioural response, or mortality. Therefore, at this stage, we cannot propose authoritative thresholds to inform the impact assessment. However, levels can be determined for pressure metrics presented in literature to assist the assessment (Quijano and McPherson 2020).

As described above, for crustaceans, a SPL_{pk-pk} sound level of 202 dB re 1 µPa (Payne *et al.* 2008) is considered to be associated with no impact, and therefore applied in the assessment. Additionally for context, the SPL_{pk-pk} sound levels determined for crustaceans in Day *et al.* (2016), 209–212 dB re 1 µPa, are also included.

For bivalves, literature does not present a sound level associated with no impact, and as particle motion is the more relevant metric, particle acceleration from the seismic source has been modelled for comparison with the results of Day *et al.* (2016). The maximum particle acceleration assessed for scallops was 37.57 ms-2 (Quijano and McPherson 2020).

The maximum particle acceleration and velocity for each of the four sites, as a function of horizontal range from the centre of the array in broadside directions (which generate the higher amplitude results) were modelled. The maximum distance to a particle acceleration of 37.57 ms-2 is 9.1 m, which occurs at the shallowest site (Site 1, 66 m water depth) (refer Figure 7-1).

Particle acceleration decays rapidly away from the source location within the distance equal to half the water depth. It is then influenced by constructive interference, resulting in an increase in levels at a distance equal to the water depth (66 m at Site 1) before again rapidly decaying by 10 ms–2 out to approximately two water depths. Beyond this distance, it exhibits an almost linear decay, apart from constructive interactions at multiples of water depth, with a low point at approximately 10 times the modelling site water depth (Figure 7-1) (Quijano and McPherson 2020).

Particle motion traces generated during the modelling show that vertical particle motion is larger than horizontal particle motion for receivers directly underneath or at short ranges from the array, but at longer ranges the horizontal particle motion dominates. The duration of particle motion also increases with distance as critically reflected multipath propagation becomes important.

Day *et al.* (2016) included a regression of particle acceleration versus range for the single 150 in^3 airgun used in their study (minimum range of 6 m) and showed that acceleration at 10 and 100 m range was typically 26 and 5 ms-2, respectively. Day *et al.* (2016) also referenced an unpublished maximum particle acceleration measurement of 6.2 ms-2 from a 3,130 in^3 airgun array at 477 m range in 36 m of water. In the acoustic modelling study for the Sauropod 3D MSS, modelled peak acceleration at 10 m range was predicted to be between 35 and 19 ms-2 depending on the site; corresponding values at 100 m range are between 21 and 12 ms-2. At ~477 m, the modelling predicts an acceleration of between 8.5 and 5.8 ms-2 in both the port and starboard broadside directions. This result aligns reasonably with the measurements reported in Day *et al.* (2016) and thus represents what is likely to occur (Quijano and McPherson 2020).

The maximum distance to a particle acceleration of 37.57 ms-2 of 9.1 m is less than that predicted for other studies in the region (Quijano and McPherson 2020), however the difference is likely due to the different airgun array configuration and tow depth, as well as the geology for the respective studies. The seabed geology used for this study, silty carbonate sand to calcarenites, are generally less reflective than seabeds which have thin layers of sand over calcarenite substrate.

Based on the above body of research and risk assessment, some benthic invertebrate species may experience sub-lethal effects or a small increase in mortality rates in the weeks or months following seismic exposure within tens or hundreds of metres from the seismic source. Should this occur, the continuous natural cycle of death, recovery and recruitment of invertebrates from adjacent sediments will occur in parallel over these same timescales, and therefore it is questionable whether any impacts from seismic exposure would be detectable from natural fluctuations in relative abundance, benthic community composition and structure. Day *et al.* (2017) and Payne *et al.* (2007, 2008) acknowledge that the changes observed in their research are likely within the range of variation that can occur from other common natural and anthropogenic stressors. The ecological implications of such impacts on benthic invertebrate communities are not expected to be significant or long-term.

The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered.

7.1.5.5.5 Summary

The potential impacts of noise emissions from the seismic source on benthic invertebrates during the Sauropod 3D MSS are considered to be slight and short-term, as the activity is not likely to result in any ecologically significant impacts at a population level for any species of invertebrate that may be present on the sea floor within or adjacent to the Acquisition Area. While some sub-lethal impacts and chronic mortality are possible in some sessile organisms exposed in very close proximity to the seismic source, not all organisms are expected to be affected. Benthic communities are expected to recover in the weeks or months following exposure and changes in community structure and composition are not expected to be detectable from natural variability.

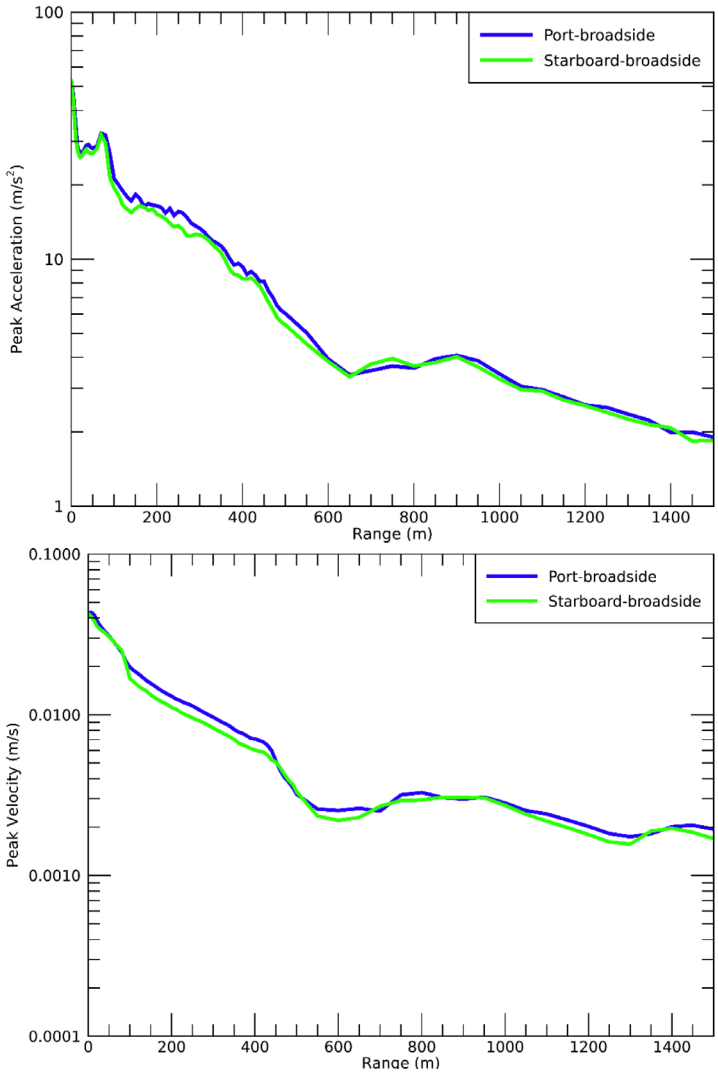


Figure 7-6 – Site 1: Maximum Particle Acceleration (top) and Velocity (bottom) at the Sea Floor as a Function of Horizontal Range from the Centre of the 3,090 in^3 Array Along the Broadband Directions

7.1.5.6 Zooplankton

7.1.5.6.1 Species Sensitivity and Sound Exposure Thresholds

Plankton is a collective term for all marine organisms that are unable to swim against a current. This group is diverse and includes phytoplankton (plants) and zooplankton (animals), as well as fish and invertebrate eggs and larvae. There is no scientific information on the potential for noise-induced effect in phytoplankton and no functional cause-effect relationship has been established. Noise-induced effects on zooplankton, such as copepods, cladocerans, chaetognaths and euphausiids, have been investigated in a number of sound exposure experiments.

Zooplankton includes fish eggs and larvae that are transported by currents and winds and hence cannot take evasive behaviour to avoid seismic sources. With respect to the Sauropod 3D MSS, key spawning areas for commercially targeted fish species (assessed under “Fish spawning” below) have been identified as areas where zooplankton populations may be more important.

Larval fish species studied appear to have hearing frequency ranges similar to those of adults and similar acoustic startle thresholds (Popper *et al.* 2014). Swim bladders may develop during the larval stage and may render larvae susceptible to pressure-related injuries such as barotrauma. Effects of sound upon eggs, and larvae containing gas bubbles, is focused on barotrauma rather than hearing (Popper *et al.* 2014). Larval stages are often considered more sensitive to stressors than adult stages, but exposure to seismic sound reveals no differences in larval mortality or abundance for fish, crabs or scallops (Carroll *et al.* 2017).

Parry *et al.* (2002) studied the abundance of plankton after exposure to airgun sounds but found no evidence of mortality or changes in catch-rate at a population-level. Other studies have also noted limited negative impacts on zooplankton, fish eggs, larvae or fry, and most have reported that impacts occur within a few metres or tens of metres from the source (Kostyuchenko 1973; Dalen and Knutsen 1987; Holliday *et al.* 1987; Kosheleva 1992 cited in Parry *et al.* 2002; Pearson *et al.* 1994; Turnpenny and Nedwell 1994; Booman *et al.* 1996; Payne 2004; Payne *et al.* 2009). These studies included exposures to sound pressures up to approximately 242 dB re 1 µPa, comparable to those predicted in close range to the Sauropod 3D MSS seismic source.

Day *et al.* (2016b) found that "seismic exposure did not result in a decrease in fecundity, either through a reduction in the average number of hatched larvae or as a result of high larval mortality; compromised larvae or morphological abnormalities". These results support the suggestion that early life stage crustaceans may be more resilient to seismic air gun exposure than other marine organisms (Pearson *et al.* 1994). Received levels were ~211 dB re 1 µPa (SPL_{pk-pk}; approximately 205 dB re 1 µPa SPL_{pk}) and as such are similar to those proposed by Popper *et al.* (2014).

For this impact assessment the sound exposure thresholds for mortality/PMI to fish eggs and larvae from Popper *et al.* (2014) have been applied (as described above in the impact assessment for fish and outlined below in Table 7-11).

In addition, a highly conservative threshold of 178 dB re 1 µPa SPL_{pk-pk} derived from the McCauley *et al.* (2017) study has also been considered, as described below.

Vereide *et al.* (2023) conducted a field experiment to assess mortality and naupliar body length of the calanoid copepod *Acartia tonsa* when exposed to the discharge of two 40-inch airguns. Nauplii were placed in plastic bags and attached to a line at a depth of 6 m. For each treatment, three bags of nauplii were exposed to one of three treatments for 2.5 h: Airgun array discharge, a boat control, or a silent control. After exposure, nauplii were kept in filtered seawater in the laboratory without food. Immediate mortality in the nauplii was approximately 14% compared to less than 4% in the silent and boat control. Similarly, there was higher mortality in the airgun exposed nauplii up to six days after exposure compared to the control treatments. Nearly all of the airgun exposed nauplii were dead after four days, while >50% of the nauplii in the control treatments were alive at six days post-exposure.

McCauley *et al.* (2017) found that after exposure to airgun sounds generated with a single airgun (150 cui) zooplankton abundance decreased and mortality in adult and larval zooplankton increased two to three-fold when compared with controls. In this large-scale field experiment on the impact of seismic activity on zooplankton, a sonar and net tows were used to measure the effects on plankton, and a maximum effect-range of horizontal 1.2 km was determined. The findings contradicted the conventional idea of limited and very localised impact of intense sound in general, and seismic airgun signals in particular, on zooplankton, with the results indicating that there may be noise-induced effects on these taxa and that these effects may even be negatively affecting ocean ecosystem function and productivity.

This study measured zooplankton abundance and the proportion of the population that was dead at three distances from a single 150 cui airgun – 0, 200 and 800 m. The experiment estimated the proportion of the zooplankton that was dead, both before and after exposure to airgun noise, using net samples to measure zooplankton abundance, and bioacoustics to identify the distribution of zooplankton. In this study, copepods dominated the mesozooplankton (0.2–20 mm), and impacts were not assessed on microzooplankton (0.02–0.2 mm) or macrozooplankton (20 mm). There was movement of water through the experimental area, which made interpreting their results more difficult (Richardson *et al.* 2017).

McCauley *et al.* (2017) provide three findings from the experiment to show that zooplankton were affected by the seismic source, the:

- Proportion of the mesozooplankton community that was dead increased two to three-fold
- Abundance of zooplankton estimated by net samples declined by 64%
- Opening of a "hole" in the zooplankton backscatter observed via acoustics.

They found that exposure to airgun noise significantly decreased zooplankton abundance and increased the mortality rate from a natural level of 19% per day to 45% per day (on the day of exposure), and that these impacts were observed out to the maximum range assessed (1.2 km) (Richardson *et al.* 2017).

Scientists from CSIRO's Oceans and Atmosphere Business Units were contracted by APPEA to undertake a desktop study that: a) critically reviewed the methodologies and findings of the McCauley *et al.* (2017) experiment; and b) simulated the large-scale impact of a seismic survey on zooplankton in the North West Shelf region, based on the mortality rate associated with airgun noise exposure reported by McCauley *et al.* (2017).

The CSIRO review of the McCauley *et al.* (2017) study found that there were three primary questions raised by the results of the experiment, all of which warrant further investigation (Richardson *et al.* 2017):

1. Why was there no attenuation of the impact with distance?

   There is no consistent decline in the proportion of zooplankton that are dead with increasing distance away from the airgun. The energy of the sound waves at a distance of 1.2 km is substantially lower than at the source.

2. Why was there an immediate decline in abundance?

   It is unclear why there would be a near immediate drop in zooplankton abundance as measured by net samples and acoustic data. If zooplankton were killed, they would not immediately sink from the surface layers, or be rapidly eaten. A drop in abundance would be more likely once the dead zooplankton either sunk to the bottom or were removed by predation. Richardson *et al.* (2017) conclude it is difficult to explain this immediate decline in zooplankton abundance.

3. Was there sufficient replication to be confident in the study findings?

   The conclusions were based on a relatively small number of zooplankton samples. A total of 24 samples were collected – two tows each sampling time × three distances from the gun (0 m, 200 m, 800 m) × two levels (Control, Exposed) × two replicate experiments (Day 1, Day 2). This means that there were only 12 samples collected under conditions exposed to the airgun, six on each day of the two experiments. The main potential confounding explanation in the study would be that a different water mass entered the area on each day of the experiment and had lower abundance and higher quantities of dead zooplankton. Richardson *et al.* (2017) conclude that: "although this is relatively unlikely it cannot be discounted because of the relatively few samples collected and only two replicate experiments conducted."

Independently of the APPEA/CSIRO study, the International Association of Geophysical Contractors (IAGC) conducted its own review of the McCauley *et al.* (2017) paper. This review came to the following conclusion:

'While we found the study interesting, we are also troubled by the small sample sizes, the large day-to-day variability in both the baseline and experimental data, and the large number of speculative conclusions that appear inconsistent with the data collected over a two-day period. Both statistically and methodologically, this project falls short of what would be needed to provide a convincing case for adverse effects from geophysical survey operations' (IAGC 2017).

The second component of the CSIRO study was to estimate the spatial and temporal impact of seismic activity on zooplankton on the North West Shelf from a large-scale seismic survey, considering mortality estimates of McCauley *et al.* (2017), and accounting for typical growth rates, natural mortality rates, and the ocean circulation in the region. The approach modelled a hypothetical 3D survey (2,900 km^2 in size, over a 35-day period, in water depths of 300–800 m) on the edge of the North West Shelf during summer. To simulate the movement of zooplankton by currents, the researchers used a hydrodynamic model that seeded 0.5 million particles into CSIRO's Ocean Forecast Australia Model. Zooplankton particles could be hit multiple times by airgun pulses if they were carried by currents into the future survey path. The greatest limitation in this approach was accurate knowledge of the natural growth and mortality rates of zooplankton, and to address this the CSIRO researchers tested the sensitivity of the model to different recovery (growth-mortality) rates, and also the sensitivity of the results to ocean circulation by undertaking simulations with and without water motion (Richardson *et al.* 2017).

The results of the simulations that included ocean circulation showed that the impact of the seismic survey on zooplankton biomass was greatest in the Survey Region (defined as the survey acquisition area with a 2.5 km impact zone around it) (22% of the zooplankton biomass was removed) and declines as one moves beyond it to the Survey Region + 15 km (14% of biomass removed), and the Survey Region + 150 km (2% of biomass removed). The time to recovery (to 95% of the original level) for the Survey Region and Survey Region + 15 km recovery was 39 days (38–42 days) after the start of the survey and three days (2–6 days) after the end of the survey (Richardson *et al.* 2017).

The major findings of the CSIRO study were that there was substantial impact of seismic activity on zooplankton populations on a local scale within or close to the survey area, however, on a regional scale the impacts were minimal and were not discernible over the entire Northwest Shelf Bioregion. Additionally, the study found that the time for the zooplankton biomass to recover to pre-seismic levels inside the survey area, and within 15 km of the area, was only three days following the completion of the survey. This relatively quick recovery was due to the fast growth rates of zooplankton, and the dispersal and mixing of zooplankton from both inside and outside of the impacted region (Richardson *et al.* 2017). The CSIRO modelling was carried out for the North West Shelf IMCRA Mesoscale Bioregion and the findings of this study are therefore applicable in determining the potential impacts of the Sauropod 3D MSS on zooplankton communities.

A recent study by Fields *et al.* (2019) exposed zooplankton (copepods) to seismic pulses at various distances up to 25 m from a seismic source. The source levels produced were estimated to be 221 dB re 1 µPa2.s and comparable to the far-field source levels predicted for the Sauropod 3D MSS seismic source. The study observed an increase in immediate mortality rates of up to 30% of copepods in samples compared to controls at distances of 5 m or less from the airguns. Mortality one week after exposure was significantly higher by 9% relative to controls in the copepods placed 10 m from the airguns. Fields

et al. (2019) also reported that no sublethal effects occurred at any distance greater than 5 m from the seismic source. The findings of the study are consistent with numerous other field studies, as referenced previously, indicating that the potential effects of seismic pulses to zooplankton are limited to within approximately 10 m from the seismic source. Fields *et al.* (2019) note that the findings of the McCauley *et al.* (2017) study are difficult to reconcile with the body of further available research. The findings of the McCauley *et al.* (2017) study may, therefore, provide an overly conservative estimate of the potential effects of seismic pulses to zooplankton.

7.1.5.6.2 Impact Assessment

As described above, the sound exposure thresholds used in this assessment for mortality/PMI to fish eggs and larvae from Popper *et al.* (2014), have been applied, as well as the 178 dB re 1 µPa SPL_{pk-pk} threshold derived from the McCauley *et al.* (2017) study (refer to Table 7-11).

Table 7-11 – Maximum Predicted Distances (Rmax) to Mortality/PMI Thresholds in the Water Column for Fish Eggs and Larvae, and Zooplankton

Sound Exposure Threshold	R_{max} (Km)
210 dB re 1 µPa2·s (SEL_{24h})	0.03
207 dB re 1 µPa (SPL_{pk})	0.13
178 dB re 1 µPa (SPL_{pk-pk})	7.93

As shown in Table 7-11, the maximum predicted R_{max} distance for mortality/PMI effects in fish eggs and larvae, based on application of the Popper *et al.* (2014) single-pulse 207 dB re 1 µPa (SPL_{pk}) threshold is 130 m. Based on the application of the McCauley *et al.* (2017) threshold of 178 dB re 1 µPa SPL_{pk-pk}, the maximum predicted R_{max} distance increases to ~8 km.

Any potential mortality/PMI impacts to zooplankton communities have to be assessed in the context of natural mortality in these populations. Any mortality or mortal injury effects to zooplankton (including fish eggs and larvae) resulting from seismic noise emissions are likely to be inconsequential compared to natural mortality rates, which are very high; exceeding 50% per day in some species and commonly exceeding 10% per day (Tang *et al.* 2014). For example, in a review of mortality estimates (Houde and Zastrow 1993), the mean mortality rate for marine fish larvae was M = 0.24, a rate equivalent to a loss of 21.3% per day. Zooplankton mortality rates vary significantly. Mortality rates of the copepod nauplii (Ac*artia tonsa*) in the control group of an experiment by Vereide *et al.* (2023) were less than 4%, while in the experiment undertaken by McCauley *et al.* (2017) zooplankton mortality rate background levels were 19%. Sætre and Ona (1996) calculated that under the 'worst-case' scenario, the number of larvae killed during a typical seismic survey was 0.45% of the total population, and they concluded that mortality rates caused by exposure to airgun sounds are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant.

The magnitude of such localised impacts is negligible and is not expected to be discernible at the regional scale when considering the large natural spatial and temporal variability and scale of plankton and spawning biomass in the NWMR. In particular, phytoplankton and zooplankton biomass in the oceans can vary significantly at spatial scales ranging from hundreds of metres to hundreds of kilometres and temporal scales of hours, days, seasons and inter-annually, due to tidal and large-scale currents, bathymetry, temperature, salinity, water chemistry parameters and other environmental factors (Gibbons and Hutchings 1996; Holliday *et al.* 2011; McKinnon *et al.* 2008; Pearce *et al.* 2000; Sutton and Beckley 2017). Therefore, changes in zooplankton abundance are likely to be replenished and indistinguishable from natural levels and distributions within hours of a seismic survey vessel passing.

7.1.5.6.3 Summary

The potential impacts of noise emissions from the seismic source on plankton during the Sauropod 3D MSS are considered to be slight and short-term, as the activity is not likely to result in any ecologically significant impacts at a population level for any fish eggs and larvae, or zooplankton that may be present in the water column within or adjacent to the Acquisition Area.

7.1.5.7 Fish Spawning

7.1.5.7.1 Impact Assessment

High intensity impulsive sound emitted from the seismic source has the potential to result in behavioural changes in fish or masking of fish vocalisations, which may temporarily divert efforts away from spawning aggregations, egg production and

recruitment success (Hawkins and Popper 2017). This impact assessment is focused on fish spawning and recruitment for key indicator commercial fish species, which commercial fisheries relevant persons have raised as a concern during consultation.

Section 4.3.4 describes the key indicator species that are relevant to the Sauropod 3D MSS. Information obtained from DPIRD (DPIRD 2019) has defined the depth ranges and key spawning periods for a range of key indicator species for the north coast scalefish resource. The reproductive biology of the key indicator fish species results in a very broad distribution of eggs and larvae, and consequently genetic connectivity over a wide geographic range. Multiple batches of pelagic eggs are released during multiple, frequent spawning events and throughout extended spawning periods (Gaughan *et al.* 2018).

The following impact assessment considers the potential magnitude of effects to fish spawning behaviours, and therefore the potential influence of the survey on recruitment success and the sustainability of key indicator fish species. The assessment considers:

1. Spatial-temporal analysis – to understand the proportion of the spawning areas and spawning areas that may be exposed during the Sauropod 3D MSS
2. Consideration of the natural variability in fish distribution, spawning biomass and recruitment
3. Consideration of the sustainability status of the fish stocks.

While the focus of the assessment is on the key indicator species, DPIRD (2017) note that the status of the key indicator fish stocks is also used as a robust indicator of the sustainability status within the broader suite of demersal scalefish species exploited in the region.

7.1.5.7.2 Spatial-Temporal Analysis

A spatial-temporal analysis has been conducted to determine the overlap between the Acquisition Area and the principal spawning ranges and seasons of key commercial indicator species. The analysis provides an indication of the proportion of the spawning area and the proportion of the spawning period for each species that may be exposed to sound from the Sauropod 3D MSS at some point during the survey.

The following assessment focuses on the following commercial key indicator species:

- Red emperor
- Rankin cod
- Goldband snapper
- Blue-spotted emperor
- Giant ruby snapper.

It is understood from DPIRD (2019) that all of these species undergo group spawning throughout their range, rather than aggregating at specific locations.

Spanish mackerel, the key indicator species for the Mackerel Managed Fishery, has been excluded from the assessment, given that the principal depth range for the spawning of this species is considered to be in water depths less than 50 m (Mackie, 2010) and the depths within the Sauropod 3D MSS Acquisition Area are greater than 95 m. The spawning period for this species (September to December) is also outside the proposed acquisition window of the survey. Therefore, the Sauropod 3D MSS is not expected to impact the spawning of Spanish mackerel.

It is important to note that a number of assumptions are applied to the analysis in order to provide a highly conservative estimate of the proportion of spawning fish stocks that may be exposed and affected during the survey:

1. Spatial overlap is based upon the entire Acquisition Area and the temporal overlap is based upon the entire 60-day survey duration. Noting that the key indicator demersal fish species are primarily sensitive to particle motion effects more so than sound pressure and significant behavioural effects are likely to be limited to within tens or hundreds of metres of the seismic source (Popper *et al.* 2014), the actual area of disturbance to fishes will be significantly smaller and likely to be within hundreds of metres from the seismic source as it moves across the acquisition area. Some awareness of sound and some level of disturbance may be possible over distances of kilometres for some fish species, but the potential for this is considered low by Popper *et al.* (2014). Therefore, the spatial-temporal analysis is simply an indication of the total area that may be ensonified. Within any 24-hour period the actual area that may be ensonified may be hundreds of square kilometres, rather than thousands of square kilometres. Hence, there will be large areas within the survey area unaffected by sound or with sound below levels that might disturb fish.

2. The spatial extent of the spawning areas for each key indicator fish species has been estimated based on each species' depth range (as advised by DPIRD 2019) and the Pilbara fishery management area. As described in Section 4.3.4, genetic connectivity and the biological stocks have been confirmed across significantly larger areas (hundreds of thousands of square kilometres compared with the tens of thousands of square kilometre spawning areas considered in the analysis). The biological stocks of the key indicator species generally extend from around the Gascoyne region of WA to the NT or even as far as south-east Queensland. The biological stock areas may be more relevant to the impact assessment from a biological perspective; however, the boundaries of the biological stocks are not clearly defined, and it is noted that genetic connectivity and recruitment within the biological stock ranges occurs over multiple years of spawning and dispersion of eggs and larvae (Martin *et al.* 2014; Gaughan *et al.* 2018). In any given year or a single spawning season, the genetic connectivity between the area of seabed exposed to disturbances from the Sauropod 3D MSS depends on the duration of the egg and larval dispersion phase and the oceanographic currents; connectivity and recruitment in a single season may therefore occur within and well beyond the limits of the Pilbara fishery management unit, but potentially not across the entire biological stock area. Therefore, to address any potential uncertainty in the biological stock ranges, the Pilbara fishery management area has been selected by CGG to provide a conservative indication of the proportion of the stocks that may be affected in a single spawning season. Referencing the fishery management units also allows the results to be considered in relation to the annual fish stock status assessments, which are also reported per fishery management area (an approach that is recognised as being a conservative approach for fishery management purposes [Gaughan *et al.* 2018]). As a result, the spatial overlaps accounted for in the spatial-temporal analysis are likely to significantly overestimate the percentage of spawning area available to each species.
3. The spatial-temporal analysis is a simplistic approach that assumes that fish spawning in the area and period of exposure will be compromised. In reality, it is possible that fishes may continue to spawn regardless, may move away from the seismic source and spawn nearby, or, given that fish behaviours may return to normal within minutes or hours of exposure, spawning may be delayed but may occur a short time later. In either of these cases, the impact on spawning success may be negligible. However, given uncertainty about how the spawning behaviours of individual fishes and populations may be affected in response to seismic sound exposure, it is conservatively assumed that cessation of spawning will occur.

Therefore, the following analysis provides a highly conservative indication of the proportion of the fish stocks that may be exposed. This provides useful context for the impact assessment, but the extent and duration of actual impacts will be significantly smaller.

It is noted that the Sauropod 3D MSS Operational Area also overlaps with the edge of the Kimberley fisheries management unit (less than 0.01% of the fishery management unit). The Acquisition Area does not overlap with the Kimberley fishery management unit. Given that seismic acquisition will not occur in this area and that operation of the seismic source in this area will be limited (e.g. very occasional source testing), the potential for disturbance to the fish populations within the Kimberley fisheries management unit is considered to be negligible and significantly smaller than in the Pilbara fisheries management unit. Therefore, the focus of the analysis is on the Pilbara fisheries management unit, and the Kimberley fisheries management unit is not considered further.

Table 7-12 presents the spatial overlap of the Sauropod 3D MSS Acquisition Area with the spawning areas of key indicator species based on each species' principal depth range and the Pilbara fisheries management unit. The spatial overlap ranges from 0.7% (Ruby snapper) to 5.1% (Goldband snapper). A temporal (duration) analysis has been conducted to determine the maximum overlap between the timing of the Sauropod 3D MSS and the spawning times of key commercial indicator fish species (refer to

Table 7-13).

Table 7-12 – Spatial Overlap with Spawning Areas of Key Indicator Fish Species in the Pilbara

Fish Species	Depth Range (m)	Spawning Area (km^2) *	Acquisition Area (3,512 km^2)	
			Overlap (km^2)	%
Red emperor	10–180	99,349	3,505	3.5%
Rankin cod	10–150	92,575	3,205	3.5%
Goldband snapper	50–200	68,748	3,505	5.1%
Bluespotted emperor	5–110	77,912	1,001	1.3%
Giant ruby snapper	150–480	43,566	300	0.7%

* Spawning areas have been estimated based on each species' depth range and the Pilbara fishery management area. It is important to note that genetic connectivity and the biological stocks have been confirmed across significantly larger areas, however, the Pilbara fishery management area is a useful and conservative indicator for assessment purposes and allows the results to be directly related to annual stock status assessments, which are also reported per fishery management area.

Table 7-13 – Temporal Overlap with Spawning Periods of Key Indicator Fish Species

Fish Species	Spawning Period	Maximum Temporal Overlap from the Sauropod 3D MSS *	
		Days	%
Red emperor	September–June (303 days)	60	19.8%
Rankin cod	June–December, March (245 days)	31	12.7%
Goldband snapper	October–May (243 days)	60	24.7%
Bluespotted emperor	July–March (274 days)	60	21.9%
Giant ruby snapper	December–April (151 days)	60	39.7%

*Temporal overlap is based on the maximum number of days that the survey may coincide with the days that each species is known to spawn.

As shown in Table 7-13, the temporal overlap with key indicator species spawning periods, ranges from 12.7% (Rankin cod) to 39.7% (Ruby snapper). It is again stressed that the temporal overlap may also over-represent what will likely, in reality, be a disturbance to one out of many spawning events for a very small proportion of fish affected by the passing seismic source at the time of a spawning event. For example, the above demersal fish species are serial/multiple batch broadcast spawners, releasing multiple batches of eggs into the water column over a wide area, and spawn multiple times throughout the spawning period (Newman *et al.* 2008; Gaughan *et al.* 2018).

A combined spatial-temporal analysis has also been conducted to determine the maximum spatial and temporal overlap of the Sauropod 3D MSS with the spawning area and period of each fish species (refer to Table 7-14). As shown in Table 7-14, the maximum spatial-temporal overlap (1.3%) is with Goldband snapper spawning area in the Pilbara management unit and spawning period. The spatial-temporal overlap for other key indicator species ranges from 0.27% (Ruby snapper) to 0.7% (Red emperor).

Table 7-14 – Combined Spatial – Temporal Overlap with Spawning Periods and Ranges of Key Indicator Fish Species

Fish Species	Spatial Overlap (%)	Temporal Overlap (%)	Spatial-Temporal Overlap (%)
Red Emperor	3.5%	19.8%	0.70%
Rankin Cod	3.5%	12.7%	0.44%
Goldband Snapper	5.1%	24.7%	1.26%
Bluespotted Emperor	1.3%	21.9%	0.28%
Giant Ruby Snapper	0.7%	39.7%	0.27%

As noted above, a number of assumptions have been applied that make the spatial-temporal analysis results highly conservative. Noting again that not all of the Acquisition Area will be ensonified for the full duration of the survey, it is important to consider how a more realistic scenario and area of disturbance may affect the spatial-temporal overlap and the magnitude and extent of the potential impacts to spawning fishes.

For example, within any 24-hour period, the seismic vessel (travelling at a speed of approximately 4.5 knots [8.3 km/hr]) will cover a distance of around 200 km. The Sauropod 3D MSS sail lines will be approximately 83 km in length and take ten hours to acquire, with approximately five hours for the vessel to turn (with the seismic source turned off) and then acquire a parallel line in the opposite direction, offset at least 7.5 km from the previous line. Therefore, in a single 24-hour period, the seismic vessel will cover nearly both sides of a racetrack. Applying a 500 m buffer to either side of the acquisition lines (representative of behavioural effects to fishes within tens or hundreds of metres from the seismic source [Popper *et al.* 2014]) would suggest a very small area of disturbance of approximately 166 km^2, which would be negligible in the context of the large spawning areas and protracted spawning seasons.

It is noted that the same groups of demersal fishes may be exposed to the seismic source again during the following 24-hour period when the seismic vessel returns to acquire the adjacent line offset approximately 450 m from the first line. Therefore, it may be more appropriate to consider a week of acquisition lines in the racetrack; the seismic vessel will gradually move across the survey area and the sound levels will reduce, after which the same groups of demersal fishes will not be exposed again. To apply an additional level of conservatism and account for possible uncertainty about the range over which fish may be disturbed, a 5 km buffer can be applied to the racetrack formation to broadly represent where some fishes may have some awareness of sound pressure changes. Overall, this scenario would result in an area of disturbance of approximately 1,450 km^2. Therefore, at any point during the 60-day duration of the survey, up to 1,450 km^2 may be disturbed (approximately 60% less than the scenario that considers the total Acquisition Area (3,512 km^2). The spatial-temporal overlaps associated with this exposure scenario are between approximately 0.12% (Ruby snapper) and 0.52% (Goldband snapper) of the available spawning area and spawning period, depending on the species.

7.1.5.7.3 Natural Variability in Fish Distribution, Spawning Biomass and Recruitment

In addition to the above spatial-temporal analyses, it is important to note that fishes may not be evenly distributed throughout their range. As is evident from historic catch-per-unit-effort (CPUE) data for the PFTIMF, Gaughan *et al.* (2018) note that species distribution and abundance may vary, for example, Bluespotted emperor is most abundant in the western part of the Pilbara region. Figure 7-7 presents CPUE data for the PFTIMF for Red emperor, Rankin cod, Blue-spotted emperor and Goldband snapper. The red and black dashed polygons indicate the location of the Sauropod 3D MSS Acquisition Area and Operational Area. The CPUE data indicates that these indicator species are potentially less abundant in the Sauropod 3D MSS Acquisition Area than they are in other parts of the Pilbara region and, therefore, the proportion of the fish stocks that may be affected may be significantly less than that inferred by the spatial-temporal analyses above.

Therefore, while it is acknowledged that some temporary and localised disturbances may occur to spawning groups of fishes, the proportion of fishes affected will be very small and there is unlikely to be a significant population level impact.

To provide further context, CGG has considered the natural levels of variability in spawning and recruitment. Spawning biomass and recruitment rates fluctuate annually, with years of elevated or reduced recruitment influencing the overall stock population (Marriott *et al.* 2014). Newman *et al.* (2003) and Marriott *et al.* (2014) suggest that both spawning and recruitment success can vary depending upon both environmental (e.g. water temperature, cyclones, El Nino-La Nina cycles) and anthropogenic influences (e.g. fisheries catch levels over and above natural mortality rates). Extended periods of high exploitation by fisheries can result in decreases in the spawning stock biomass and number of effective spawnings (Newman *et al.* 2003). For example, between 1980 and 2013, Red emperor spawning biomass in the adjacent Kimberley management unit generally decreased to approximately 35% of unfished (pre-1980) levels, while recruitment success fluctuated inter-annually between a minimum of approximately 150 million fish and 400 million fish (a fluctuation of approximately 250%) (refer to Figure 7-8). Similarly, Goldband snapper spawning biomass declined steadily while recruitment success fluctuated inter-annually between a minimum of approximately 250,000 fish and 900,000 fish (a fluctuation of 350%) (refer to Figure 7-9). This provides an indication of the high natural inter-annual variability in the spawning and recruitment of these indicator species. The trends in spawning biomass and recruitment do not clearly reflect one another, indicating that there may also be significant variation in spawning biomass and stock recruitment success as a result of other natural factors.

In the context of this large natural variability, the potential for approximately 1.26% or less of the spawning biomass of each species in the Pilbara management unit to be disturbed is expected to have a negligible effect. The effects of the Sauropod 3D MSS are unlikely to be discernible from natural variation given that it is only the groups of fishes exposed at a particular site and point in time that may be affected; spawning will continue undisturbed elsewhere throughout the stocks' ranges and the majority of spawning groups in the region at any point in time will be undisturbed. The affected groups of fishes will also

spawn again at multiple other times during the spawning season and so discernible impacts to recruitment and populations are not expected.

The serial, broadcast spawning strategies of the indicator demersal fish species, by their very nature, offset potential high natural embryo and larval mortality as a result of predation or other environmental factors and thereby spreads the risk or potential opportunity for larval settlement over large areas and long timeframes. Subsequent recruitment of fishes to the adult stock also occurs over extended timeframes and is ongoing. For example, with reference to Goldband snapper stocks, the Australian Government's FRDC has previously noted that moderate or long-lived species such as Goldband snapper are unlikely to be affected by “short-duration” environmental/climatic changes (of one or a few years), because adult stocks comprise fish that are recruited over many years (Martin *et al.* 2014). Therefore, in comparison, the occasional, short-term, transient and localised disturbances to groups of fish as a result of a seismic survey would have impacts many orders of magnitude smaller than regional scale environmental/climatic events that would affect entire stocks.

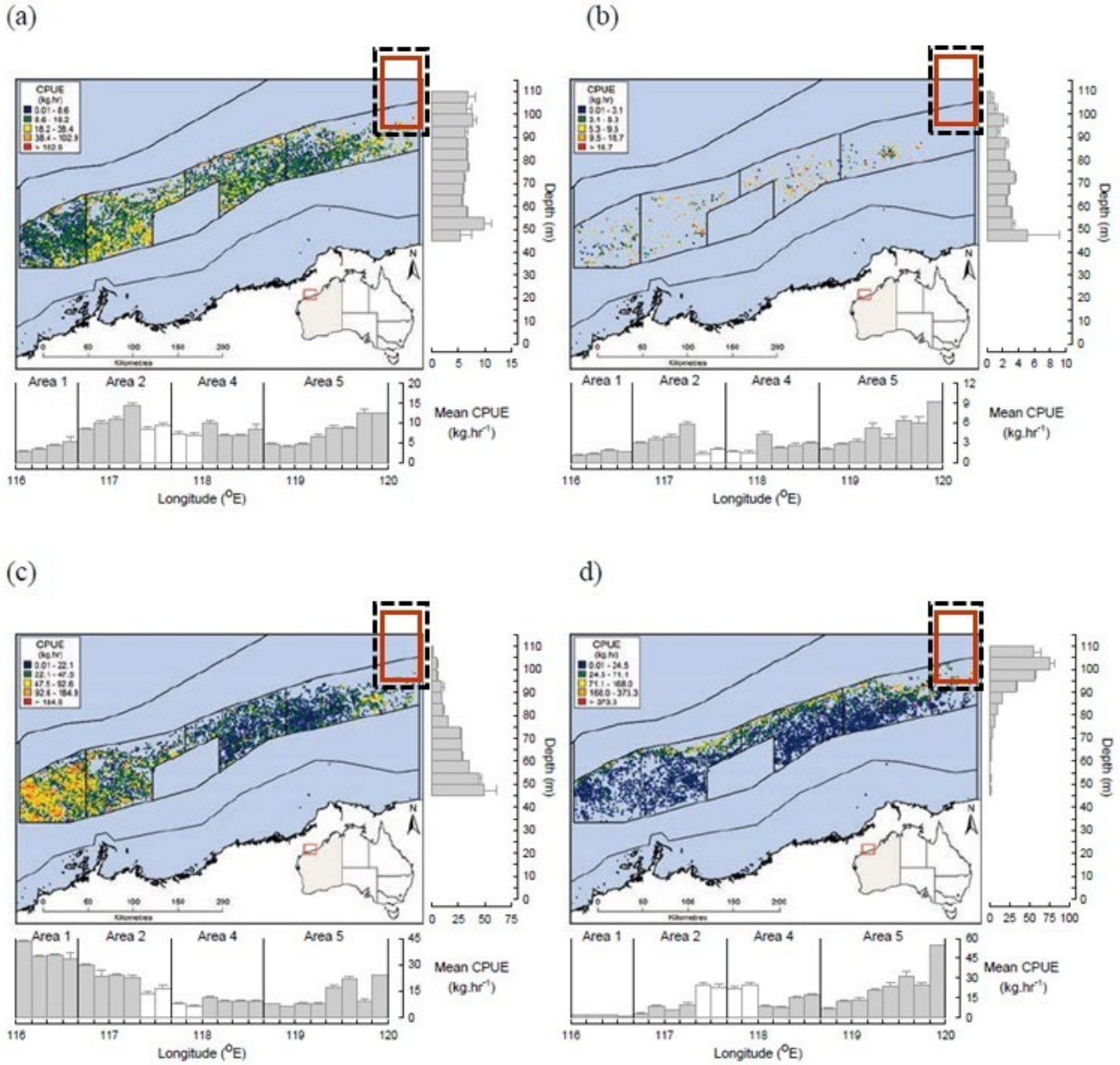


Figure 7-7 – Spatial Distribution of Catch per Unit Effort (CPUE) for the PFTIMF from 2004-2008 for Four Indicator Species, Including (a) Red emperor, (b) Rankin cod, (c) Blue-spotted emperor and (d) Goldband snapper (Gaughan *et al.* 2018). The Red and Black Dashed Polygons Indicate the Location of the Sauropod 3D MSS Acquisition Area and Operational Area Respectively

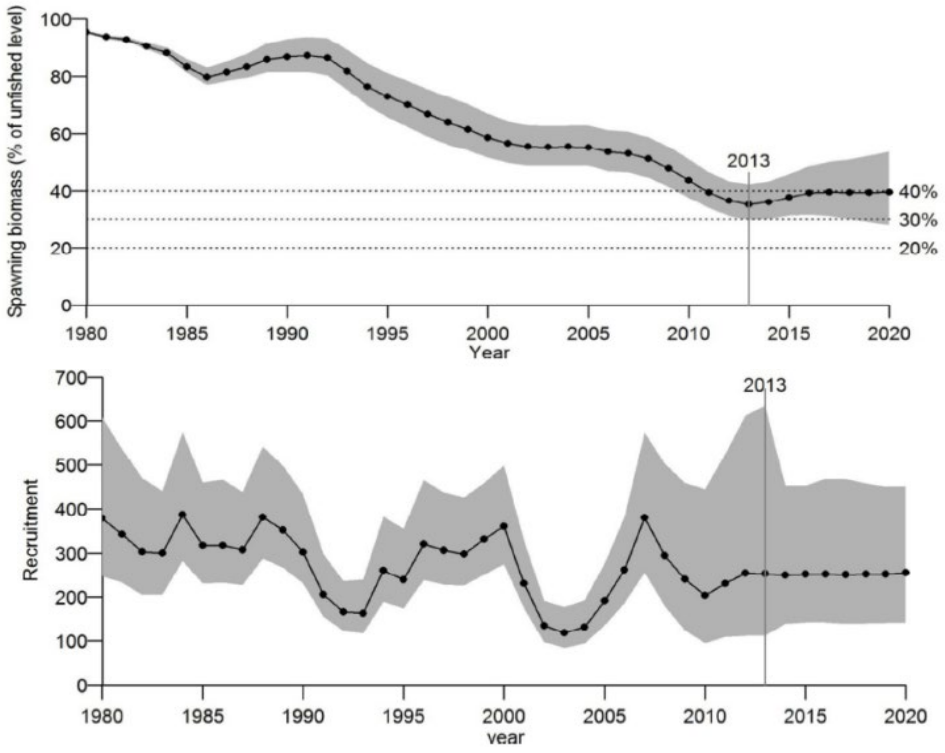


Figure 7-8 – Red emperor Spawning Biomass (Expressed as a Percentage of Unfished Levels) (Top) and Recruitment (Millions of Fish) (Bottom) (source: Department of Fisheries 2015). Levels After 2015 are Predictions Made in 2015 Based on Different Fishing and Stock Scenarios, and do not Represent Real Levels

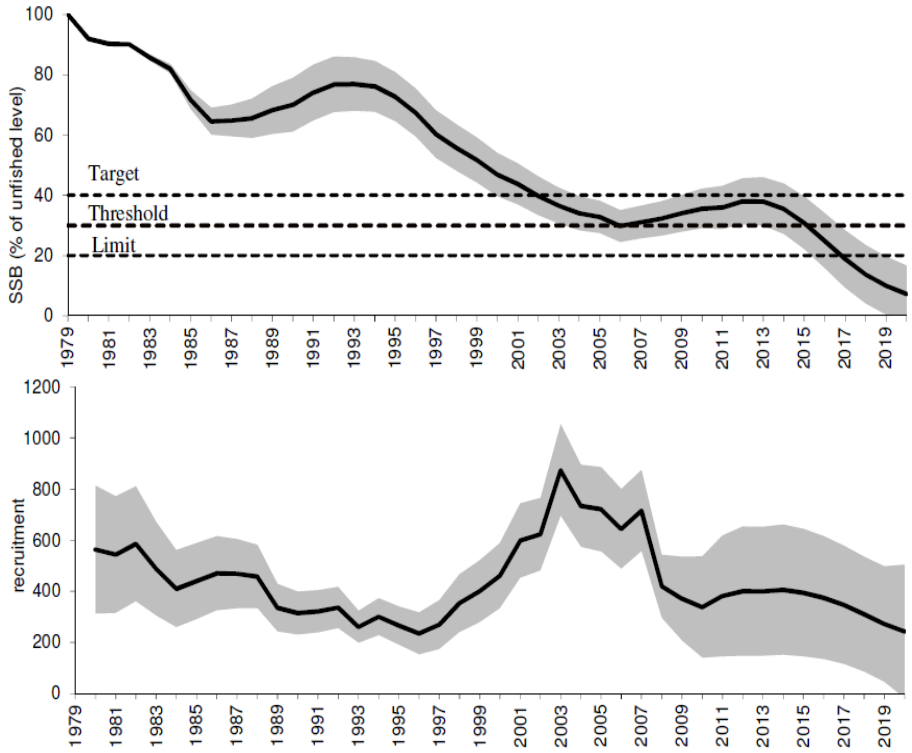


Figure 7-9 – Goldband snapper Spawning Biomass (Expressed as a Percentage of Unfished Levels) (Top) and Recruitment (Thousands of Fish) (bottom) (Source: Department of Fisheries 2015). Levels After 2015 are Predictions Made in 2015 Based on Different Fishing and Stock Scenarios, and do not Represent Real Levels

7.1.5.7.4 Fish Stock Assessments and Sustainability Status

Assessment and management of the north coast demersal scalefish resource is undertaken by DPIRD for the two separate Pilbara and Kimberley fisheries management units. As outlined in the North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017; not updated as at August 2025), assessment of the sustainability of the fisheries and fish stocks is undertaken by DPIRD based on two assessment processes. The first is a formal resource-level review, which is undertaken every three to five years and assesses the current status of the resource (the overall stock abundance and spawning biomass, and fish mortalities from fishing catch) against defined biological reference levels (target, threshold and limit) to determine whether management arrangements are appropriate (DPIRD 2017).

Spawning biomass is estimated based on abundance, sex and age composition derived from catch data. The target, threshold and limit levels in each stock correspond with 40%, 30% and 20% of the virgin spawning biomass (unfished levels) respectively. The target level is an aspirational and acceptable level based on stock biomass and the fishing mortality rate that fisheries managers aim to achieve to be protective of the stock. Due to natural variability in the sizes of fish populations, DPIRD set a target range of 30-40% of unfished biomass (DPIRD 2017).

The second process involves an annual, fishery-level review, which determines whether the current catch/effort is consistent with the reference levels and the status of the resource defined during the resource-level review process (DPIRD 2017). The last available published integrated assessment for the North Coast Demersal Scalefish Resource (both processes) was undertaken in 2017 (DPIRD 2017), although an assessment of the status of the Pilbara Demersal Scalefish Resource was recently completed in 2024 (Wakefield *et al.* 2024).

The stock assessment process and objectives are consistent with the principles of ecologically sustainable development as they aim to maintain spawning stock biomass, high productivity and recruitment, as well as to ensure that fishing impacts do not result in serious or irreversible environmental harm (Wakefield *et al.* 2024). Any stock size at or above the threshold level is consistent with meeting the objectives for biological sustainability and is also sufficient to meet the stock status certification requirements under the Marine Stewardship Council's standard for sustainability (DPIRD 2017).

Table 7-15 outlines the stock assessments of these key indicator fish species for the Pilbara region, as completed by DPIRD (eg Wakefield *et al*. 2024) and published online by the FRDC (Roelofs et al. 2024). Overall, whilst biological stocks of indicator species in the Kimberley region are classified as sustainable – adequate, the biological stocks of indicator species in the Pilbara region have been classified as unsustainable – inadequate (Newman *et al.* 2024). However, Newman *et al.* (2024) note that the total demersal scalefish catch in the PFTIMF in 2023 (1,907 t, or 74% of the total catch in the PDSF), exceeded the acceptable catch range for the total catch (940–1,416 t), despite having the same annual effort allocations as those imposed since 2010. In response to the 2023 PDSR stock assessment, DPIRD is in the process of implementing Phase 1 of a three phase Recovery Plan to recover the demersal scalefish resource in the Pilbara region. This first phase will continue until 30 June 2026 and involve a reduction in the total retained catch of key species by 25% from the 2022 level in order to stabilise the resource while allowing the industry to adjust, before moving to Phase 2 which will involve further reductions in total catch (DPIRD 2024).

In comparison with the unsustainable fishing mortalities, the Sauropod 3D MSS is not expected to result in any direct reduction in the available spawning biomass / allocated stock through fish mortalities as fish are unlikely to be killed as a result of the seismic survey, as noted in Section 7.1.5.4 above).

Table 7-15 – Stock Assessment of Key Indicator Fish Species in the Pilbara region

Fish Species	Stock Assessment
Red emperor (Wakefield *et al.* 2024)	The Level 5 integrated assessment model results for the Pilbara red emperor stock indicate that overfishing is likely to be occurring, and that if future catches remain at current levels, this will lead to the stock becoming overfished, with female mature biomass declining below the limit reference level during the 2023- 2027 model projection period. Thus, a Major level of stock depletion is considered Possible.
Rankin cod (Newman *et al.* 2024)	The stock assessment of Rankin cod was not updated in 2023 due to resource limitations and is scheduled to be updated in 2026. The spawning biomass level of Rankin cod in the Pilbara was previously determined to be well above target levels in 2021. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. The fishing mortality levels of Rankin cod in 2021 were mainly between the target and threshold levels in all management areas. The current level of fishing mortality is unlikely to cause the stock to become recruitment impaired. Therefore, Rankin cod in the Pilbara management unit have been classified as a sustainable stock.
Goldband snapper (Wakefield *et al.* 2024)	The Level 3 estimated relative spawning biomass from per-recruit analyses results indicate that the goldband snapper stock in the western Pilbara region is heavily exploited, with the relative female spawning biomass about midway between the threshold and limit reference levels. Thus, a High level of stock depletion is considered Likely.
Bluespotted emperor (Wakefield *et al.* 2024)	The Level 5 integrated assessment model results for the Pilbara bluespotted emperor stock indicate that although the component of the stock vulnerable to fishing is heavily exploited, this species is relatively resilient to fishing pressure (due to early maturity). If future catches remain at current levels, female spawning stock biomass is predicted to remain at sustainable levels. Thus, a Moderate level of stock depletion is considered Possible.

7.1.5.7.5 Summary

The potential spatial-temporal overlap of the survey with the spawning fish stocks (≤1.26%) will be minor. The effects of the seismic survey on the spawning biomass of the various stocks are expected to comprise occasional localised behavioural disturbances to spawning groups of fish, but the level of impact to the populations (spawning biomass and recruitment) is predicted to negligible, particularly in the context of normal variability in the fish biomass and recruitment levels (250–350%) indicated above.

Potential impacts to spawning and recruitment within commercially significant fish stocks are, therefore, expected to be within an acceptable level based on:

- The seismic survey is not expected to result in any direct reduction in the spawning biomass through fish mortalities
- The high fecundity and broadcast spawning characteristics of key demersal and pelagic fish species in the region, which provide for genetic connectivity of the stocks over extensive areas
- The very short ranges to injury thresholds for fish eggs and larvae shown in in Table 7-9 (130 m from the seismic source) and negligible impacts in the context of natural turnover
- Localised (tens to hundreds of metres) and short-term (minutes, hours, days) behavioural disturbances resulting from a transient seismic source are unlikely to result in a discernible impact to demersal fish populations given that spawning and stock connectivity occurs over significantly larger geographic areas, over protracted spawning periods of several months, and involves the production of millions of eggs over multiple spawning events
- A small spatial-temporal overlap of the Sauropod 3D MSS with the spawning areas in the Pilbara management unit and spawning periods of key indicator fish species (maximum spatial-temporal overlap of 1.26%, based on highly conservative spatial-temporal analyses)
- The approach to assessing the spatial-temporal overlap of the survey includes a significant level of conservatism due to the assumptions outlined previously
- The level of disturbance and spatial-temporal overlap (maximum of 1.26%) with the key fish stocks is expected to be negligible in the context of natural variability in spawning biomass and recruitment (250–350%)

- CPUE data indicates that fish abundance is relatively low within the Sauropod 3D MSS Acquisition Area compared with other parts of the region, therefore, there may be a lower likelihood of disturbing significant numbers of fish
- Key indicator species in the Pilbara fisheries management unit are currently overexploited requiring a reduction in total catch by the fishery. In comparison, the Sauropod 3D MSS is not expected to result in any direct reduction in the available spawning biomass / allocated stock through fish mortalities as fish are unlikely to be killed as a result of the seismic survey.
- Adult stocks comprise fish that are recruited over many years and are unlikely to be affected by seasonal disturbances, even at a regional scale (Martin *et al.* 2014). Therefore, in comparison, the occasional, short-term, transient and localised disturbances to groups of fish as a result of a seismic survey are not expected to impact recruitment
- DPIRD Status of the Fisheries reports also consider other activities in the region, including oil and gas activities and seismic surveys. DPIRD considers the risk status of oil and gas activities to be 'Low' and states that 'While there are a number of specific oil and gas related offshore developments that are proposed in this region, at the overall ecosystem level there is only a low risk that the ecosystem will be altered measurably'. The Status of the Fisheries assessments are undertaken by DPIRD's principal research scientists, responsible for assessing risks to the stocks and maintaining suitable management measures.

Therefore, the survey is not expected to result in a serious or irreversible impact to the recruitment or sustainability of key indicator commercial fish stocks.

Based on the timing and duration (up to 60 days) of seismic acquisition, the potential impacts of noise emissions from the seismic source on spawning of key indicator commercial fish species during the Sauropod 3D MSS are considered to be slight and short-term, as the activity is not likely to result in any ecologically significant impacts at a population level for any key indicator species that may be spawning within or adjacent to the Acquisition Area during acquisition activities.

7.1.5.8 Commercial Fisheries

7.1.5.8.1 Impact Assessment

Increased sound levels associated with seismic acquisition may modify the behaviour, local abundance and distribution of fish species and therefore affect commercial fisheries catch rates in proximity to the Operational Area.

Additionally, seismic acquisition has the potential to affect commercial fisheries via displacement or exclusion of fishers from areas where they normally operate for all or part of the period during which the survey is being acquired. This potential impact is assessed separately in Section 7.4.

As described in Section 4.4.4, there are a number of commercial fisheries that have historic fishing effort within the Operational Area, as follows:

- Pilbara Trap Managed Fishery (PTMF)
- Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)
- Northern Demersal Scalefish Managed Fishery (NDSMF)
- Mackerel Managed Fishery (MMF).

The Pilbara Line Fishery also has fishing rights (the fishery licence areas) that extend into the same waters as the Operational Area; however, fishing effort is not reported here and so they are not assessed further.

Noise impact to the operation of the Pearl Oyster Managed Fishery, which collects pearl shell by drift diving (see Section 4.4.4), has been discussed in Section 7.1.5.10 which addresses noise impact to human divers from the seismic source.

Scientific evidence of acoustic impacts on fish catches are somewhat equivocal because of the lack of determination between natural movements and changes in fish abundance. Based on studies presented in Engås *et al.* (1996) and Slotte *et al.* (2004) where fish were observed to return to the survey areas within 3–5 days following completion of the seismic surveys, any disruptions would likely be short-term and limited to the period of the survey itself, with conditions returning to 'normal' levels soon (days to weeks after).

Not all studies have resulted in behavioural alteration. Feeding Atlantic herring (*Clupea harengus*) schools off northern Norway showed no changes in swimming speed, direction or school size in response to a transmitting seismic vessel as it approached from a distance of 27 km to 2 km, over a six-hour period (Peña *et al.* 2013). As fishing areas are large and

commercial fish species are free-swimming, if fish are 'scared' temporarily from an area, based on evidence presented, it is likely they will be displaced temporarily to another area still within the fishing zone and so able to be caught.

There is little research undertaken on what effect seismic surveys have on fish catchability. Salgado Kent *et al.* (2016) acknowledge that there has been some effort to relate fisheries catch data to seismic survey effort, but to date none of the Australian efforts to relate fin fish catch rates with seismic surveys have yielded results of any meaning. The Gippsland Marine Environmental Monitoring (GMEM) project provided no clear evidence of adverse effects on scallops, fish, or commercial catch rates due to the 2015 seismic survey (Przeslawski *et al.* 2016a): "Catch rates in the six months following the seismic survey were different than predicted in nine out of the 15 species examined across both Danish Seine and Demersal Gillnet sectors. Across both fishing gear types, six species (Tiger flathead, Goatfish, Elephantfish, Boarfish, Broadnose shark and School shark) indicated increases in catch subsequent to the seismic survey, and three species (Gummy shark, Red gurnard, Sawshark) indicated decreases in catch. These results support previous work in which the effects of seismic surveys on catch seem transitory and vary among studies, species, and gear types."

Research to date has identified effects and no effects from seismic surveys on catch rates and abundance. This is likely due to the importance of the context of exposure. In many instances, fish may move away from an area when a seismic survey is being undertaken. This could impact on the catchability and catch rates for the target species of any commercial fisheries occurring in the same area at the same time.

A critical review of the potential impacts of marine seismic surveys on fish and invertebrates (Carroll *et al.* 2017) found that other studies on fish have positive, inconsistent, or no effects from seismic surveys on catch rates or abundance. A desktop study of four species (Gummy shark, Tiger flathead, Silver warehou and School whiting) in the Bass Strait found no consistent relationships between catch rates and seismic survey activity in the area, although the large historical window of the seismic data may have masked immediate or short-term effects, which cannot therefore be excluded (Przeslawki *et al.* 2016b). Przeslawki *et al.* (2016b) concluded that "These results support previous work in which the effects of seismic surveys on catch seem transitory and vary among studies, species, and gear types". The body of peer-reviewed literature does not indicate any long-term abandonment of fishing grounds by commercial species, with several studies indicating that catch levels returned to pre-survey levels after seismic activity had ceased (Carroll *et al.* 2017). As noted by Przeslawski *et al.* (2016b), it is possible that fish may be displaced from a survey footprint to adjacent areas, however the total number of fish within the fishery stock remains unchanged.

Effects will be temporary as the seismic vessel traverses each survey line, and fish may move away as the airgun array approaches. As described above, significant behavioural responses in the key indicator demersal fish species (Red emperor, Rankin cod, Goldband snapper, Blue-spotted emperor and Ruby snapper) will be limited to distances of a few tens or hundreds of metres from the operating seismic source.

An analysis has been conducted to determine the area of overlap of historic fishing activity (effort) and the Acquisition Area (refer to Table 7-16).

Table 7-16 – Spatial Overlap of the Acquisition Area with Fishing Effort for Relevant Commercial Fisheries

Relevant Commercial Fisheries	Average area of Fishing Effort (km^2)*	Maximum Potential Spatial Overlap	
		Overlap (km^2)	%
Pilbara Fish Trawl (Interim) Managed Fishery	27,791.7	1,224.5	4.4
Pilbara Trap Managed Fishery	162,305.1	3,503.7	2.1
Northern Demersal Scalefish Managed Fishery	113,129.7	0	0

*The area of fishing effort for WA managed fisheries is based on historic FishCube data from 2020 to 2024.

As shown in Table 7-16, the spatial overlap between the Acquisition Area and historic fishing effort in the Pilbara region ranges from 0% (Northern Demersal Scalefish Managed Fishery) to 4.4% (Pilbara Fish Trawl Interim Managed Fishery). These fisheries operate throughout the year. The Sauropod 3D MSS is expected to take 60 days to acquire, therefore the temporal overlap is approximately 16%, indicating a total spatial-temporal overlap with the Pilbara demersal scalefish fisheries of ≤0.66%. In addition, as noted in Section 4.4.4, fishing effort is highest in western areas of the fisheries compared to the eastern areas of the fisheries (where the Sauropod 3D MSS is located). FishCube data reports that less than three vessels have typically operated in the Operational Area each year for the last six years, compared with greater fishing effort located to the south-west of the Operational Area, between Exmouth and Dampier (up to five vessels operating). Therefore, interactions and the potential for disturbances to commercial catch rates may be infrequent or may not occur at all. The

distribution of fishing effort (Section 4.4.4) as well as catch-per-unit-effort (CPUE) of key indicator fish species (Section 7.1.5.8) indicates that target fish populations may be more abundant elsewhere.

The Acquisition Area has no overlap with the area of historic fishing activity for the Northern Demersal Scalefish Managed Fishery. Although sound will propagate into the waters accessible to the NDSMF, historically fishing activity only occurs at the eastern edge of the Operational Area where the effort was undertaken by 3 – 8 vessels pooled across the entire five-year period from 2020 to 2024 (often < 3 vessels per year; refer to Section 4.4.4). Therefore, it is considered highly unlikely that disturbances to catch rates in the NDSMF will occur.

In addition to the limited overlap between the Acquisition Area and commercial fishing effort, it is important to note that the spatial overlaps in Table 7-16 are conservative as they assume that disturbance occurs across the entire Operational Area (approximately 6,000 km^2). In reality, the area that may be exposed to seismic sound at any one time during the survey will be significantly less. For example, as described in Section 7.1.5.8, in a single 24-hour period, the area of disturbance (based on the distance travelled by the seismic vessel and a 500 m buffer to either side of the acquisition lines to be representative of behavioural effects to fishes within tens or hundreds of metres from the seismic source [Popper *et al.* 2014]) would be approximately 166 km^2. Even considering the area exposed during a week of racetrack acquisition with a highly conservative 5 km buffer applied, the total area exposed would be approximately 1,450 km^2, approximately 60% less than the total Acquisition Area (3,512 km^2).

It is also important to note that, despite ongoing fishing and seismic surveys across the fisheries in previous years, the demersal scalefish catch in the Pilbara remained historically stable and within catch tolerance levels. This has changed in recent years, with catches above acceptable catch range and stocks of key species depleted or depleting in the Pilbara region (Newman *et a*l., 2024, Wakefield *et al*. 2024), however this is decoupled from seismic survey activity since none has occurred in the Pilbara or Kimberley region for almost three years.

It was understood through consultation with DPIRD and MMF fishers that there has been a moderate depletion of the mackerel stock as evident from the decline in catch rates in recent years (FRDC 2021). Whilst short-term movement by mobile pelagic species away from a marine seismic survey area is not unexpected, coincident changes in mackerel catches reflect the long-term trajectory of the fishery and cannot be attributed to a seismic activity. The behaviour and distribution of mackerel is affected by various environmental factors such as water temperature (Mackie *et al.* 2003) and the fishery experiences regular intrinsic fluctuations. There was a decline in effort and catch rates in the MMF over the 2011/12 year, which may have been due to the 2011 marine heatwave causing changes in biomass and availability of mackerel (DOF 2012). Declining catches were seen again following the 2016 marine heatwave (which occurred over the spawning period) in all three areas of the MMF (DPIRD 2020a). DPIRD has considered this an ‘acceptable moderate depletion of stock’ (FRDC 2021).

The low catches in Western Australia are attributed to ‘widespread environmental changes’ and the status report notes that other Australian states have also recorded declining catches (DPIRD 2020a). Whilst considered three distinct stocks, declines in CPUE have also been observed across the Queensland and Torres Strait fisheries in recent years (ABARES 2020, DAF 2021). The Gulf of Carpentaria fishery is currently considered a depleting stock (FRDC 2021) which is in part attributed to “extreme climatic conditions observed in 2015-2016 (that) may have exacerbated declines in biomass post 2017, once fish spawned in those years became vulnerable to fishing”. The decline in catches described could be the result of these factors.

Pelagic fishes are most likely to exhibit a significant behavioural response (avoidance) by moving away from an operating seismic source that approaches within hundreds of metres of them (Wardle *et al.* 2001). Research shows that mackerel in this region don’t move more than 100 km along the coast (DOF 2013), and whilst it is possible that fish may be displaced from a survey footprint to adjacent areas, the total number of fish within the fishery stock remains unchanged and survey-induced mortality is highly unlikely. Apart from temporary avoidance behaviour around the source and vessel, mackerel behaviour and catchability will also be unaffected by the survey. It is noted that the majority of the survey area is more distant from the actively fished areas than the southern edge where there may be some behavioural disturbance when the vessel is at its closest and therefore, for most of the survey duration noise levels in actively fished areas will be significantly lower than the behavioural effect threshold. Refer to Section 7.1.9 for further evaluation of the cumulative effects of past seismic surveys on the commercial fisheries.

Impacts to commercial fish stocks and fishing catch rates due to the survey are likely to be negligible for the following reasons:

- As noted in Section 7.1.5.8, mortality of fish (both immediate and delayed) is considered highly unlikely based on no documented cases of fish mortality upon exposure to seismic airgun sound under experimental or field operating conditions (ERM 2017).

- Large proportions of the PFTIMF, PTMF, MMF and NDSMF fished areas (95%) are located outside of the Sauropod 3D MSS.
- Fishing catch and effort within the Sauropod 3D MSS Acquisition Area is relatively low (refer to Section 4.4.4). Historic catch effort indicates effort is more focussed in other areas than it is in the Sauropod 3D MSS Operational Area.
- As noted in Section 7.1.5.8, fish recovery from TTS or behavioural effects is expected in days to weeks. No population level effects are predicted to target fish species hence no lasting effects on their catchability, and consequently to commercial catch rates, are expected.
- There are no effects predicted to the ecosystems or habitats of the North Coast fishing bioregion, therefore the proposed seismic activities do not threaten the sustainability of the fisheries that cover significantly smaller areas than the overall distribution of fish in the North Coast fishing bioregion.
- The area of potential impact for the assessed species is a low proportion of the area that they are likely to inhabit and where they are targeted by commercial fishers.

7.1.5.8.2 Summary

Based on the timing and duration (up to 60 days) of seismic acquisition, the potential impacts of underwater noise emissions from the seismic source on commercial catch rates during the Sauropod 3D MSS are considered to be slight and short-term. The activity is not likely to result in any ecologically significant impacts at a population level for any key indicator commercial fish species targeted by commercial fisheries within or adjacent to the Operational Area.

7.1.5.9 Marine Protected Areas

7.1.5.9.1 Impact Assessment

As shown in Figure 4-15, the northern boundary of the Operational Area is located approximately 21 km from the southern boundary of the Multiple Use Zone (MUZ) of the Argo-Rowley Terrace Marine Park (an AMP) and approximately 60 km from the boundary of the Rowley Shoals Marine Park (State waters) at Imperieuse and Clerke reefs. The Operational Area is located approximately 80 km from the boundary of the Mermaid Reef Australian Marine Park.

As described in Section 4.4.1.1, the Argo-Rowley Terrace AMP was established to protect a range of natural, cultural and heritage values, including the canyons linking the Argo Abyssal Plain with the Scott Plateau and the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEFs. The latter KEF overlaps the MUZ of the Argo-Rowley Terrace AMP.

Based on the sound level isopleths for modelling Site 3, maximum predicted received sound levels in the water column at the boundaries of these marine protected areas (MPAs) are as follows:

- MUZ of the Argo-Rowley Terrace Marine Park - approximately 134 dB re 1 µPa (SPL)
- Rowley Shoals Marine Park (at Clerke Reef) - approximately 125 dB re 1 µPa (SPL)
- Mermaid Reef Marine Park – approximately 122 dB re 1 µPa (SPL).

Maximum predicted received sound levels at the boundary of the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF closest to the Operational Area are approximately 127 dB re 1 µPa (SPL).

Consequently, received sound levels in the water column or at the sea floor within the areas of these MPAs closest to the Operational Area will not exceed any of the sound exposure thresholds for injury, TTS or behavioural disturbance in cetaceans, marine reptiles, fishes/elasmobranchs, benthic invertebrates or zooplankton that may be present within the MPAs during acquisition of the Sauropod 3D MSS.

7.1.5.9.2 Summary

Based on the timing and duration (up to 60 days) of the Sauropod 3D MSS and the control measures that will be implemented, predicted noise levels from seismic acquisition are not considered likely to cause any impacts to the natural or cultural heritage values of the any AMP in the region, or to the values of the Rowley Shoals Marine Park (State waters) (Section 4.4.1).

7.1.5.10 Tourism and Recreation (including divers)

7.1.5.10.1 Impact Assessment

As described in Section 4.4, a range of recreational activities take place at Imperieuse and Clerke reefs, within the Rowley Shoals Marine Park (State waters), including scuba diving, snorkelling and fishing charter trips. In addition, the operations of the Pearl Oyster Managed Fishery include hand collection of pearl shell by drift diving (see Section 4.4.4) which may occur in 30 m water depth, which is approximately 91 km from the Acquisition Area.

The separation minimum distances from the Operational Area and Imperieuse and Clerke reefs, where recreational activities may occur, are 67 km and 63 km, respectively. At these ranges, received sound levels at the reefs will be well below levels that would result in any effects, including TTS and behavioural disturbance, in fish targeted by recreational fishers. Therefore, acquisition of the Sauropod 3D MSS will not result in any impact to recreational fishing charter trips to the Rowley Shoals.

To assess the potential impacts from operation of the seismic source in the Acquisition Area on divers and snorkellers in the water at Imperieuse and Clerke reefs, a single-impulse sound exposure threshold of 145 dB re 1 µPa (SPL) was applied, which represents a human health assessment threshold for sound exposure to divers and swimmers, derived from Ainslie (2008) and Parvin (2005). This does not imply that this level is associated with the onset of injury. Based on a number of studies examining the potential effects of underwater noise emissions on both military and recreational divers Parvin (2005) suggested 145 dB re 1 µPa (SPL) as a safety criterion for recreational divers and swimmers, within a frequency range between 100 and 500 Hz. Seismic airgun sources are broadband sources and therefore, for this assessment, the most precautionary and conservative diver acoustic impact threshold has been used.

For modelling Site 3, which is the closest of the four single impulse modelling sites to the Rowley Shoals, the maximum predicted R_{max} distance to the 145 dB re 1 µPa (SPL) threshold was 15.8 km, in the endfire direction (i.e. north towards the reefs). Received levels at Imperieuse and Clerke reefs are predicted to be at or below 120 dB re 1 µPa (SPL), which is approaching ambient background noise levels in these offshore atoll environments where SPLs are consistently between 85–110 dB increasing at times to in excess of 120 dB re 1 µPa as a result of biological noise, waves and tidal currents.

On this basis, divers and snorkelers at Imperieuse and Clerke reefs will not be exposed to sound levels anywhere close to the 145 dB re 1 µPa (SPL) threshold. If diving and snorkelling activities in these areas were to coincide with acquisition of the Sauropod 3D MSS, it is highly unlikely that individuals in the water would be able to hear individual shots from the seismic source above background ambient noise levels.

Dive operations of the Pearl Oyster Managed Fishery may occur approximately 85 km from the Operational Area and approximately 91 km from the Acquisition Area. The maximum predicted R_{max} distance to the 145 dB re 1 µPa (SPL) threshold was 17.72 km from the Acquisition Area (modelled from Site 1). At this distance, underwater noise impacts to divers are not considered credible given the separation distance between likely POMF activities and the Sauropod survey.

The Diving Medical Advisory Committee (DMAC), Safe Diving Distance from Seismic Operations propose the need to make divers aware of activities within 45 km separation and for SIMOPS planning at a separation distance less than 30 km. The POMF is a relevant relevant person and has been informed of the activity as detailed in Section 5. No further specific management or ongoing specific consultation is determined necessary.

7.1.5.10.2 Summary

On the basis of the information provided above there will be no impacts from seismic noise emissions during the Sauropod 3D MSS on diving and snorkelling activities at the Rowley Shoals or to human divers in POMF.

7.1.5.11 First Nations Cultural Features and Heritage Values

7.1.5.11.1 Impact Assessment

As described in Section 4.4.8 and considered in Section 6.4.1 it is assumed that marine habitat and fauna within the Acquisition Area are of cultural importance to First Nations peoples. Assessment of impacts to marine fauna described in Sections 7.1.5.1 to 7.1.5.7 consider the physical effects of noise emissions on these fauna and the context in which individuals are exposed to the noise, including their location relative to the noise source, their spatial and temporal migratory behaviour, and the proportion of the population potentially affected by the noise. The suite of control measures adopted in Table 7.1.7 are designed to ensure that marine fauna that may be affected by seismic noise are not injured and are able to continue biologically important behaviours and this level of management will also ensure that impacts to culturally important

fauna are managed to acceptable levels. It should also be noted that biologically important habitats for the marine fauna species identified during relevant persons consultation as culturally important (e.g. turtles and dugongs) are well inshore of the acquisition area and the activity location inherently reduces potential for impact.

As described in Section 7.1.5.9 Marine Protected Areas such as the Rowley Shoals Marine Park, Mermaid Reef Marine Park, and the Argo-Rowley Terrace Marine Park have been established to protect important natural, cultural and heritage values. Assessment of received noise levels in the water column and at the sea floor within areas of these MPAs closest to the Operational Area will not exceed thresholds for injury, TTS or behavioural disturbance in marine fauna. Given the received noise levels within MPAs are below behavioural disturbance thresholds it is considered that impacts to marine fauna of First Nations cultural significance in these areas will be managed to acceptable levels.

7.1.5.11.2 Summary

Based on assessment of impacts on marine habitat and fauna described in Sections 7.1.5.1 to 7.1.5.10 and summarised above the predicted noise levels from seismic acquisition during the CGG Sauropod MSS are not expected to have a significant effect on relevant cultural features such as whales. Based on assessment of impacts to Marine Protected Areas in Section 7.1.5.9 the predicted noise levels from the MSS are also not expected to cause any impacts to tangible/nontangible heritage values.

7.1.6 Decision Context

The decision context for underwater sound emissions from the seismic source has been assessed as ‘Type B’ due to relevant person concerns raised in relation to potential impacts to commercial fisheries, including fish spawning. As described in Section 6.7.1, further analysis is required in addition to using the tools for a Decision Type A, including assessing the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures.

7.1.7 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Operation of the seismic source within the Operational Area for the Sauropod 3D MSS will be compliant with EPBC Act Policy Statement 2.1 Part A Standard Management Measures	Yes	Consistent with Part A of EPBC Policy Statement 2.1, the following precaution zones will be applied: • Observation zone: 3+ km horizontal radius from the seismic source • Low power zone: 2 km horizontal radius from the seismic source • Shut-down zone: 500 m horizontal radius from the seismic source. Part A of EPBC Policy Statement 2.1 provides standard management procedures and will be implemented during the Sauropod 3D MSS. Precaution zones will be implemented around the seismic source to allow whale observations to be undertaken and the seismic source to be powered or shut down to reduce the potential for PTS and TTS in the event a whale is observed within the precaution zones. Consistent with Part A of EPBC Policy Statement 2.1, the following procedures will be applied: • Pre-Start-up Visual Observations (30 minutes) • Start-up Delay Procedures (if sighting) • Soft-start Procedures (30 minutes) • Operational Shut-down and Low-power Procedures • Night-time and Low Visibility Procedures • Seismic survey vessel crew will be briefed in marine fauna observations, distance estimation and procedures • Cetacean sighting and compliance reports to be submitted to DCCEEW within two months of survey completion.	1.1
Operation of the seismic source within the Operational Area for the Sauropod 3D MSS will be compliant with EPBC Act Policy Statement 2.1 Part B.1 – Additional Management Measures: Marine Mammal Observers	Yes	Two trained and experienced marine fauna observers (MFOs) will be aboard the seismic survey vessel. The two MFOs (in addition to briefed crew members) will alternate shifts during daylight hours in order to manage fatigue and provide some redundancy in the event one MFO is unavailable. At least one MFO will be performing marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. The MFOs will have adequate training and will have 12 months experience in Australian waters. Good industry practice, environmental benefit outweighs additional cost.	1.2
Operation of the seismic source within the Operational Area for the Sauropod 3D MSS will be compliant with EPBC Act Policy Statement 2.1 Part B.4 - Increased precaution zones and buffer zones	Yes	In accordance with criteria outlined in EPBC Policy Statement 2.1, acoustic modelling confirmed that the received sound exposure level from a single seismic pulse will exceed 160 dB re 1µPa2.s for 95% of pulses at 1 km range. Therefore the low power zone will be increased from 1 km to 2 km from all whale species. In addition, a larger shut down zone of 3 km will be implemented for a Pygmy Blue Whale (or potential Pygmy Blue Whale[1]) sighting due to their high conservation value, thus reducing the potential for TTS/PTS impacts in accordance with EPBC Act Policy Statement 2.1 Part B.4. Good industry practice, environmental benefit outweighs additional cost.	1.3
Good Industry Practice			
The seismic source will not be discharged outside the Operational Area. The seismic source will only be discharged outside of the Acquisition Area for the purpose of run-outs, source testing and soft starts.	Yes	The seismic source will not be discharged outside the Operational Area and will only be discharged outside the Acquisition Area for the purpose of run-outs, source testing and soft starts. Good industry practice, environmental benefit outweighs additional cost.	1.4
CGG will engage with proponents identified as having potential concurrent MSS activities prior to commencing the Sauropod 3D MSS and develop a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area	Yes	Engagement with titleholders for potential concurrent MSS activities prior to acquisition commencing, and development of a concurrent operations plan, which will include the following aspects: • Communications protocols • SIMOPS and work programming • Hazard management • Emergency response. Good industry practice, environmental benefit outweighs additional cost.	1.5

[1] A Pygmy Blue Whale or potential Pygmy Blue Whale sighting is defined as an observed whale that is either:
a) positively identified as a Pygmy Blue Whale, or
b) cannot be positively identified as a Pygmy Blue Whale but is potentially a Pygmy Blue Whale (i.e. a large baleen whale), or
c) a whale species cannot be positively identified*.
* A whale sighting that cannot be positively identified could be ruled out as being a potential Pygmy Blue Whale if there is high certainty it is not a large baleen whale.
Whale species verification may occur following an unidentified or potential Pygmy Blue Whale sighting.

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Alternatives/Substitutes Considered			
The source volume used during acquisition of the survey will be equal to or less than the source volume used for the acoustic modelling and impact assessment	Yes	CGG has assessed the minimum size source required to fulfil survey data objectives. A maximum source volume of 2,820 in^3 will be used to acquire the survey. This provides confidence in the impact assessment conducted, which was based on modelling results for a 3,090 in^3 array. Good industry practice, no additional cost.	1.6
Additional Controls Considered			
Survey acquisition timed to avoid the migration periods for Humpback whales (June to October).	Yes	The survey will be acquired in the period January to May, which will avoid the northbound and southbound migration season for Humpback whales in the region (June to October). Good industry practice, avoids potential impacts to a whale species that may be of cultural significance to First Nations people, environmental benefit outweighs additional cost.	1.7
Survey acquisition timed to avoid the migration periods for Pygmy Blue Whales	No	Not justified. Acquisition of the survey may overlap the commencement of the northbound migration (April/May) but avoids most of the northbound migration and the entire southbound migration period for Pygmy Blue Whales in the region (October to December). The migration BIA is located 72 km from the Operational Area. Only occasional, transient individuals of the commencement of the northbound migration (April to August) are therefore expected in the area during the proposed acquisition period. As detailed in the impact assessment (Section 7.1.5.1), based on the timing and duration of the survey, the absence of critical habitats for any species of cetacean (i.e. feeding, breeding, calving areas) or a constricted migratory pathway within the Operational Area and surrounding waters, and the control measures proposed, predicted noise levels from seismic acquisition are not considered likely to cause injury (PTS/TTS) effects or disturb foraging activity for Pygmy Blue Whales that may be present within or adjacent to the Operational Area. Restricting the MSS schedule to completely avoid Pygmy Blue Whale migration periods will significantly increase vessel contracting fees and place logistical constraints (e.g. weather and vessel availability) that jeopardise the viability of the survey. The costs of limiting the acquisition window further to avoid the Pygmy Blue Whale migration entirely are grossly disproportionate to any potential environmental benefit gained.	N/A
Survey acquisition timed to avoid turtle internesting periods	No	Not justified. Acquisition of the survey may overlap the nesting and breeding season for a number of turtle species in the region, however the Operational Area is located at least 15 km from the closest BIA or 'Habitat Critical' boundary. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
EPBC Act Policy Statement 2.1 Part B.2 – Night-time/ Poor Visibility	No	Not justified. These control measures will not be implemented given the relatively low densities of whales expected in the Operational Area during survey acquisition, and the absence of any overlap between critical habitats (i.e. feeding, breeding, calving areas) or a constricted migratory pathway and the Acquisition Area. Additionally, survey acquisition is timed to avoid the Humpback whale migration season. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
EPBC Act Policy Statement 2.1 Part B.3 - Use of spotter aircraft and vessels to detect presence of cetaceans	No	Not justified. These control measures will not be implemented given the relatively low densities of whales expected in the Operational Area during survey acquisition, and the absence of any overlap between critical habitats (i.e. feeding, breeding, calving areas) or a constricted migratory pathway and the Acquisition Area. Additionally, survey acquisition is timed to avoid the Humpback whale migration season. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
EPBC Act Policy Statement 2.1 Part B.5 - Passive Acoustic Monitoring (PAM) to detect presence of vocalising cetaceans	No	Not justified. These control measures will not be implemented given the relatively low densities of whales expected in the Operational Area during survey acquisition, and the absence of any overlap between critical habitats (i.e. feeding, breeding, calving areas) or a constricted migratory pathway and the Acquisition Area. Additionally, survey acquisition is timed to avoid the Humpback whale migration season. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
EPBC Act Policy Statement 2.1 Part B.6 - Adaptive Management Measures	Yes	Part B.6 - Adaptive Management Measures have been applied to further reduce the low likelihood of impacts to Pygmy Blue Whales as timing for the survey may overlap with the possible presence of this species in the region. During acquisition, if a Pygmy Blue Whale (or potential Pygmy Blue Whale[1]) is observed within the extended 3 km Pygmy Blue Whale shutdown zone (as per control measure 1.3), then seismic operations will not be undertaken over the following night-time or period of low visibility. Seismic acquisition will only commence during daylight hours. Night-time operations will only commence when a Pygmy Blue Whale (or potential Pygmy Blue Whale[1]) is not observed in the extended 3 km Pygmy Blue Whale shut down zone in the previous daylight period. The migration BIA (which is not considered a narrow or restricted pathway) is 72 km from the Operational Area and the closest foraging area is approximately 400 km distant from the Operational Area. Hence, whilst there is a possibility of isolated individuals travelling through the Operational Area, due to the lack of foraging grounds in the vicinity of the activity it is not expected that individuals would remain due to the lack of a food source. Cumulative PTS and TTS impacts to LF-cetaceans (such as Pygmy Blue Whales) are predicted to be constrained to within 0.63 km and 15.4 km of the seismic source, respectively (Table 7-5). A tagging study of blue whales showed that migrating individuals can travel 50 to 100 km per day (Double et al, 2012). This equates to an average swimming speed of 2-4 km/hr over a 24-hour period. In comparison, the seismic vessel will be traveling at around 4.5 knots (8 km/hr). Migrating Pygmy Blue Whales at greatest risk of seismic noise exposure are likely to be moving perpendicular to the survey lines, so it can conservatively be assumed the vessel is effectively stationary to the Pygmy Blue Whale movement if they are present. Therefore, given sound levels from the seismic source will only exceed the PTS SEL_{24hr} metric for LF cetaceans for up to 0.63 km from the vessel, a whale could only remain in the area around the vessel where sound levels were sufficient to elicit a 24-hour cumulative exposure response for less than an hour. Similarly for cumulative TTS exposure, sound levels from the seismic source will exceed the TTS SEL_{24hr} metric for LF cetaceans for up to 15.4 km from the vessel. A whale is expected to pass through the ensonified area in approximately 10 hours. Therefore, an isolated individual is highly unlikely to remain within the reported SEL_{24hr} radius for the full 24 hours leading to TSS exposure, particularly due to the lack of foraging grounds within the region. In addition, given the application of EPBC Act Policy Statement 2.1 Part A Standard Management Measures and Part B.4 - Increased precaution zones and buffer zones, the risk of TTS is already reduced. Survey acquisition is timed to avoid the Humpback whale migration season.	1.8
Application of a 200 m shut-down zone for Whale sharks	Yes	Whale sharks are most likely to be present in the Operational Area from July to November and so are not expected to occur in high numbers during the January to May period of the survey. However, they may occur in low numbers.	1.9

Control Measure	Control Adopted	Justification	Performance Standard Ref.
		Acoustic modelling indicates that the maximum predicted distance to the injury threshold for Whale sharks (categorised in the hearing group of fishes without swim bladders) is 60 m. A shut-down zone with a horizontal radius of 200 m from the seismic source is therefore considered to reduce the potential for PTS and TTS to occur.	
Application of a 100 m shut-down zone for marine turtles	Yes	The Operational Area is located at least 15 km from the closest BIA or 'Habitat Critical' boundary for turtles; however, occasional turtles may be present in the Operational Area. Acoustic modelling indicates that injury (PTS) and TTS effects will only occur within very close ranges (tens of metres) to the operating source. A shut-down zone with a horizontal radius of 100 m from the seismic source is therefore considered to reduce the potential for PTS and TTS to occur. It is also noted that turtles were identified as a fauna group of First Nations cultural significance during relevant persons consultation.	1.10
Survey acquisition timed to avoid or limit temporal overlap with the spawning periods for key indicator species for commercial fisheries	No	Not justified. The maximum spatial-temporal overlap of the survey with the spawning areas and periods of commercial fish species is approximately 1.26%. However, the spatial overlap is simply an indication of the area that may be ensonified and where potential spawning aggregations may be influenced. At any one time and during any single spawning event, the area of disturbance will be significantly smaller and will represent a very small proportion of the spawning stock. Therefore, this assessment is conservative. In addition, CPUE data indicates that fish abundance within the Operational Area is relatively low. The level of impact to the populations (spawning biomass and recruitment) is predicted to be negligible, particularly in the context of normal variability. Further limiting the temporal overlap with the spawning periods has been considered. The proposed schedule and temporal window for the Sauropod 3D MSS (January to May) was determined considering the: • Timing of key environmental and socio-economic receptors • Hearing ability and sensitivity of those receptors to sound from the seismic survey • Proximity of sensitive habitat areas to seismic survey areas • Species distribution and range • Level of overlap (in space and time) by the survey with important habitats and life stages of sensitive species • Species vulnerability / conservation status • Potential for impacts to species at both an individual level and at a population level. The optimum window of opportunity was determined to be from January to May (inclusive). The proposed survey timing was selected primarily to avoid the Humpback whale migration through the region (June to October), as well as reduce exposure to Pygmy Blue Whales during their migrations to the north of the Operational Area (April – August and October to December). Both of these species are low-frequency cetaceans and sensitive to seismic sound over several kilometres. The defined survey period, therefore, limits the potential for impacts to these protected species, including preventing injury/hearing impairment (PTS/TTS) or significant behavioural effects during their migrations. It is noted that the Pygmy Blue Whale migration BIA is located sufficiently far from the Operational Area for impacts to be avoided but the timing had also originally taken into account Pygmy Blue Whale distribution outside of the main migration BIA. Fish spawning periods were also considered in detail, noting the importance of spawning and recruitment of fish stocks, but also noting fishes' sensitivity to seismic sound is significantly less than that of cetaceans. Significant disturbance to groups of spawning fishes may occur for short periods when the seismic source is passing within hundreds of metres of their location. The spawning periods of the many different key indicator fish species for the commercial fisheries in the region extend throughout the majority of the year but can vary significantly between species. It is noted that most key indicator species spawn between October and March, April or May. In order to avoid or reduce the survey's overlap with this period, the survey window would extend into both the Humpback whale and more of the Pygmy Blue Whale migration periods. As noted in the above risk assessment, occasional localised disturbances of groups of spawning fishes may occur, but this is not expected to have a significant impact on the stocks, due to their high fecundity, protracted spawning periods, biological connectivity through recruitment from across the region, as well as large natural variability in the spawning biomass and recruitment levels. Avoidance of fish spawning periods would provide limited additional environmental benefit at a disproportionate cost (in terms of potential impacts to more sensitive marine fauna and costs associated with additional measures that would likely be required for whales such as additional shutdowns, adaptive management, etc. Therefore, this option is not considered practicable. Further constraining the survey window and limiting the overlap of the survey with fish spawning periods may mean that the proposed seismic survey could not be completed, potentially equivalent to a cost in the order of millions of dollars of lost seismic survey effort time and data. Given the limited predicted risk to fish spawning and fish stocks, the costs are grossly disproportionate to any potential environmental benefit gained.	
Survey acquisition timed to reduce temporal overlap with commercial fishing operations	No	The Sauropod 3D MSS primarily overlaps with the Pilbara Demersal Scalefish Fisheries, specifically the fished areas of the PFTIMF and the PTMF. The survey does not overlap with the fished area of the PLF or the Mackerel Managed Fishery. Overlap between the Operational Area and the NDSMF is negligible (as explained in the above risk assessment). The PFTIMF, PTMF and NDSMF operate throughout the year. Analysis of FishCube data for the fisheries monthly catch and effort does not provide sufficient information to indicate any clear seasonal trends. Therefore, it is not practicable to alter the timing of the survey in a way that would reduce the temporal overlap with these fisheries.	N/A
No acquisition overlapping the ancient coastline at 125 m depth contour KEF	No	Not justified. Would result in removal of 1,272 km^2 from the Acquisition Area and CGG would not be able to obtain data for all hydrocarbon prospects being targeted. The area of the KEF potential impact by the survey is small (8%), and the KEF is not expected to support large numbers of site-attached species. Any impacts to individuals are not expected to lead to population or ecosystem level impacts. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Implementation of the NERA (2021 – Revision 1) CSEP Commercial Fishing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities.	Yes	Compensation for short term loss of catch due to seismic sound from the survey has been identified as a key issue during relevant person consultation and the NERA Protocol (Revision 1, 2021) provides a practical, evidence-based process that has been developed by the CSEP in consultation with the commercial fishing industry (including WAFIC and CFA), government bodies and seismic industry representatives. Benefit to fishers' livelihoods and industry reputation outweighs the cost of compensation.	1.11

Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)

No practicable improvements have been identified

ALARP Statement

CGG considers the adopted control measures appropriate to manage the impacts and risks of underwater sound emissions from the seismic source. As no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP. Consequence and Likelihood values assigned to cultural features and heritage values are based on the highest value assigned to other relevant receptors.

Receptor	Consequence	Likelihood	Residual Risk Ranking
Cetaceans	Moderate (2)	Unlikely (B)	Medium
Marine reptiles	Moderate (2)	Rare (A)	Low
Seabirds	Minor (1)	Rare (A)	Low
Fishes and elasmobranchs	Minor (1)	Possible (C)	Medium
Benthic invertebrates	Minor (1)	Unlikely (B)	Low
Zooplankton	Minor (1)	Possible (C)	Medium
Fish spawning	Moderate (2)	Unlikely (B)	Medium
Commercial fisheries	Moderate (2)	Unlikely (B)	Medium
Marine protected areas	Minor (1)	Rare (A)	Low
Tourism and recreation	Minor (1)	Rare (A)	Low
Cultural features and heritage values	Moderate (2)	Unlikely (B)	Medium

7.1.8 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The impact/risk associated with underwater noise emissions from the seismic source will be managed in accordance with CGG's HSE Policy. The risk management strategy for managing underwater noise impacts is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	The impact/risk associated with underwater noise emissions from the seismic source will be managed in accordance with CGG's Management System. Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management • Notification and Reporting.
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk associated with underwater noise emissions from the seismic source has been assessed as Medium and will not have a 'significant impact' upon Protected Matters in accordance with EPBC Policy Statement 1.1. – Significant Impact Guidelines.
		Conservation Advice, Recovery Plans, and Other Guidelines The activity will be undertaken in a manner consistent with the applicable objectives and actions of the following marine reserve management plans, species conservation or recovery plans, threat abatement plans, and conservation advice: • Conservation Management Plan for the Blue Whale – Anthropogenic noise in biologically important areas will be managed such that any Blue whale continues to utilise the area without injury, and is not displaced from a foraging area • Approved Conservation Advice for *Megaptera novaeangliae* (Humpback whale) – Consistent with the previous Conservation advice for Humpback whales (prior to the delisting of the species in effect under the EPBC Act from 26-Feb-2022), acoustic modelling was undertaken to assess the potential impacts on Humpback whales. The seismic survey will also be undertaken consistent with the EPBC Act Policy Statement 2.1 • Conservation advice for Sei and Fin whales – The Conservation Advice for both species do not specify required standards for managing noise impacts from seismic surveys, but they do recognise anthropogenic noise as a potential threat to the species. No significant or long-term disturbance, or injury, to Sei or Fin whales from noise emissions is expected as a result of the seismic survey • Recovery Plan for Marine Turtles in Australia – The Recovery Plan states that a precautionary approach should be applied to seismic surveys, such that surveys should not occur inside important internesting habitat during the nesting season. The Recovery Plan also states that in accordance with EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales, all seismic survey vessels operating in Australian waters must undertake a soft start during surveys irrespective of location and time of year of the survey • Conservation Advice for *Rhincodon typus* (Whale Shark) - This Conservation Advice identifies habitat disruption from mineral exploration, production and transportation as a threat to Whale sharks. It does not specifically outline management actions in relation to seismic noise emissions, however, given the control measures to be implemented for the seismic survey, which include soft-start procedures, as well as shut-down procedures for Whale sharks, no injury is expected and the potential for significant disturbance is limited.
		Conservation values and objectives of the North-west Marine Parks Management Plan No impacts are predicted to occur to the natural or cultural heritage values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs as a result of underwater noise from the seismic source.
	Socio-economic Environment – Commercial Fisheries	The assessment of impacts to commercial fisheries and key indicator fish stocks has been undertaken based on relevant external context, including the following data and publications: • North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017), which describes the stock assessment and management approach (consistent with the principles of ESD), including annual fishing effort allocations and catch tolerance levels • Spatial and temporal patterns in fisheries catch and effort distribution (based on DPIRD 2016-2021 FishCube data) • DPIRD (2019c) key indicator fish species' spawning information • DPIRD and FRDC publications and summaries (various, as referenced in this EP) that describe the extent of the biological stocks and fisheries management units. CGG has considered the mitigation recommended in the Department of Fisheries (2013) Guidance statement on undertaking seismic surveys in Western Australian waters: • Avoid key times of year – CGG has considered reducing the temporal overlap of the survey with fish spawning periods, but found this not to be practicable • 'Soft starts' for every event – Soft-starts will be implemented • Avoid restricting movement of fish away from the source of seismic sounds – Fish movements will not be restricted • Minimise the sound intensity and exposure time of surveys - CGG has assessed the minimum size source required to fulfil survey data objectives • Address specific advice from WAFIC, Recfishwest and individual fishers – Consultation has been undertaken. Key indicator fish species' stock status and annual performance reviews, as determined annually by DPIRD and outlined in the annual DPIRD Status of the Fisheries reports. In relation to impacts to commercially targeted fishes and invertebrates, CGG also considered DPIRD Fisheries Research Report No.288 - Risk Assessment of the Potential Impacts of Seismic Air Gun Surveys on Marine Finfish and Invertebrates in Western Australia (Webster *et al.* 2018). However, the report states that the assessment is only applicable to individual fish, assumes they do not move away from the seismic source and only considers mortality. Therefore, the report is not suitable for application to larger scale impacts such as regional aggregations and population level impacts.

Context	Factor	Demonstration
	Relevant persons Expectations	Relevant person concerns have been assessed, responded to and controls adopted for objections and claims which hold merit. First Nations relevant persons identified a number of marine values that hold cultural significance, and a review of the impact assessment and control measures confirms that impacts to these values will be managed to acceptable levels through a combination of effective control measures that will ensure biologically important behaviour can continue and the activity location being distant from coastal reefs, seagrass and BIAs for turtles and whales. Additional controls, including the implementation of a Commercial Fishing Industry Adjustment Protocol has been adopted to formally manage claims by commercial fishing relevant persons so that they do not suffer finically as a result of loss of catch, displacement or loss or damage to fishing gear as a result of survey activities.
Legislation and Other Requirements	Legislation and Conventions	The proposed control measures meet or exceed the required standards and control measures set out in Part A of EPBC Policy Statement 2.1.
Industry Standards	Industry Standards and Best Practices	The activity will comply with the following applicable industry standards and best practice guidance: • EPBC Act Policy Statement 2.1. Part A Standard Management Measures • IOGP Recommended monitoring and mitigation measures for cetaceans during marine seismic survey geophysical operations (March 2017) • IAGC Mitigation Measures for Cetaceans during Geophysical Operations (February 2015).
Ecological Sustainability Development (ESD)	ESD Application	CGG has reduced the impact/risk of underwater noise emissions from the seismic source to prevent serious or irreversible ecological damage. Impacts are expected to have a Negligible or Minor consequence, with likelihoods ranging from Very Unlikely to Possible. The aspect and potential interactions are well understood and managed in accordance with EPBC Policy Statement 2.1 and applicable industry standards and best practice guidance.

7.1.8.1 Defined Acceptable Levels of Impact

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
Marine Fauna or Ecological Communities Listed as Threatened or Migratory under the EPBC Act (Matters of NES)	EPBC Act Part 3 (18A and 20A) EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013).	Seismic survey activities are undertaken in alignment with: • The EPBC Act Part 3 (18A and 20A) and Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013), whereby activities do not have a significant impact on a listed threatened or migratory species population or a listed threatened ecological community • Do not result in the mortality or physical injury of an individual of an EPBC listed (marine fauna) species.	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to marine fauna given the controls adopted will: • Prevent mortality or physical injury to EPBC listed marine fauna species • Prevent a significant impact on a listed threatened or migratory species population or a listed threatened ecological community.
	Conservation Management Plan for the Blue Whale	Seismic survey activities are undertaken in a manner consistent with the requirements of the Conservation Management Plan for the Blue Whale, specifically: • Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury* and is not displaced from a foraging area. **Injury is both permanent and temporary hearing impairment (Permanent Threshold Shift and Temporary Threshold Shift) and any other form of physical harm arising from anthropogenic sources of underwater noise*	With the controls proposed, including enhanced controls as recommended in EPBC Act Policy Statement 2.1 Part B, no injury/hearing impairment (PTS or TTS) are expected to occur to any Pygmy Blue Whale within a biologically important area and no blue whale is expected to be displaced from a foraging area. The proposed timing of the Sauropod 3D MSS (between January and May) has been selected to limit overlap with the Pygmy Blue Whale migration periods (April to August and October to December) and therefore reduce the risk of impacts to individual Pygmy Blue Whales that may occur outside of the migration BIA. Restricting the MSS schedule to completely avoid Pygmy Blue Whale migration periods will significantly increase vessel contracting fees and place logistical constraints (e.g. weather and vessel availability) that jeopardise the viability of the survey. The costs of limiting the acquisition window further to avoid the Pygmy Blue Whale migration entirely are grossly disproportionate to any potential environmental benefit gained. The migration BIA is located is located 72 km to the north of the Operational Area. The predicted maximum distance to the marine mammal behavioural threshold is approximately 8.4 km (refer Table 7-6). The survey is not anticipated to significantly inhibit the migration of Pygmy Blue Whales since the ensonified area only overlaps a small proportion of their known distribution area. There are no known Pygmy Blue Whale foraging areas within the vicinity of the activity, with the closest possible foraging area identified to be approximately 400 km from the Operational Area. Therefore, no significant behavioural impacts are expected to occur. Adaptive management measures to cease night-time operations have been adopted to reduce impact any Pygmy Blue Whale in low visibility or night-time conditions. In addition, an increased shutdown zone of 3 km has been adopted to reduce TTS/PTS impact to a Pygmy Blue Whale or potential Pygmy Blue Whale. The adaptive management measures conservatively apply to Pygmy Blue Whales and potential Pygmy Blue Whale sightings[1] such that injury to Pygmy Blue Whales is prevented, even if not positively identified as a Pygmy Blue Whale.
	Conservation Advice for *Megaptera novaeangliae* (Humpback whale) (no longer approved)	Seismic survey activities are undertaken in a manner consistent with the previous Conservation Advice for Humpback whales (prior to the delisting of the species in effect under the EPBC Act from 26-Feb-2022), specifically: • For actions involving acoustic impacts on Humpback whale calving, resting, feeding areas, or confined migratory pathways, site specific acoustic modelling should be undertaken (including cumulative noise impacts). • All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B Additional Management Procedures must also be applied.	Consistent with the previous Conservation advice for Humpback whales (prior to the delisting of the species in effect under the EPBC Act from 26-Feb-2022), acoustic modelling was undertaken to assess the potential single pulse and cumulative sound exposure impacts on Humpback whales. The seismic survey will also be undertaken consistent with Part A of EPBC Act Policy Statement 2.1, although the survey will not take place near a calving, resting or foraging area. The proposed timing of the Sauropod 3D MSS (between January and May) has been selected to avoid the Humpback whale migration through the region, therefore, no impacts to Humpback whales are expected.
	Recovery Plan for Marine Turtles in Australia 2017-2027.	Seismic survey activities are undertaken in a manner consistent with the requirements of the Recovery Plan for Marine Turtles in Australia 2017-2027, specifically: • Seismic surveys should not occur inside important internesting habitat during the nesting season. • Consistent with EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration	The Sauropod 3D MSS seismic source will not be operated within any important internesting habitats. The Operational Area is located at least 15 km from the closest BIA or 'Habitat Critical' for marine turtles and no significant impacts to marine turtle populations are expected. Soft-starts (as well as shut-down procedures for turtles, which exceed this requirement) will be implemented during the seismic survey.

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
		and Whales, all seismic survey vessels operating in Australian waters must undertake a soft start during surveys irrespective of location and time of year of the survey.	
Marine Fauna or Ecological Communities not listed as threatened or migratory (not matters of NES) under the EPBC Act	Principles of ESD, specifically no serious or irreversible damage.	No serious* or irreversible damage to a population of any marine fauna species or ecological community not listed as threatened or migratory (matters of NES) under the EPBC Act, including: • Marine fauna species not listed under the EPBC Act as threatened or migratory • Benthic invertebrate communities, including those associated with KEFs • Fish communities, including those associated with KEFs • Planktonic communities. * *In the absence of a definition for 'serious' environmental damage in relation to the Principles of ESD under the EPBC Act, CGG considers a serious impact to be impacts with the potential to result in a threat to population or community viability, consistent with a consequence ranking of 'Significant' or greater.*	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to non-listed marine fauna given that: Non-listed marine fauna – The controls adopted to reduce risks to marine fauna such as cetaceans and turtles, apply to all species in these groups irrespective of their status under the EPBC Act. No injury or mortality to such marine fauna is expected to occur given the controls proposed consistent with EPBC Policy Statement 2.1 (e.g. marine fauna observers, precaution zones, soft-starts, shut-down procedures). No species is expected to be displaced from an area of significant habitat; no significant areas for non-listed species are identified in the Operational Area and no serious (i.e. population level) or irreversible impacts are predicted to occur. The structure and ecological function of the ancient coastline at 125 m depth contour KEF will not be impacted. Benthic communities – Impacts to benthic communities are expected to be recoverable. While some benthic invertebrate organisms may experience sub-lethal or effects or chronic mortality, benthic communities are expected to recover in the weeks or months following exposure and changes in community structure and composition are not expected to be detectable from natural variability. No serious (i.e. community level) or irreversible impacts are predicted to occur. The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered Fish communities – Consistent with fisheries management principles, key indicator species have been considered as representative of the full suite of fishes that occur in the Operational Area. The effects of the seismic survey on the spawning biomass of the various stocks are expected to comprise occasional localised behavioural disturbances to spawning groups of fish, but the level of impact to the populations (spawning biomass and recruitment) is predicted to negligible, particularly in the context of normal variability in the fish biomass and recruitment levels (250-350%). Injury or mortality to the types of fish found in the Operational Area is highly unlikely. No serious (i.e. population level) or irreversible impacts are predicted to occur. The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered. Planktonic communities – Zooplankton may be injured or killed in close proximity to the seismic source, however, the magnitude of such localised impacts is negligible and is not expected to be discernible at the regional scale when considering the large natural spatial and temporal variability. No serious (i.e. community level) or irreversible impacts are predicted to occur. Octopus, spiny bream fish, sting rays were identified by the First Nations group Wanparta Aboriginal Corporation as being important totem species to Ngarla people (see Section 4.4.8.6). In addition, staple foods of living cultural value for the Nyangumarta, Karajarri and Ngarla people include saltwater fish, turtles, crabs and oysters (Section 4.4.8.6DNP 2018). The residual risk ranking is Medium for fishes and elasmobranchs, Low for benthic invertebrates and Low for marine reptiles (turtles) (Section 7.1.7). Given that no serious (i.e. population level) or irreversible impacts are predicted to any of these fauna categories, no serious or irreversible impacts are predicted to occur to these First Nations values.
Marine Protected Areas	Conservation objectives and zone rules/requirements of the North-west Marine Parks Management Plan and other marine protected area management plans	Seismic activities are undertaken in a manner consistent with a management plan that is in force for AMPs or State Marine Parks in the region (i.e. Eighty Mile Beach AMP, Argo-Rowley Terrace AMP, Rowley Shoals Marine Park and Mermaid Reef Marine Park).	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to marine protected areas given the activity will be managed in a manner that is consistent with management objectives for relevant AMPs and State Marine Parks.
Commercial Fisheries and Commercial Fish Stocks	Commercial fisheries relevant person objections, claims and concerns regarding: • Effects of seismic sound on key indicator commercially targeted finfish and invertebrate stocks, and • Effects of seismic sound on fish	Commercial fish stocks: Seismic activities are undertaken in a manner that does not result in serious* or irreversible impacts to key indicator commercial fish populations, such that sufficient spawning fish biomass and recruitment of the stocks may be maintained, and the stocks continue to be assessed by DPIRD as Sustainable. * *In the absence of a definition for 'serious' environmental damage in relation to the Principles of ESD under the EPBC Act, CGG considers a serious impact to be impacts with the potential to result in a threat to population or community viability, consistent with a consequence ranking of 'Significant' or greater.* Commercial fisheries:	CGG considers the level of impact to commercial fish stocks to be of an acceptable level given that: • The seismic survey is not expected to result in any direct reduction in the spawning biomass through fish mortalities. • The high fecundity and broadcast spawning characteristics of key demersal and pelagic fish species in the region, which provide for genetic connectivity of the stocks over extensive areas • The very short ranges to injury thresholds for fish eggs and larvae shown in in Section 7.1.6.6 (130 m from the seismic source) and negligible impacts in the context of natural turnover • Localised (tens to hundreds of metres) and short-term (minutes, hours, days) behavioural disturbances resulting from a transient seismic source are unlikely to result in a discernible impact to demersal fish populations given that spawning and stock connectivity occurs over significantly larger geographic areas, over protracted spawning periods of several months, and involves the production of millions of eggs over multiple spawning events • A small spatial-temporal overlap of the Sauropod 3D MSS with the spawning areas in the Pilbara management unit and spawning periods of key indicator fish species • The approach to assessing the spatial-temporal overlap of the survey includes a significant level of conservatism due to the assumptions outlined in the assessment

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
	behaviour and commercial catch levels.	Seismic activities are undertaken in a manner that: • Does not interfere with commercial fishing to a greater extent than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities. • Does not prevent each of the licenced commercial fisheries that overlap with the survey area from a catch that meets (or exceeds) the acceptable annual catch tolerance ranges for the fishery, as defined in the relevant harvest strategy (where catch below these tolerance levels cannot be attributed to other factors, such as changes in annual fishing effort allocations, changes in active vessel numbers, environmental conditions, or market induced impacts). Note - It is a legislated function of DPIRD to annually report the status of the fisheries and fish stocks to WA Parliament and so the status and trends can be considered over time.	• The level of disturbance and spatial-temporal overlap (maximum of 1.26%) with the key fish stocks is expected to be negligible in the context of natural variability in spawning biomass and recruitment (250-350%) • CPUE data indicates that fish abundance is relatively low within the Sauropod 3D MSS Acquisition Area compared with other parts of the region, therefore, there may be a lower likelihood of disturbing significant numbers of fish • Adult stocks comprise fish that are recruited over many years and are unlikely to be affected by seasonal disturbances, even at a regional scale (Martin *et al.* 2014). Therefore, in comparison, the occasional, short-term, transient and localised disturbances to groups of fish as a result of a seismic survey are not expected to impact recruitment • The DPIRD Status of the Fisheries reports indicate that during the period of overlap with previous seismic surveys fish catches remained stable or increased. • The DPIRD Status of the Fisheries Report considers other activities in the region, including oil and gas activities and seismic surveys. DPIRD consider the risk status of oil and gas activities to be 'Low' and states that 'While there are a number of specific oil and gas related offshore developments that are proposed in this region, at the overall ecosystem level there is only a low risk that the ecosystem will be altered measurably'. Therefore, the survey is not expected to result in a serious or irreversible impact to the sustainability of key indicator commercial fish stocks. CGG acknowledges that localised and temporary disturbances to fishing activities from seismic survey activities may occur. CGG recognises that clear and regular communication with fisheries relevant persons is required in order to facilitate planning and resource sharing. However, the level of impact from the Sauropod 3D MSS to commercial fisheries is considered to be Acceptable due to the following reasons: • Based on DPIRD FishCube data and CPUE data, the Sauropod 3D MSS Acquisition Area only overlaps with areas fished by the PFTIMF and the PTMF, however, fishing catch and effort as well as the CPUE (indicative of fish abundance) for these fisheries are relatively low. • The level of interference CGG may have on commercial fisheries is no greater than is necessary to exercise of right conferred by the titles granted to carry out exploration activities. • Disturbances to fisheries are likely to be infrequent and short-term. These are not expected to impact the overall annual catch rates and annual performance of the fisheries to the degree that it prevents the fisheries from achieving (or exceeding) the acceptable annual catch tolerance ranges for the fishery, as defined in the North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017). • The NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS.
Tourism and Recreation	N/A	On the basis of the assessment provided above, no impacts are expected from seismic noise emissions during the Sauropod 3D MSS on tourism and recreation activities (including recreational fishing, diving and snorkelling at the Rowley Shoals). No relevant person objections, claims or concerns were raised regarding recreation and tourism. Therefore, no acceptable level of impact has been defined.	Not applicable – No impacts are expected from seismic noise emissions during the Sauropod 3D MSS on tourism and recreation activities (including recreational fishing, diving and snorkelling at the Rowley Shoals).

Acceptability Statement
As identified in Section 6.2.4, impacts and risks classified as 'Decision Type B' are considered acceptable if the criteria outlined in Table 6-7 are met and it can be demonstrated that the predicted levels of impact and/or residual risk, are at or below pre-defined acceptable level(s) for that impact or risk. The evaluation of potential impacts from noise emissions from the seismic source meets these requirements as outlined above. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.1.9 are considered industry best practice and meet legislative requirements. CGG considers the adopted controls appropriate to manage the impacts of noise disturbance from the seismic source to be of an acceptable level.

7.1.9 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	EPO Measurement Criteria
EPO 1.1	Seismic acquisition is undertaken in a manner that: • Prevents injury or mortality to an individual listed marine fauna species protected under the EPBC Act from underwater noise emissions from the seismic source. • Allows any blue whale to utilise the area without injury and does not displace a blue whale from a foraging area.	PS 1.1 PS 1.2 PS 1.3	No records of an incident (including a breach of Environmental Performance Standards) that could result in suspected injury or mortality of listed marine fauna species under the EPBC Act (required to be reported to NOPSEMA as a reportable incident).

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	EPO Measurement Criteria
EPO 1.2	Seismic acquisition is undertaken in a manner that prevents serious or irreversible damage to a marine fauna or ecological communities not listed as threatened or migratory (not matters of NES) under the EPBC Act.	PS 1.4 PS 1.5 PS 1.6 PS 1.7 PS 1.8 PS 1.9 PS 1.10 PS 1.11	No records of an incident (including a breach of Environmental Performance Standards) that could result in serious or irreversible damage to a marine fauna or ecological communities not listed as threatened or migratory (not matters of NES) under the EPBC Act.
EPO 1.3	Seismic acquisition is undertaken in a manner that does not compromise the objectives of relevant recovery plans or wildlife conservation plans/advice that are in force for a marine fauna species.		No records of an incident (including a breach of Environmental Performance Standards) that could result in compromise of the objectives of relevant recovery plans or wildlife conservation plans/advice from underwater noise emissions from the seismic source.
EPO 1.4	Seismic acquisition is undertaken in a manner that does not compromise the principles, values and objectives of protected areas (AMPs and State Marine Parks) from underwater noise emissions from the seismic source (as defined in relevant in-force management plans).		No records of an incident (including a breach of Environmental Performance Standards) that could result in impacts to the principles, values and objectives of protected areas (AMPs and State Marine Parks) from underwater noise emissions from the seismic source.
EPO 1.5	Seismic acquisition is undertaken in a manner that: • Prevents serious or irreversible impacts to key indicator commercial fish populations, such that sufficient spawning fish biomass and recruitment of the stocks may be maintained, and the stocks continue to be assessed by DPIRD as Sustainable. • Does not prevent each of the licenced commercial fisheries that overlap the Adjustment Area from a catch that meets (or exceeds) the acceptable annual catch tolerance ranges for the fishery, as defined in the relevant harvest strategy (where catch below these tolerance levels cannot be attributed to other factors, such as changes in annual fishing effort allocations, changes in active vessel numbers, environmental conditions, or market induced impacts). • Does not result in financial loss to commercial fishers due to reduced catchability of target species, decreased catch or catch per unit effort, loss or damage to fishing equipment, or decreased ability to fish within the area impacted by seismic noise emissions.		No records of an incident (including a breach of Environmental Performance Standards) that could result in serious or irreversible impacts to key indicator commercial fish populations, or a reduction in the total annual catch levels of the commercial fisheries that may operate within the Operational Area below the annual catch tolerance ranges. No records of financial loss by commercial fishers resulting from the seismic survey.

Number	Performance Standards	Measurement Criteria
PS 1.1	Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 Part A Standard Management Measures: • Observation zone: 3+ km horizontal radius from the seismic source • Low power zone: 2 km horizontal radius from the seismic source • Shut-down zone: 500 m horizontal radius from the seismic source • Pre-Start-up Visual Observations (30 minutes) • Start-up Delay Procedures (if sighting) • Soft-start Procedures (30 minutes) • Operational Shut-down and Low-power Procedures • Night-time and Low Visibility Procedures • Seismic survey vessel crew will be briefed in marine fauna observations, distance estimation and procedures • Cetacean sighting and compliance reports to be submitted to DCCEEW within two months of survey completion.	Records demonstrate compliance with Policy Statement 2.1 Part A Standard Management Measures.
PS 1.2	Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 Part B.1 – Additional Management Measures: Marine Mammal Observers. Two trained and experienced MFOs are aboard the seismic survey vessel. The two MFOs (in addition to briefed crew members) alternate shifts during daylight hours in order to manage fatigue and provide some redundancy in the event one MFO is unavailable. At least one MFO will be performing marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. The MFOs have adequate training and will have 12 months experience in Australian waters.	Records demonstrate that two MFOs were aboard the survey vessel for the duration of the survey and that at least one MFO performed marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. MFO sighting records and final report. CVs and training records for the MFOs.
PS 1.3	Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 Part B.4 - Increased precaution zones and buffer zones. • Observation zone: 3+ km horizontal radius from the seismic source • Low power zone: 2 km horizontal radius from the seismic source • Shut-down zone: 500 m horizontal radius from the seismic source and a shut down zone of 3 km for a Pygmy Blue Whale (or potential Pygmy Blue Whale⁺) sighting. ⁺A Pygmy Blue Whale or potential Pygmy Blue Whale sighting is defined as an observed whale that is either:	Records demonstrate compliance with Policy Statement 2.1 Part B.4 Increased precaution zones and buffer zones.

Number	Performance Standards	Measurement Criteria
	a) positively identified as a Pygmy Blue Whale, or b) cannot be positively identified as a Pygmy Blue Whale but is potentially a Pygmy Blue Whale (i.e. a large baleen whale), or c) a whale species cannot be positively identified*. *A whale sighting that cannot be positively identified could be ruled out as being a potential Pygmy Blue Whale if there is high certainty it is not a large baleen whale.	
PS 1.4	The seismic source is not discharged outside the Operational Area. The seismic source is only discharged outside of the Acquisition Area for the purpose of run-outs, source testing and soft starts.	Records demonstrate that there has been no discharge of the seismic source outside the Operational Area.
PS 1.5	CGG has engaged with proponents identified as having potential concurrent MSS activities prior to commencing the Sauropod 3D MSS and have developed a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area.	Records demonstrate CGG has re-engaged with identified titleholders prior to commencing the Sauropod 3D MSS, and has developed a concurrent operations plan, if required.
PS 1.6	The source volume used during acquisition of the survey is equal to or less than the source volume used for the acoustic modelling and impact assessment.	Records confirm that a source with a maximum volume of 2,820 in^3 has been used throughout the survey.
PS 1.7	Survey acquisition is timed to avoid the migration periods for Humpback whales (June to October).	Records confirm that the survey has been acquired outside the June to October Humpback whale migration season.
PS 1.8	Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 - Part B.6 - Adaptive Management Measures. During acquisition, if a Pygmy Blue Whale (or potential Pygmy Blue Whale⁺) is observed within the extended 3 km Pygmy Blue Whale shutdown zone (as per control measure 1.3), then seismic operations will not be undertaken over the following night-time or period of low visibility. Seismic acquisition will only commence during daylight hours. Night-time operations will only commence when a Pygmy Blue Whale is not observed in the extended 3 km Pygmy Blue Whale shut down zone in the previous daylight period. ⁺A Pygmy Blue Whale or potential Pygmy Blue Whale sighting is defined as an observed whale that is either: a) positively identified as a Pygmy Blue Whale, or b) cannot be positively identified as a Pygmy Blue Whale but is potentially a Pygmy Blue Whale (i.e. a large baleen whale), or c) a whale species cannot be positively identified*. *A whale sighting that cannot be positively identified could be ruled out as being a potential Pygmy Blue Whale if there is high certainty it is not a large baleen whale.	Records demonstrate compliance with Policy Statement 2.1 Part B.6 – Adaptive Management Measures.
PS 1.9	A shut-down zone of 200 m horizontal radius from the seismic source is implemented for Whale sharks.	MFO sighting records and final report confirm implementation of a 200 m shut-down zone for Whale sharks.
PS 1.10	A shut-down zone of 100 m horizontal radius from the seismic source is implemented for marine turtles.	MFO sighting records and final report confirm implementation of a 100 m shut-down zone for marine turtles.

Number	Performance Standards	Measurement Criteria
PS 1.11	Implementation of the NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) (NERA Protocol) to formally manage claims by commercial fishers for loss of catch, displacement, and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS, in accordance with the following performance parameters: 1. A claim can only be lodged by an eligible commercial fisher (as defined by NERA, 2021) or a person authorised to do so on behalf of the commercial fisher. 2. The Sauropod 3D MSS Adjustment Area (extending 10 km around the perimeter of the area in which the seismic source can be active) establishes the spatial extent of a claim. 3. A commercial fisher (or fishing vessel or licence) must have previous fishing history in fishing blocks/events overlapping the Adjustment Area for which they make a claim for loss of catch or displacement. The minimum fishing history is two out of the five years within fishing blocks/events which overlap the Adjustment Area, prior to the Sauropod 3D MSS. 4. Loss of Catch adjustment is available to eligible commercial fishers for a loss experienced during the period of the Sauropod 3D MSS and for 6 months after this period. 5. Displacement or Loss of Gear adjustment may be claimed for a loss experienced during the period of the Sauropod 3D MSS. 6. A Loss of Catch claim may be submitted up to 12 months after completion of the Sauropod 3D MSS. 7. A Displacement or Loss of Gear claim may be submitted up to 6 months after completion of the Sauropod 3D MSS. 8. CGG will notify relevant commercial fishing licence holders and respective peak commercial fishing industry bodies of the establishment of the claims process, the survey timing and the Adjustment Area no less than 28 days before commencement of the Sauropod 3D MSS. Notification will be in writing and include a map and digital files in KML, GPX and shapefile format as well as contact details for lodgement of a claim. 9. Full details on the information required to be lodged with a claim are contained in the application forms provided in the NERA Protocol (Appendix 2- Loss of catch, Appendix 3- Displacement, Appendix 4 – Fishing gear loss or damage). 10. CGG will confirm with a commercial fisher that their claim has been received within 7 days of its receipt. 11. Claims will be assessed by an independent assessor with experience in fisheries management or claim assessment. 12. If an assessor believes the information lodged with a claim is not sufficient to conduct a meaningful assessment or support the application, then the claimant will be advised in writing and given 14 days to respond to the assessor. If no response is received within 14 days, then the assessment will be completed, and the claimant advised of the outcome. 13. An appropriately documented claim (including relevant catch and effort information) will be assessed, and a report provided to the claimant within 60 days of the lodgement date of the claim. The 60-day time period begins upon receipt of the necessary catch and effort data. The 60-day period may be extended if mutually agreed between CGG and the claimant, however if no agreement is possible CGG shall appoint an expert reviewer (independent of both parties and the assessor) (at CGGs expense and in consultation with the claimant). The expert reviewer must have experience in fisheries management or claims assessment. 14. The assessment report will include the following information: • a copy of the letter of instruction/project brief received by an assessor when engaged to carry out the independent assessment, • confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment, • a summary of the claim details (survey, applicant, vessel, month(s)), • for a loss of catch claim, monthly CPUE assessments as outlined in this protocol including an estimation of any loss of catch (in kilograms) and its market price, and • any other information, comments, or views relevant to the assessment that the assessor may wish to include. 15. If a claimant disagrees with a claim assessment outcome and cannot reach agreement with CGG they may request an expert reviewer (independent of both parties and the assessor) (funded by CGG). The expert reviewer must have experience in fisheries management or claim assessment. As part of that process both the claimant and CGG shall be given the opportunity to address the expert reviewer to state their position, prior to a decision being reached. The expert reviewer will provide opinion as to whether the claim assessment process has been conducted in line with the requirements of the protocol, and their decision will be binding on the claimant and CGG. 16. Once a claimant and CGG agree on the claim outcome, or an expert reviewer has issued a report, CGG will provide monetary adjustment to the claimant within 60 days. 17. Revision 1 of the NERA Protocol provides full detail of and is the ultimate reference for the commercial fisher claims process.	Records demonstrate that: 1. Commercial fishers or their authorised persons have been able to submit a claim if desired for loss of catch, displacement or lost or damaged fishing gear resulting from the Sauropod 3D MSS. 2. Eligible commercial fishers and their respective commercial fishing industry peak bodies have been notified of the establishment of the claims process and the Adjustment Area in writing no less than 28 days prior to commencement of the Sauropod 3D MSS. Notification has included a map and digital files in KML, GPX and shapefile format, and included contact details for lodgement of a claim. 3. A claim by a commercial fisher was considered valid if evidence confirmed that: • They were eligible to do so. • They had the required catch history. • The claim was for the applicable period. • The claim was lodged within the time frames described in PS 1.11. 4. Claimants were notified within 7 days of receipt of their claim. 5. A claim, made using forms provided in Appendices 2 – 4 of the NERA Protocol, was assessed: • By an independent assessor with experience in fisheries management or claim assessment. • In accordance with the process and reporting requirements described in points 12 – 14 of PS 1.11. 6. If requested by the claimant the assessment outcome was reviewed by an independent expert reviewer in accordance with point 15 of PS 1.11. 7. Once a claimant and titleholder agreed with a claim outcome or an expert reviewer had issued a report CGG provided monetary adjustment to the claimant within 60 days. 8. Revision 1 of the NERA Protocol was the reference document for the commercial fisher claims process.

7.2 Cumulative Impacts from Seismic Surveys

7.2.1 Source of Impact / Risk

Cumulative impacts from seismic surveys can potentially occur as a result of:

- Consecutive/successive seismic surveys where the spatial footprint of impacts from previous seismic surveys have occurred over the same area as where impacts from the Sauropod 3D MSS are predicted to occur. Cumulative impacts will only occur where the effects of previous surveys overlap the same area and when recovery of the impacts from these seismic surveys has not occurred prior to the Sauropod 3D MSS commencing; or
- Multiple seismic surveys that occur concurrently in a region (i.e. at the same time). Effects may or may not overlap spatially but may result in an incremental increase in impacts within the range and extent of the same receptors, for example, where different surveys overlap with the distribution of the same population of a marine species or with the same commercial fishery.

Therefore, this section assesses the potential for cumulative impacts associated with Sauropod 3D MSS being undertaken:

- In an area where other seismic surveys have occurred previously
- Concurrently (at the same time) as other marine seismic surveys in the areas.

This section does not assess cumulative impacts from seismic surveys that may occur after the Sauropod 3D MSS. It is not possible to anticipate what surveys will be planned after the Sauropod 3D MSS and it is the responsibility of future seismic survey proponents to assess the potential cumulative impacts in their EPs.

7.2.2 Impact/Risk Evaluation

7.2.2.1 Previous Seismic Surveys

7.2.2.1.1 Cumulative Impacts to Ecological Receptors

Table 7-17 presents a summary of the marine seismic surveys that have been undertaken recently within approximately 150 km of the Sauropod 3D MSS Acquisition Area. The footprint of any significant underwater noise effects resulting from the Sauropod 3D MSS has been assessed as being within approximately 15 km from the seismic source (based on the maximum range to TTS and behavioural effects assessed for any receptor type in Section 7.1), however, a 150 km buffer (ten times this distance) has been selected as a conservative search criterion to understand where previous surveys have occurred close by. The locations of previous surveys are shown in Figure 7-10.

In some instances, it has not been possible to confirm the exact dates surveys were acquired or the final areas that were acquired. Therefore, for the purposes of the assessment, it has been conservatively assumed that surveys have gone ahead within the total area and timescale proposed in their respective EPs.

Cumulative impacts from successive surveys over the same areas can occur when the timing between surveys is less than the recovery rate of any potential impacts to receptors. As described in Section 7.1, the duration of recovery following exposure to underwater noise emissions from a seismic survey can be in the order of minutes to hours for some receptors, or weeks to months for other receptors, for example:

- Localised changes in zooplankton abundance are likely to be replenished and indistinguishable from natural levels within hours of a seismic survey vessel passing or, based on the most conservative studies (McCauley *et al.* 2017) and a precautionary approach, within a few days of a seismic survey being completed.
- Sub-lethal effects and chronic lethal effects to some benthic invertebrates may occur for weeks or several months after exposure, although changes in overall benthic community composition and structure are expected to be negligible in the context of natural variability in mortality and recruitment.
- Changes in fishes' behaviour, abundance and distribution have been observed to last for minutes, hours or days, depending on the species, hearing sensitivity and situational context.
- Behavioural changes in migrating or foraging marine fauna (e.g. cetaceans, turtles, whale sharks) likely returning to normal within hours or days after exposure.

Most of the seabed where the Sauropod 3D MSS would occur does not appear to have been previously investigated by 3D MSS activities. Approximately 5.6 km^2 of the 650 km^2 area completed during the Santos Keraudren Extension 3D MSS overlapped seabed where the Sauropod MSS survey would occur (Table 7-17). This survey was acquired between the 6 and 17th of February, 2022, approximately 3.7 years prior to the earliest possible start date for the Sauropod 3D MSS. Phase 1 of the Keraudren Extension 3D MSS encompassed a larger area than phase 2 and was located directly adjacent to the Sauropod 3D MSS Acquisition Area, however this survey was completed approximately 4.4 years prior to the earliest possible start date for the Sauropod 3D MSS (Table 7-17). Prior to that, Fugro Multi Client Services Pty Ltd completed the Zeester 3D MSS in an area that partially overlaps the planned Sauropod 3D MSS in early 2012, and other more recent surveys were undertaken between 45.4 – 81.4 km from the Sauropod 3D MSS Acquisition Area (Table 7-17).

Therefore, noting the potential longer duration between surveys if the Sauropod 3D MSS commences at a later date, the small area of overlap between surveys, and the maximum potential duration of recovery (several months in the case of benthic invertebrates), the cumulative impacts to ecological receptors are not expected to occur as a result of any of the identified previous seismic surveys in the region and the proposed Sauropod 3D MSS.

Table 7-17 – Previous Seismic Surveys Completed Within 150 km of the Sauropod 3D MSS in the last 5 years

Survey Name	Survey Location	Survey Timing and Duration	# days/years from survey end to 1 Jan 2026 (earliest start date for Sauropod MSS)
TGS-NOPEC Geophysical Company Pty Ltd, Capreolus-2 3D Marine Seismic Survey 2020 - 2024	The Sauropod 3D MSS Acquisition Area is located 81.3 km east of the TGS Acquisition Area.	Completed January – March 2023 (exact dates not known).	~ 1008 days (~ 2.8 years)
INPEX 2D MSS WA-532-P, WA-533-P and WA-50-L	The Sauropod Acquisition Area is located 45.4 km southwest of the INPEX 2D Acquisition Area.	Completed December 2021 - 2 May 2022.	1340 days (~ 3.7 years)
Santos Keraudren Extension 3D MSS (phase 2)	The Sauropod Acquisition Area overlaps 5.6 km^2 of the Keraudren Extension (phase 2) Active Source Area.	Completed 6 – 17 February 2022	1414 (~ 3.9 years)
Santos Keraudren Extension 3D MSS (phase 1)	The Sauropod 3D MSS Acquisition Area is located 0.2 km east of the Keraudren Extension (phase 1) Active Source Area.	Completed 6 June – 26 July 2021	1620 (~ 4.4 years)
Santos Archer 3D MSS	The Sauropod Acquisition Area is located 81.4 km west northwest of the Archer Active Source Area.	Acquired 23 April – 1 June 2021	1675 (~ 4.6 years)

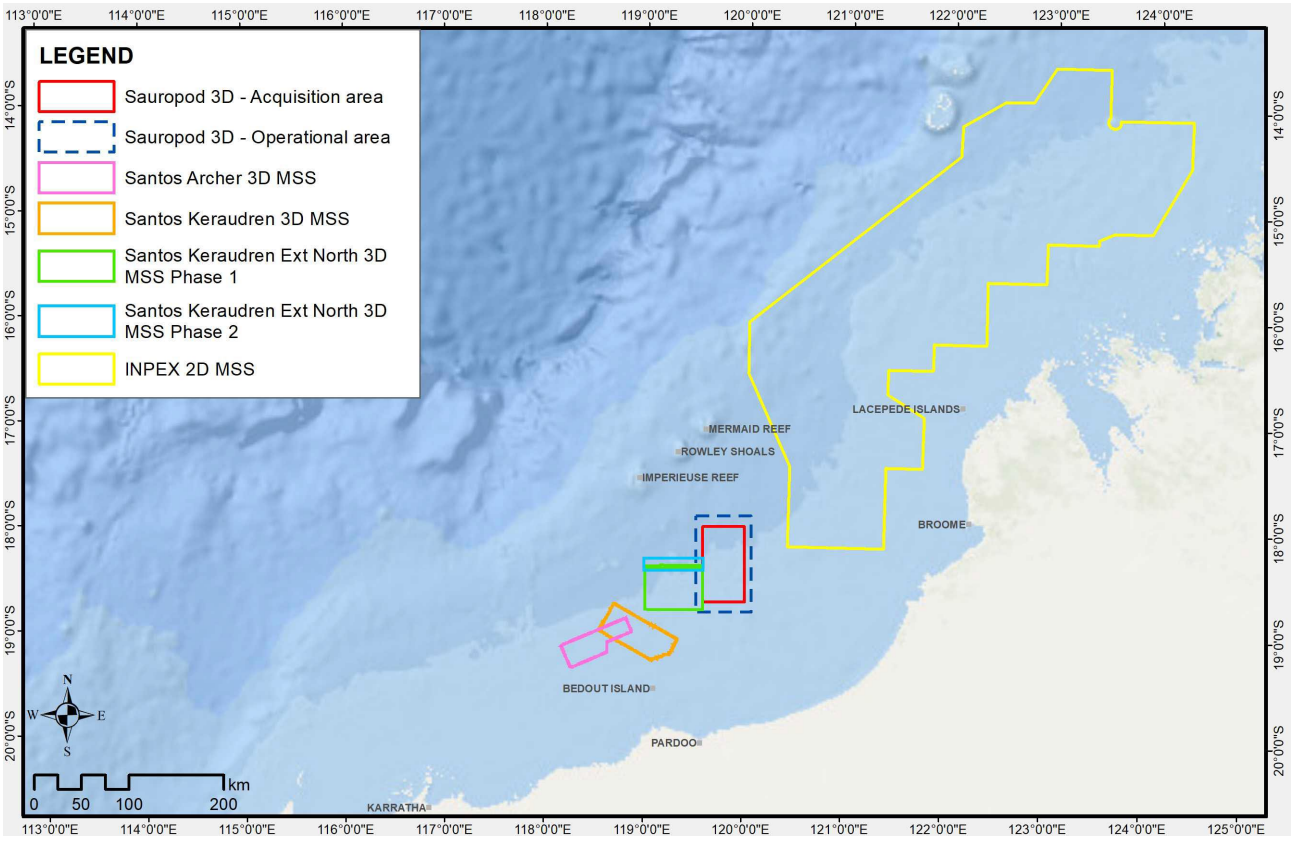


Figure 7-10 - Previous Seismic Surveys Completed Within 150 km of the Sauropod 3D MSS in the last 5 years

7.2.2.1.2 Cumulative Impacts to Commercial Fisheries and Commercial Fish Stocks

In addition to the assessment of cumulative impacts to ecological receptors, a separate and more detailed assessment has been undertaken of the potential cumulative impacts to commercial fish stocks and commercial fisheries. This assessment addresses concerns from fisheries relevant persons regarding multiple seismic surveys occurring within the fisheries over consecutive years. In this respect, the concerns are not just limited to seismic surveys occurring over the same area of seabed, but the additive effects of different seismic surveys occurring in separate locations within the same fishery or the fish stock distribution. Therefore, to address these concerns, CGG has assessed the potential cumulative impacts to the Pilbara Demersal Scalefish Fisheries using the same fish spawning areas within the Pilbara fisheries management unit that were assessed in Section 7.1.6.6.

To assess the potential cumulative impacts of past surveys to the commercial fisheries historically active within the Operational Area CGG has reviewed both historical seismic surveys and available FishCube data over the period 2020–2024. The assessment focuses on the PFTIMF of the Pilbara Demersal Scalefish Fisheries as this fishery is the most conservative in terms of the potential for marine user interaction and area of overlap with the fishery for the Sauropod 3D MSS. FishCube data for the PFTIMF was available in a 10 nm CAES block resolution. As such, the area of fishing effort and overlap is likely to be overestimated, as fishing is likely limited spatially to discrete locations rather than over the entire area of the fishing blocks. The available FishCube data and DPIRD's annual Status of the Fisheries publications indicates between 66% and 78% of the total retained catch in the Pilbara Demersal Scalefish Fisheries retained by the trawl sector in any year. Therefore, the assessment of impacts to the PFTIMF is considered representative of the greatest likely impacts to any of the commercial fisheries historically active within the Operational Area.

Vessel presence per fishing block per month has been used to indicate the level of fishing effort; this was the only complete data set available within the FishCube data, as total fish catch, effort or catch per unit effort was not available (confidential information for fisheries) based on less than three operating vessels being reported in most blocks in the monthly and annual datasets. Hence, fishing vessel presence per month was used as an indicator of the general level of fishing activity in the fishery.

The following limitations and assumptions apply to the assessment, including:

- Survey areas have been calculated based upon the Acquisition Areas as these were the only available areas for all surveys. Operational Areas and ramp-up zones could not be confirmed for most surveys.
- Although the start and end dates of seismic surveys are known, it has not been possible to ascertain the dates when acquisition will have occurred in the parts of the survey areas that overlap the area fished by the PFTIMF. Therefore, it has not been possible to assess temporal overlap.
- It is important to note the overlap of the Acquisition Areas with the fisheries is likely to overestimate the actual area of disturbance to fishers in most cases, as the seismic survey vessel will not be operating across the whole of these areas all of the time. Instead, survey effort will be more focussed on discrete areas at any one time, comprising racetracks in the case of 3D surveys, or individual broadly spaced lines in the case of 2D seismic surveys. For example, the actual areas surveyed during any single day or week during the surveys will be a smaller part of the total survey areas, with survey vessels typically requesting that other vessels keep 3 nm (5.5 km) ahead and either side to avoid the vessel and towed equipment. However, using the larger acquisition areas is useful for making a direct comparison of the areas of overlap and an indication of the potential total area of disturbance during each year.

A review of spatial areas associated with historic surveys and their overlap with the PFTIMF fished area identifies the following:

- The PFTIMF fished area has historically been subject to 0 - 14% overlap by seismic surveys (maximum occurring in 2019).
- Overall, it is considered that commercial fishers continue to fish in similar areas each year with no obvious variations in fishing vessel distribution attributable to the presence of seismic surveys. However, it is acknowledged that more localised and temporary disturbances to fishing activities from seismic survey activities may have occurred during the years shown (and has been communicated to CGG through consultation with the MMF). Nevertheless, a widespread pattern cannot be identified from the available data for any fishery, which is presented at a coarser spatial and temporal resolution than disturbances may have occurred at. It is also acknowledged that each disturbance to fishers may have resulted in operational inconveniences (e.g. manoeuvring around the seismic vessel) to temporary loss of access to fishing areas (i.e. displacement). However, the assessment is useful in demonstrating the limited influence of seismic surveys on total overall fishing activity and distribution of fishing effort in any year.
- Since 2015 total fish catch in the PFTIMF has increased each year despite the occurrence of large-scale seismic surveys, attributed to the effective management of the fishery by controlling effort input (Newman et al. 2024).

The State of the Fisheries Report for 2023-24 (Newman et al. 2024) also notes that the total annual catch in the Pilbara Demersal Scalefish Fisheries has remained relatively stable, with the PFTIMF averaging ~1,159 tonnes between 2008-15. Again, this has occurred despite seismic surveys being undertaken most years. The fisheries report further notes that total catch since 2015 has increased despite having the same annual effort allocations, with catches since 2017 exceeding the Department's defined acceptable catch range of 940-1,416 tonnes (including in 2023).

Therefore, despite temporary disturbances to fishers from seismic surveys, no long-term impacts on the overall annual performance of the fisheries (in terms of distribution of effort or catch levels) or the sustainability of the fishery is evident from past surveys.

CGG has also undertaken a spatial-temporal analysis to determine the maximum annual overlap of previous seismic surveys with the spawning areas and periods of the key indicator fish species in the Pilbara Demersal Scalefish Fisheries. 2015 was chosen as the maximum annual case for the analysis, given the greater number and area of 2D and 3D seismic surveys that occurred within the Pilbara Demersal Scalefish Fisheries during that particular year, with 50% overlap of the fished area as compared to a range of 0 - 14% overlap experienced since 2017.

As per the analysis undertaken of the spatial-temporal overlap of the Sauropod 3D MSS in Section 7.1.6.6, a number of assumptions have been applied to during the analysis, many of which apply a significant level of conservativism in order to provide a precautionary approach. These are:

- Spatial overlap is based upon the total area of each survey overlapping the spawning areas of the fish stocks. The actual area of disturbance will be significantly smaller and likely to be within hundreds of metres from the seismic source as it moves across the acquisition area. Therefore, the analysis is simply an indication of the total area that may have been ensonified and where potential spawning aggregations may have been exposed to seismic sound. Within any 24-hour period the total area that may have been ensonified would have been tens to hundreds of square kilometres, rather than hundreds to thousands of square kilometres.

- Temporal overlap is based on the total survey durations even though some of these survey periods would have involved seismic acquisition outside of the spawning ranges of the fish species. Therefore, the temporal overlap and resultant spatial-temporal overlap may be over-represented.
- The spatial extent of the spawning areas for each key indicator fish species have been estimated based on each species' depth range and the FRDC stock assessment data (Roelofs 2024) and DPIRD Pilbara fishery management area. It is important to note that genetic connectivity and the biological stocks have been confirmed across significantly larger areas (hundreds of thousands of square kilometres compared with the tens of thousands of square kilometre spawning areas considered in the analysis. As a result, the spatial overlaps accounted for in the analysis are likely to significantly overestimate the percentage of spawning area available to each species. However, the Pilbara fishery management area is a useful and conservative indicator for assessment purposes and allows the results to be directly related to annual stock status assessments, which are also reported per fishery management area.
- The purpose of the analysis is to understand how much of the spawning areas and spawning periods may have been affected by behavioural disturbances in response to seismic sound. It is conservatively assumed that fish spawning in the area and period of exposure will have been compromised. As indicated in Section 7.1.6.3, some studies have observed very limited changes in fish behaviour or behaviours have returned to normal within minutes or an hour of a seismic source passing their location and the 2021 AIMS study observed no impact to fish behaviours as the result of commercial scale seismic surveys (Meekan *et al.* 2021). It is therefore possible that fishes may have continued to spawn regardless or may have moved away from the seismic source and spawned nearby, or spawning may have been delayed but still occurred a short time later once normal behaviours resumed. In either of these cases, the impact on spawning success may be negligible.

The results of the spatial-temporal analysis are presented in Table 7-18. The following observations are made from the 2015 spatial-temporal analysis (noting that this presents a 'worst case scenario' given the very high overlap of seismic surveys with the area fished):

- The maximum spatial-temporal overlap with the spawning area and spawning period of a key indicator demersal fish species in the Pilbara fisheries management area in 2015 was with Goldband snapper (8.73%).
- The maximum spatial-temporal overlap for other key indicator demersal fish species ranged from 1.87% (Bluespotted emperor) to 5.81% (ruby snapper).
- Large areas available for spawning by indicator fish species in the Pilbara were not overlapped by seismic surveys (between approximately 68% and 90%).
- None of the surveys occurred across the full spawning period for any commercially important fish species.

As demonstrated in Section 7.1.6.6, the 1.87% to 8.73% spatial-temporal overlaps are relatively small and is unlikely to have a significant population level affect, considering natural levels of variability in the spawning biomass and recruitment of some of these species have fluctuated by approximately 250% and 350% respectively, as a result of fishing and natural factors.

Even if it is assumed that spawning success was compromised within up to 8.73% of an indicator species spawning area and spawning period, it is of fundamental importance to note that from 2015, the key indicator fish stocks and the Pilbara Demersal Scalefish Fisheries have historically maintained a classification of 'Sustainable' despite the occurrence of large-scale seismic surveys, except for red emperor in the Pilbara region which was recently classified as overfished with depleted stock following a formal 2023 assessment of spawning biomass (Newman *et al*. 2024). In response to this, and noting that total annual trawl catches by the PFTIMF exceeded the acceptable catch range, DPIRD is intending to develop a recovery plan for the Pilbara demersal scalefish resource (Newman *et al.* 2024). Notably, in the assessment of external drivers on this resource the latest State of the Fisheries Report considers the potential impacts of climate change but does not mention seismic surveys, which reflects the lack of seismic surveys in the area over the past three years and overall minor spatial-temporal overlap by earlier surveys with the spawning areas of key fish species.

Table 7-18 – Cumulative Spatial-Temporal Overlap of 2015 Seismic Surveys with Spawning Areas of Key Indicator Fish Species in the Pilbara

Fish Species	Depth Range (m)	Spawning Area (km^2)*	Spawning Period	Cumulative Spatial Overlap (%)[1]	Temporal Overlap (%)[2]	Cumulative Spatial-Temporal Overlap (%)[3]
Red emperor	10–180	99,349	September–June (303 days)	22.91% (0% to 7.63% per survey)	0% to 34.65% per survey	5.40% (0% to 2.64% per survey)
Rankin cod	10–150	92,575	June–December, March (245 days)	23.22% (0% to 7.41% per survey)	0.41% to 17.14% per survey	2.58% (0% to 0.94% per survey)
Goldband snapper	50–200	68,748	October–May (243 days)	32.31% (0% to 11.27% per survey)	0% to 43.21% per survey	8.73% (0% to 4.87% per survey)
Bluespotted emperor	5–110	77,912	July–March (274 days)	17.48% (0% to 5.57% per survey)	0% to 27.37% per survey	1.87% (0% to 0.96% per survey)
Giant ruby snapper	150–480	43,566	December–April (151 days)	9.72% (0.06% to 7.63% per survey)	0% to 69.54% per survey	5.81% (0% to 5.47% per survey)

* Spawning areas have been estimated based on each species' depth range and the FRDC (2019) stock assessment data and DPIRD Pilbara fishery management area. It is important to note that genetic connectivity and the biological stocks have been confirmed across significantly larger areas, however, the Pilbara fishery management area is a useful and conservative indicator for assessment purposes and allows the results to be directly related to annual stock status assessments, which are also reported per fishery management area.

1. Cumulative spatial overlap is calculated based on the sum of all individual survey areas.
2. The temporal overlap is based on the maximum possible number of days each species may spawn within defined acquisition windows. Temporal overlap is not expressed as a cumulative value because the timing of some surveys partially overlaps with other surveys. Therefore, summing together the temporal overlaps of each survey would not provide an accurate representation of the cumulative temporal overlap.
3. Total cumulative spatial-temporal overlap with each species is calculated based on the spatial overlap × temporal overlap calculated first for each individual survey and then summed together. 2D line kms have been converted to km^2 by applying a 500 m buffer either side of the lines, as representative of the range of "tens to hundreds of metres" where significant behavioural effects to fishes may occur.

7.2.2.1.3 Cumulative Impacts to First Nations Cultural Features and Heritage Values

As described above, cumulative impacts may occur where the effects of previous surveys overlap the project area and recovery of the impacts from these seismic surveys has not occurred prior to the Sauropod 3D MSS commencing. The duration of recovery following exposure to underwater noise emissions from a seismic survey can be in the order of minutes to hours for some receptors, or weeks to months for other receptors (the duration is expected to be days in the case of behavioural change to fish and migrating or foraging whales and turtles). However, as the most recent previous survey occurred 2.8 years ago (as at 1 January 2026) and 81.3 km away from the project area, cumulative impacts to ecological receptors are not expected to occur as a result of any of the identified previous seismic surveys in the region and the proposed Sauropod 3D MSS. As such, no cumulative effects to cultural features and heritage values are expected either.

7.2.2.2 Concurrent Seismic Surveys

Review of the NOPSEMA website (Industry environment plans; accessed 30/7/2025) indicate that within the scheduled period of the Sauropod 3D MSS (January to May 2026 or 2027) no other seismic surveys are proposed in the region that:

- May occur within the same EP time frames, within 150 km of the Sauropod MSS.
- Either have an EP accepted by NOPSEMA or have submitted an EP to NOPSEMA that is currently under assessment.

Note that the following assessment does not assess cumulative impacts from seismic surveys in the region that occur after the Sauropod 3D MSS, as it is the responsibility of that titleholder to assess the cumulative impacts. In the event that a new EP is submitted to NOPSEMA for another seismic survey that temporally and spatially overlaps with the Sauropod 3D MSS

survey area CGG will assess the cumulative impacts of that survey through either the EP development process or the MoC process as part of the ongoing environmental management of the impacts and risks of the activity (Section 9.2).

7.2.2.2.1 Summary

Based on the assessment presented above, in particular the duration since previous and lack of concurrent seismic surveys, and the implementation of the identified controls (Section 7.2.4), the worst-case cumulative impacts that may result from concurrent seismic surveys is assessed as Low.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.2.3 Decision Context

The decision context for underwater sound emissions from the seismic source has been assessed as ‘Type B’ due to relevant person concerns raised in relation to potential impacts to commercial fisheries, including fish spawning, during consultation for the previously accepted Sauropod MSS EP. As described in Section 6.7.1, further analysis is recommended in addition to using the tools for a Decision Type A, including assessing the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures.

7.2.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
No relevant legislation has been identified.	N/A	N/A	N/A
Good Industry Practice			
Issue of marine navigation warnings and Notice to Mariners of survey presence and towed array	Yes	AHO will be contacted four weeks prior to the commencement of the survey for the publication of related Notices to Mariners. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of interactions with other marine users. Good industry practice, environmental benefit outweighs additional cost.	2.1
Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings	Yes	The AMSA JRCC will be contacted 24-48 hrs before operations commence for issuing of radio-navigation warnings. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of interactions with other marine users. Good industry practice, environmental benefit outweighs additional cost.	2.2
Notification will be provided to fisheries relevant persons, prior to survey commencement and following survey completion.	Yes	Notification will be provided to fisheries relevant persons four weeks prior to commencement of the survey and two weeks following completion of the survey. Implementation of the control will reduce the likelihood of interactions with marine users. Good industry practice, environmental benefit outweighs additional cost.	2.3
CGG will engage with proponents identified as having potential concurrent seismic activities prior to commencing the Sauropod survey and develop a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area.	Yes	Engagement with titleholders for potential concurrent MSS activities prior to acquisition commencing, and development of a concurrent operations plan, which will include the following aspects: • Communications protocols • SIMOPS and work programming • Hazard management • Emergency response. Good industry practice, environmental benefit outweighs additional cost.	1.5
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the above controls have been identified.	N/A	N/A	N/A
Additional Controls Considered			
A minimum separation distance of 40 km shall be maintained between the Sauropod 3D MSS seismic sources and other operating seismic sources.	Yes	Although a redundant control due to the lack of other concurrent seismic surveys this is a standard measure that would reduce the risk of cumulative impacts occurring and also preserves seismic data quality.	2.4
Survey acquisition timed to avoid or limit temporal overlap with the spawning periods for key indicator species for commercial fisheries	No	The maximum spatial-temporal overlap of the Sauropod 3D MSS with the spawning areas and periods of commercial fish species is approximately 1.26%. Depending on which combination of seismic surveys are acquired during the spawning seasons, the total cumulative spatial-temporal overlap may range from between 0.35% and 5.52% (based on representative but conservative exposure scenarios). This is likely to be negligible in the context of normal variability in spawning biomass and recruitment. Further limiting the temporal overlap with the spawning periods has been considered. The proposed schedule and temporal window for the Sauropod 3D MSS (January to May) was determined taking into account the: • Timing of key environmental and socio-economic receptors • Hearing ability and sensitivity of those receptors to sound from the seismic survey • Proximity of sensitive habitat areas to seismic survey areas • Species distribution and range • Level of overlap (in space and time) by the survey with important habitats and life stages of sensitive species • Species vulnerability / conservation status • Potential for impacts to species at both an individual level and at a population level The optimum window of opportunity was determined to be from January to May (inclusive). The proposed survey timing was selected primarily to avoid the Humpback whale migration through the region (June to October), as well as reduce exposure to Pygmy Blue Whales during their	N/A

Control Measure	Control Adopted	Justification	Performance Standard Ref.
		migrations to the north of the Operational Area (April – August and October to December). Both of these species are low-frequency cetaceans and sensitive to seismic sound over several kilometres. The defined survey period, therefore, limits the potential for impacts to these protected species, including preventing injury/hearing impairment (PTS/TTS) or significant behavioural effects during their migrations. It is noted that the Pygmy Blue Whale migration BIA is located sufficiently far from the Operational Area for impacts to be avoided but the timing had also originally taken into account Pygmy Blue Whale distribution outside of the main migration BIA. Fish spawning periods were also considered in detail, noting the importance of spawning and recruitment of fish stocks, but also noting fishes' sensitivity to seismic sound is significantly less than that of cetaceans. Significant disturbance to groups of spawning fishes may occur for short periods when the seismic source is passing within hundreds of metres of their location. The spawning periods of the many different key indicator fish species for the commercial fisheries in the region extend throughout the majority of the year but can vary significantly between species. It is noted that most key indicator species spawn between October and March, April or May. In order to avoid or reduce the survey's overlap with this period, the survey window would extend into both the Humpback whale and more of the Pygmy Blue Whale migration periods. As noted in the above risk assessment, occasional localised disturbances of groups of spawning fishes may occur, but this is not expected to have a significant impact on the stocks, due to their high fecundity, protracted spawning periods, biological connectivity through recruitment from across the region, as well as large natural variability in the spawning biomass and recruitment levels. Avoidance of fish spawning periods would provide limited additional environmental benefit at a disproportionate cost (in terms of potential impacts to more sensitive marine fauna and costs associated with additional measures that would likely be required for whales such as additional shut-downs, adaptive management, etc.). Therefore, this option is not considered practicable. Further constraining the survey window and limiting the overlap of the survey with fish spawning periods may mean that the proposed seismic survey could not be completed, potentially equivalent to a cost in the order of millions of dollars of lost seismic survey effort time and data. Given the predicted risk to fish spawning and fish stocks, the costs are disproportionate to the limited environmental benefit that may be gained.	
Reduce temporal overlap with commercial fishing operations	No	The Sauropod 3D MSS primarily overlaps with the Pilbara Demersal Scalefish Fisheries, specifically the fished areas of the PFTIMF and the PTMF. Other seismic surveys considered in the cumulative impact assessment also overlap with the Pilbara Demersal Scalefish Fisheries. The Sauropod 3D MSS does not overlap with the fished area of the PLF or the Mackerel Managed Fishery. Overlap between the Sauropod 3D MSS Operational Area and the NDSMF is negligible (as explained in the above risk assessment). The PFTIMF, PTMF and NDSMF operate throughout the year. Analysis of FishCube data for the fisheries monthly catch and effort does not provide sufficient information to indicate any clear seasonal trends. Therefore, it is not practicable to alter the timing of the survey in a way that would reduce the temporal overlap with these fisheries.	N/A
Reduce survey area to decrease cumulative area of overlap with commercial fisheries	No	Not justified. The Sauropod 3D MSS has minimal spatial overlap with any commercial fishing activities. The greatest overlap is with the PFTIMF, where there is approximately 4% spatial overlap. In addition, the level of fishing effort reported in this area is low (less than 50 days over a five-year period) and historical CPUE data also indicates low fish abundance in the Operational Area. Reducing the size of the Acquisition Area would mean that CGG would not be able to obtain data for all hydrocarbon prospects being targeted. Recognising the need to minimise disturbance to fisheries as much as practicable, CGG has considered whether it might be feasible to reduce the Acquisition Area by approximately half (the minimum acquisition area that may be considered, if the alternative meant the survey could not be approved and the inability to meet work commitments under the permit). However, the primary target that would still be surveyed is in the western half of the Acquisition Area. This includes the south-west corner of the Acquisition Area where PFTIMF fishing effort has mainly been recorded in past years. The area of the PFTIMF that would be avoided has recorded less than 25 days of fishing activity or has been trawled by less than 3 vessels during the entire five-year (1,826 day) period from 2014 to 2018 (refer to Section 4.4.4.1 and Figure 4.20). Therefore, reducing overlap with this small, infrequently fished area would provide limited benefit to fisheries but would result in millions of dollars of lost work programme to CGG. The south-west corner itself also experiences low levels of fishing effort (less than 50 days fishing effort during the entire five-year (1,826 day) period from 2014 to 2018 and interactions with trawl vessels in this area are already expected to be infrequent if they occur at all. The costs of this option are grossly disproportionate to the limited benefit gained. Therefore, while acknowledging the importance of managing cumulative impacts to commercial fisheries, CGG cannot practicably do anything further to manage the risk posed with other titleholders' surveys.	N/A
Implementation of the NERA (2021 Revision 1) CSEP Commercial Fishing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities.	Yes	Compensation for short term loss of catch due to the cumulative impact of multiple seismic surveys has been identified as a key issue during relevant person consultation and the NERA Protocol (Revision 1, 2021) provides a practical, evidence-based process that has been developed by the CSEP in consultation with the commercial fishing industry (including WAFIC and CFA), government bodies and seismic industry representatives. Benefit to fishers' livelihoods and industry reputation outweighs the cost of compensation.	1.11

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified.	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the risk of cumulative impacts. As the risk has been classified as Low and no reasonable additional or alternative controls were identified that would further reduce the risk, without jeopardising the objectives of the survey, the risk is considered to be ALARP. Consequence and Likelihood values assigned to cultural features and heritage values are based on the highest value assigned to other relevant receptors.			

Receptor	Risk Ranking	Consequence	Likelihood	Risk Ranking
Marine Fauna	Residual Risk	Moderate (2)	Rare (A)	Low
Fishes and elasmobranchs	Residual Risk	Minor (1)	Rare (A)	Low
Benthic invertebrates	Residual Risk	Minor (1)	Rare (A)	Low
Zooplankton	Residual Risk	Minor (1)	Rare (A)	Low
Fish spawning	Residual Risk	Moderate (2)	Rare (A)	Low
Commercial fisheries	Residual Risk	Moderate (2)	Rare (A)	Low
Cultural features and heritage values	Residual Risk	Moderate (2)	Rare (A)	Low

7.2.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing cumulative impacts is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.7) • Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	EPBC Policy Statement 1.1. – Significant guidelines The residual risk to cetaceans has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. Conservation Advice, Recovery Plans, and Other Guidelines N/A: No advice or guidelines have been identified that specifically address cumulative impacts from multiple seismic surveys. Conservation values and objectives of the North-west Marine Parks Management Plan No impacts are predicted to occur to the natural, cultural and socio-economic values of the Argo-Rowley Terrace Marine Park and Mermaid Marine Park.
	Relevant persons Expectations	During relevant person consultation for the Sauropod 3D MSS, WAFIC specifically expressed an interest in the cumulative impacts of multiple seismic surveys and requested that cumulative impact assessment is addressed in the EP. The above assessment has considered the cumulative impacts.
Legislation and Other	Legal Requirements	The controls adopted comply with the *Navigation Act 2012* and *Offshore Petroleum Greenhouse Gas Storage Act 2006*.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practice is demonstrated by the commitment to maintain a 40 km separation distance from other operating seismic sources.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with cumulative impacts from the Sauropod 3D MSS and other concurrent seismic surveys.

7.2.6 Defined acceptable levels of impact

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
Marine Fauna or Ecological Communities Listed as Threatened or Migratory under the EPBC Act (Matters of NES)	EPBC Act Part 3 (18A and 20A); EPBC Act Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013).	Seismic survey activities are undertaken in alignment with: • the EPBC Act Part 3 (18A and 20A) and Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013), whereby activities do not have a significant impact on a listed threatened or migratory species population or a listed threatened ecological community • do not result in the mortality or physical injury of an individual of an EPBC listed (marine fauna) species.	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to marine fauna given the controls adopted will: • Prevent mortality or physical injury to EPBC listed marine fauna species • Prevent a significant impact on a listed threatened or migratory species population or a listed threatened ecological community. Other potential concurrent surveys in the region also propose similar management measures and propose measures to limit or avoid impacts with sensitive areas. The potential for disturbances from two seismic surveys and their separate sound fields are acknowledged, however, no significant impacts, mortality or injury are expected.
	Conservation Management Plan for the Blue Whale	Seismic survey activities are undertaken in a manner consistent with the requirements of the Conservation Management Plan for the Blue Whale, specifically: • Anthropogenic noise in biologically important areas will be managed such that any Blue whale continues to utilise the area without injury* and is not displaced from a foraging area. **Injury is both permanent and temporary hearing impairment (Permanent Threshold Shift and Temporary Threshold Shift) and any other form of physical harm arising from anthropogenic sources of underwater noise*	With the controls proposed, including enhanced controls as recommended in EPBC Act Policy Statement 2.1 Part B, no injury/hearing impairment (PTS/ or TTS) or significant behavioural impacts are expected to occur to any Pygmy Blue Whale within a biologically important area and no blue whale is expected to be displaced from a foraging area. The proposed timing of the Sauropod 3D MSS (between January and May) has been selected to limit overlap with the Pygmy Blue Whale migration periods (April to August and October to December) and therefore reduce the risk of impacts to individual Pygmy Blue Whales that may occur outside of the migration BIA. Restricting the MSS schedule to completely avoid Pygmy Blue Whale migration periods will significantly increase vessel contracting fees and place logistical constraints (e.g. weather and vessel availability) that jeopardise the viability of the survey. The costs of limiting the acquisition window further to avoid the Pygmy Blue Whale migration entirely are grossly disproportionate to any potential environmental benefit gained. The migration BIA is located is located 72 km to the north of the Operational Area. The predicted maximum distance to the marine mammal behavioural threshold is approximately 8.4 km (refer Table 7-5). The survey is not anticipated to significantly inhibit the migration of Pygmy Blue Whales since the ensonified area only overlaps a small proportion of their known distribution area. There are no known Pygmy Blue Whale foraging areas within the vicinity of the activity, with the closest possible foraging area identified to be approximately 400 km from the Operational Area. Therefore, no significant behavioural impacts are expected to occur. Adaptive management measures to cease night-time operations have been adopted to reduce impact to any Pygmy Blue Whale in low visibility or night-time conditions. In addition, an increased shutdown zone of 3 km has been adopted to reduce TTS/PTS impact to a Pygmy Blue Whale or potential Pygmy Blue Whale. The adaptive management measures conservatively apply to Pygmy Blue Whales and potential Pygmy Blue Whale sightings[1] such that injury to Pygmy Blue Whales is prevented, even if not positively identified as a Pygmy Blue Whale.
	Conservation Advice for *Megaptera novaeangliae* (Humpback whale).	Seismic survey activities are undertaken in a manner consistent with the previous Conservation advice for Humpback whales (prior to the delisting of the species in effect under the *EPBC Act* from 26-Feb-2022), specifically: • For actions involving acoustic impacts on Humpback whale calving, resting, feeding areas, or confined migratory pathways, site specific acoustic modelling should be undertaken (including cumulative noise impacts). • All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B Additional Management Procedures must also be applied.	Consistent with the previous Conservation advice for Humpback whales (prior to the delisting of the species in effect under the *EPBC Act* from 26-Feb-2022), acoustic modelling was undertaken to assess the potential single pulse and cumulative sound exposure impacts on Humpback whales. The seismic survey will also be undertaken consistent with Part A of EPBC Act Policy Statement 2.1, although the survey will not take place near a calving, resting or foraging area. The proposed timing of the Sauropod 3D MSS (between January and April) has been selected to avoid the Humpback whale migration through the region, therefore, no impacts to Humpback whales are expected. Therefore, no significant cumulative impacts from concurrent survey activities are expected.
	Recovery Plan for Marine Turtles in Australia 2017-2027.	Seismic survey activities are undertaken in a manner consistent with the requirements of the Recovery Plan for Marine Turtles in Australia 2017-2027, specifically: • Seismic surveys should not occur inside important internesting habitat during the nesting season. • Consistent with EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales, all seismic survey vessels operating in Australian waters must undertake a soft start during surveys irrespective of location and time of year of the survey	The Sauropod 3D MSS seismic source will not be operated within any important internesting habitats. The Operational Area is located at least 15 km from the closest BIA or 'Habitat Critical' for marine turtles and no significant impacts to marine turtle populations are expected. Soft-starts (as well as shut-down procedures for turtles, which exceed this requirement) will be implemented during the seismic survey. Other potential concurrent surveys in the region also propose similar management measures and propose measures to limit or avoid impacts with sensitive areas. The potential for disturbances from two seismic surveys and their separate sound fields are acknowledged, however, no significant impacts, mortality or injury are expected.

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
Marine Fauna or Ecological Communities not listed as threatened or migratory (not matters of NES) under the EPBC Act	Principles of ESD, specifically no serious or irreversible damage.	No serious* or irreversible damage to a population of any marine fauna species or ecological community not listed as threatened or migratory (matters of NES) under the EPBC Act, including: • Marine fauna species not listed under the EPBC Act as threatened or migratory • Benthic invertebrate communities, including those associated with KEFs • Fish communities, including those associated with KEFs • Planktonic communities. * In the absence of a definition for 'serious' environmental damage in relation to the Principles of ESD under the EPBC Act, CGG considers a serious impact to be impacts with the potential to result in a threat to population or community viability, consistent with a consequence ranking of 'Significant' or greater.	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to non-listed marine fauna given that: Non-listed marine fauna – The controls adopted to reduce risks to marine fauna such as cetaceans and turtles, apply to all species in these groups irrespective of their status under the EPBC Act. No injury or mortality to such marine fauna is expected to occur given the controls proposed consistent with EPBC Policy Statement 2.1 (e.g. marine fauna observers, precaution zones, soft-starts, shut-down procedures). No species is expected to be displaced from an area of significant habitat; no significant areas for non-listed species are identified in the Operational Area and no serious (i.e. population level) or irreversible impacts are predicted to occur. The structure and ecological function of the ancient coastline at 125 m depth contour KEF will not be impacted. Benthic communities – Impacts to benthic communities are expected to be recoverable. While some benthic invertebrate organisms may experience sub-lethal or effects or chronic mortality, benthic communities are expected to recover in the weeks or months following exposure and changes in community structure and composition are not expected to be detectable from natural variability. No serious (i.e. community level) or irreversible impacts are predicted to occur. The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered Fish communities – Consistent with fisheries management principles, key indicator species have been considered as representative of the full suite of fishes that occur in the Operational Area. The effects of the seismic survey on the spawning biomass of the various stocks are expected to comprise occasional localised behavioural disturbances to spawning groups of fish, but the level of impact to the populations (spawning biomass and recruitment) is predicted to negligible, particularly in the context of normal variability in the fish biomass and recruitment levels (250–350%). Injury or mortality to the types of fish found in the Operational Area is highly unlikely. No serious (i.e. population level) or irreversible impacts are predicted to occur. The physical structure, ecosystem functioning and integrity of the ancient coastline at 125 m depth contour KEF are not predicted to be altered. Planktonic communities – Zooplankton may be injured or killed in close proximity to the seismic source, however, the magnitude of such localised impacts is negligible and is not expected to be discernible at the regional scale when considering the large natural spatial and temporal variability. No serious (i.e. community level) or irreversible impacts are predicted to occur. The potential for disturbances from two seismic surveys and their separate sound fields are acknowledged, however, no serious or irreversible impacts are expected.
Marine Protected Areas	Conservation objectives and zone rules/requirements of the North-west Marine Parks Management Plan and other marine protected area management plans	Seismic activities are undertaken in a manner consistent with a management plan that is in force for AMPs or State Marine Parks in the region (i.e. Eighty Mile Beach AMP, Argo-Rowley Terrace AMP, Rowley Shoals Marine Park and Mermaid Reef Marine Park).	The predicted level of impact from underwater noise emissions from the seismic source, as assessed above, does not exceed the defined acceptable level of impact to marine protected areas given the activity will be managed in a manner that is consistent with management objectives for relevant AMPs and State Marine Parks.
Commercial Fisheries and Commercial Fish Stocks	Commercial fisheries relevant person objections, claims and concerns regarding: • Effects of seismic sound on key indicator commercially targeted finfish and invertebrate stocks, and • Effects of seismic sound on fish behaviour and commercial catch levels.	Commercial fish stocks: Seismic activities are undertaken in a manner that does not result in serious* or irreversible impacts to key indicator commercial fish populations, such that sufficient spawning fish biomass and recruitment of the stocks may be maintained, and the stocks continue to be assessed by DPIRD as Sustainable. * In the absence of a definition for 'serious' environmental damage in relation to the Principles of ESD under the EPBC Act, CGG considers a serious impact to be impacts with the potential to result in a threat to population or community viability, consistent with a consequence ranking of 'Significant' or greater. Commercial fisheries: Seismic activities are undertaken in a manner that: • Does not interfere with commercial fishing to a greater extent than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities. • Does not prevent each of the licenced commercial fisheries that overlap with the survey area from a catch that meets (or exceeds) the acceptable annual catch tolerance ranges for the fishery, as defined in the relevant harvest	CGG considers the level of cumulative impact to commercial fisheries and fish stocks to be of an acceptable level. CGG acknowledges that localised and temporary disturbances to fishing activities from seismic survey activities may occur. However, the level of impact from seismic surveys is considered to be acceptable due to the following reasons: • Based on DPIRD FishCube data and CPUE data (Gaughan *et al.* 2018), the Sauropod 3D MSS Acquisition Area only overlaps with areas fished by the PFTIMF and the PTMF, however, fishing catch and effort as well as the CPUE (indicative of fish abundance) are low. • The level of interference CGG may have on commercial fisheries is no greater than is necessary to exercise of right conferred by the titles granted to carry out exploration activities. • A maximum of 10% to 14% of the PFTIMF fished area may be subject to seismic survey activities at one time in 2024 or 2025, based on the maximum credible survey scenario. Areas of comparable fishing effort (i.e. alternative viable fishing grounds) adjacent to these areas will remain accessible to fishers. • The total spatial overlap of 2026 survey acquisition areas with the PFTIMF is less than half the overlap that occurred in 2015. No long-term impacts on the overall annual performance of the fisheries or the sustainability of the fishery was evident from 2015 or other past years, total catch remained stable, and the distribution of fishing effort remained broadly the same. • Disturbances to fisheries are likely to be infrequent and short-term. These are not expected to impact the overall annual catch rates and annual performance of the fisheries to the degree that it prevents the fisheries from achieving (or

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
		strategy (where catch below these tolerance levels cannot be attributed to other factors, such as changes in annual fishing effort allocations, changes in active vessel numbers, environmental conditions, or market induced impacts). Note - It is a legislated function of DPIRD to annually report the status of the fisheries and fish stocks to WA Parliament and so the status and trends can be considered over time.	exceeding) the acceptable annual catch tolerance ranges for the fishery, as defined in the North Coast Demersal Scalefish Resource Harvest Strategy 2017–2021 (DPIRD 2017). The cumulative effects of seismic surveys are also not expected to result in any direct reduction in the spawning biomass through fish mortalities, and the potential spatial-temporal overlap of the survey with spawning fish stocks will be minor (10% worst case), which will not be significant in the context of natural variability in spawning biomass and recruitment. Therefore, seismic surveys are not expected to result in a serious or irreversible impact to the sustainability of key indicator commercial fish stocks. Historic fishing effort and catch levels have remained stable or increased during historic periods of overlap between seismic surveys and commercial fishing activity. The NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS.

Acceptability Statement

As identified in Section 6.7.1, impacts and risks classified as ‘Decision Type B’ are considered acceptable if the criteria outlined in Table 6-7 are met and it can be demonstrated that the predicted levels of impact and/or residual risk, are at or below pre-defined acceptable level(s) for that impact or risk. The evaluation of potential cumulative impacts meets these requirements as outlined above. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.2.4 are considered industry best practice and meet legislative requirements. CGG considers the adopted controls appropriate to manage the cumulative impacts of noise disturbance from the seismic source to be of an acceptable level.

7.2.7 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	
EPO 2	Multiple seismic surveys do not occur concurrently in the same location, with a minimum separation distance of 40 km maintained between the Sauropod 3D MSS seismic sources and other operating seismic sources.	PS 1.5 PS 2.1 PS 2.2	PS 2.3 PS 2.4

Number	Performance Standards	Measurement Criteria
PS 2.1	The AHO is advised four weeks prior to survey commencement to allow for the issue of a Notice to Mariners.	Records verify that Notice to Mariners issued by AHO prior to survey commencement.
PS 2.2	AMSA JRCC are notified of survey activities 24-48 hours before operations commence, to allow for issue of AUSCOAST warnings, at survey commencement and at completion.	Available records verify AMSA JRCC notifications have been made, and that AUSCOAST warnings have been issued.
PS 2.3	Notification is provided to fisheries relevant persons, four weeks prior to commencement of the survey, indicating location and expected timing. Notification will also be provided to fisheries relevant persons within two weeks of completion of the survey.	Consultation and notification records verify relevant persons have been informed of survey activities throughout the survey period.
PS (refer to PS 1.5)	CGG have engaged with proponents identified as having potential concurrent seismic activities prior to commencing the Sauropod survey and have developed a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area.	Records verify that CGG has engaged with proponents prior to acquisition commencement (if relevant), and a concurrent operations plan has been developed.
PS 2.4	A minimum separation distance of 40 km is maintained between the Sauropod 3D MSS seismic sources and other operating seismic sources.	Records verify that a minimum separation distance of 40 km has been maintained between the Sauropod 3D MSS seismic sources and other operating seismic sources.
PS (refer PS 1.11)	Implementation of the NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) (NERA Protocol) to formally manage claims by commercial fishers for loss of catch, displacement, and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS, in accordance with the following performance parameters: 1. A claim can only be lodged by an eligible commercial fisher (as defined by NERA, 2021) or a person authorised to do so on behalf of the commercial fisher. 2. The Sauropod 3D MSS Adjustment Area (extending 10 km around the perimeter of the area in which the seismic source can be active) establishes the spatial extent of a claim. 3. A commercial fisher (or fishing vessel or licence) must have previous fishing history in fishing blocks/events overlapping the Adjustment Area for which they make a claim for loss of catch or displacement. The minimum fishing history is two out of the five years within fishing blocks/events which overlap the Adjustment Area, prior to the Sauropod 3D MSS. 4. Loss of Catch adjustment is available to eligible commercial fishers for a loss experienced during the period of the Sauropod 3D MSS and for 6 months after this period. 5. Displacement or Loss of Gear adjustment may be claimed for a loss experienced during the period of the Sauropod 3D MSS.	Records demonstrate that: 1. Commercial fishers or their authorised persons have been able to submit a claim if desired for loss of catch, displacement or lost or damaged fishing gear resulting from the Sauropod 3D MSS. 2. Eligible commercial fishers and their respective commercial fishing industry peak bodies have been notified of the establishment of the claims process and the Adjustment Area in writing no less than 28 days prior to commencement of the Sauropod 3D MSS. Notification has included a map and digital files in KML, GPX and shapefile format, and included contact details for lodgement of a claim. 3. A claim by a commercial fisher was considered valid if evidence confirmed that: • They were eligible to do so. • They had the required catch history. • The claim was for the applicable period. • The claim was lodged within the time frames described in PS 1.11. 4. Claimants were notified within 7 days of receipt of their claim.

Number	Performance Standards	Measurement Criteria
	6. A Loss of Catch claim may be submitted up to 12 months after completion of the Sauropod 3D MSS. 7. A Displacement or Loss of Gear claim may be submitted up to 6 months after completion of the Sauropod 3D MSS. 8. CGG will notify relevant commercial fishing licence holders and respective peak commercial fishing industry bodies of the establishment of the claims process, the survey timing and the Adjustment Area no less than 28 days before commencement of the Sauropod 3D MSS. Notification will be in writing and include a map and digital files in KML, GPX and shapefile format as well as contact details for lodgement of a claim. 9. Full details on the information required to be lodged with a claim are contained in the application forms provided in the NERA Protocol (Appendix 2- Loss of catch, Appendix 3- Displacement, Appendix 4 – Fishing gear loss or damage). 10. CGG will confirm with a commercial fisher that their claim has been received within 7 days of its receipt. 11. Claims will be assessed by an independent assessor with experience in fisheries management or claim assessment. 12. If an assessor believes the information lodged with a claim is not sufficient to conduct a meaningful assessment or support the application, then the claimant will be advised in writing and given 14 days to respond to the assessor. If no response is received within 14 days, then the assessment will be completed, and the claimant advised of the outcome. 13. An appropriately documented claim (including relevant catch and effort information) will be assessed, and a report provided to the claimant within 60 days of the lodgement date of the claim. The 60-day time period begins upon receipt of the necessary catch and effort data. The 60-day period may be extended if mutually agreed between CGG and the claimant, however if no agreement is possible CGG shall appoint an expert reviewer (independent of both parties and the assessor) (at CGGs expense and in consultation with the claimant). The expert reviewer must have experience in fisheries management or claims assessment. 14. The assessment report will include the following information: • a copy of the letter of instruction/project brief received by an assessor when engaged to carry out the independent assessment, • confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment, • a summary of the claim details (survey, applicant, vessel, month(s)), • for a loss of catch claim, monthly CPUE assessments as outlined in this protocol including an estimation of any loss of catch (in kilograms) and its market price, and • any other information, comments, or views relevant to the assessment that the assessor may wish to include. 15. If a claimant disagrees with a claim assessment outcome and cannot reach agreement with CGG they may request an expert reviewer (independent of both parties and the assessor) (funded by CGG). The expert reviewer must have experience in fisheries management or claim assessment. As part of that process both the claimant and CGG shall be given the opportunity to address the expert reviewer to state their position, prior to a decision being reached. The expert reviewer will provide opinion as to whether the claim assessment process has been conducted in line with the requirements of the protocol, and their decision will be binding on the claimant and CGG. 16. Once a claimant and CGG agree on the claim outcome, or an expert reviewer has issued a report, CGG will provide monetary adjustment to the claimant within 60 days. 17. Revision 1 of the NERA Protocol provides full detail of and is the ultimate reference for the commercial fisher claims process.	5. A claim, made using forms provided in Appendices 2 – 4 of the NERA Protocol, was assessed: • By an independent assessor with experience in fisheries management or claim assessment. • In accordance with the process and reporting requirements described in points 12 – 14 of PS 1.11. 6. If requested by the claimant the assessment outcome was reviewed by an independent expert reviewer in accordance with point 15 of PS 1.11. 7. Once a claimant and titleholder agreed with a claim outcome or an expert reviewer had issued a report CGG provided monetary adjustment to the claimant within 60 days. 8. Revision 1 of the NERA Protocol was the reference document for the commercial fisher claims process.

7.3 Noise Emissions: Vessel, Helicopter and Mechanical Equipment

7.3.1 Details of Impacts and Risks

7.3.1.1 Source of Impact/Risk

Generation of noise emissions from vessels, helicopters and mechanical equipment during routine operations has the potential to cause behavioural disturbance to marine fauna.

A purpose-built seismic vessel and two support vessels (one supply and one chase) will be employed for the Sauropod 3D MSS. Vessel noise comprises a combination of continuous noise generated by engine and machinery noise, and modulated, broadband noise produced by propeller rotation and cavitations (Richardson *et al.* 1995; Southall 2009; Jensen *et al.* 2009; Wales and Heitmeyer, 2002; Hildebrand, 2009). Vessel noise emissions vary with the size, speed, and engine type and the activity being undertaken. Noise levels for a range of vessels have been measured at 164–182 dB re µPa at 1 m (SPL) at dominant frequencies between 50 Hz and 7 kHz (Wyatt 2008; Simmonds *et al.* 2004).

A helicopter may be employed for the Sauropod 3D MSS for the purpose of crew changes. Crew changes are expected to occur every 4–6 weeks. The main source of noise from a helicopter is the main rotor. Dominant tones from helicopters are generally below 500 Hz (Richardson *et al.* 1995). The penetration of noise into the ocean is dependent on the angle of the aircraft and its distance from the sea surface. Typically, noise does not transmit well from air into water due to impedance at the air-water interface. Noise levels from a Bell 212 helicopter flying at altitudes of 610 to 152 m respectively were measured at 101–109 decibels (dB) at 3 m water depth (Richardson *et al.* 1995). This provides an indication of the low received level noise that may be expected from a helicopter.

Potential impacts associated with underwater sound emission from the seismic source is addressed in Section 7.1.

7.3.1.2 Receptors

- Cetaceans
- Marine turtles
- Whale sharks
- Seabirds
- Cultural features and heritage values.

7.3.2 Impact/Risk Evaluation

Elevated underwater noise can affect marine fauna, including culturally important totemic species such as cetaceans, in three main ways (Richardson *et al.* 1995; Simmonds *et al.* 2004):

- By causing direct physical effects on hearing or other organs (injury)
- By masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey)
- Through disturbance leading to behavioural changes or displacement from important areas.

The Operational Area is located in water depths ranging from approximately 95 m to 172 m. The fauna associated with these areas will be predominantly pelagic species of fish with the potential for the transient presence of other megafauna species encounters such as turtles, whale sharks and large whales passing through the areas (Section 4.3). The Operational Area overlaps with the whale shark foraging BIA. However, it is expected low numbers of marine fauna will be present in the Operational Area (refer to Section 4.3).

Given there are no high energy impulsive sound sources associated with the routine operation of vessels, there may be some localised behavioural disturbance of marine fauna in the immediate vicinity of vessels during operations, but physiological effects on fauna are not anticipated. Gradual exposure to continuous noise, such as noise produced by an approaching vessel, is generally regarded as being unlikely to startle or stress marine fauna (Southall *et al.* 2007). Permanent injury would be expected to occur at 230 dB re 1 µPa (peak) (Southall *et al.* 2007) for cetaceans. Noise generated by vessels is unlikely to exceed that level so permanent or temporary injury to protected migratory whale species is not anticipated.

Some transient marine fauna individuals may choose to avoid the immediate proximity of the vessel, but this is not expected to have any widespread or longer-term impacts on their behaviour or populations. Hence, any avoidance or attraction behaviours displayed are expected to be localised and temporary, based on the limited duration of the survey (approximately 60 days). Predicted noise levels are not considered to be ecologically significant at a population level and the potential impacts are considered to be localised with no lasting effect.

In general, exposure to helicopter sound emissions is of short duration, peaking as the helicopter passes directly overhead. Received levels are expected to be low during transit when helicopter altitude is greatest and disturbance to marine fauna is not expected. The highest received levels will occur at lower altitudes on approach to landing. Some minor behavioural disturbance may occur for short periods if marine fauna are present near the surface in the vicinity of landing helicopters. This would be limited to a temporary change in behaviour due to avoidance of the area but is not expected to have any longer-term impacts. Seabirds are expected to avoid the immediate vicinity of a helicopter, but again no long-term impacts are anticipated.

Based on the assessment presented above and the implementation of the identified controls (Section 7.3.4), the consequence of occasional short term and localised disturbance to marine fauna including those of cultural importance is Negligible (0). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measure, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.3.3 Decision Context

The decision context for noise from seismic vessel, support vessels and mechanical equipment has been assessed as ‘Type A’, given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest.

7.3.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Vessels will comply, when safe to do so, with the relevant requirements of EPBC Regulations 2000 - Part 8 Division 8.1, including: • Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale • Not exceeding a speed of six knots within the caution zone of a cetacean (300 m).	Yes	The requirements of the EPBC Regulations set out clear measures to reduce speed and avoid approaching cetaceans, which also reduce the risk of engine noise in close proximity to cetaceans. It is a legislative requirement for vessels to comply with the EPBC Act.	3.1
Helicopter movements will be undertaken in accordance with EPBC Regulations 2000 – Part 8 Division 8.1, including: • Helicopters not to operate at a height lower than 1650 feet within a horizontal radius of 500 metres of a cetacean • Helicopters not to approach a cetacean from head on.	Yes	The requirements of the EPBC Regulations set out clear measures on altitudes above cetaceans and on approaching cetaceans, which reduce the risk of noise in close proximity to cetaceans. It is a legislative requirement for helicopters to comply with the EPBC Act.	3.2
Good Industry Practice			
No good industry practice measures have been identified	N/A	N/A	N/A
Alternatives/Substitutes Considered			
No helicopter transfers	No	The alternative option of eliminating helicopter transfers was considered but not selected. Helicopter transfers are necessary from time to time to make crew transfers. The alternative would require the vessel to return to port to change crew or the use of an additional transfer vessel which would be costly, time consuming and would increase vessel movements and potential interactions with receptors. Given the already low risk of potential short term, localised behavioural responses from up to a few individuals, the control is disproportionate to the level of risk and is not expected to provide any benefit.	N/A
Additional Controls Considered			
Vessel engines maintained according to manufacturer's specification.	Yes	This will ensure reliability of equipment to reduce noise impacts.	3.3
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)		Good industry practice, environmental benefit outweighs additional cost.	
In addition to the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for cetaceans, vessels, when safe to do so, will also: • Take action to avoid approaching or drifting closer than 50 m to a turtle • Not exceeding a speed of six knots within 300 m of a turtle.	Yes	In addition to implementing avoidance measures for cetaceans, CGG has considered extending the prescribed avoidance measures to turtles. Good industry practice, environmental benefit outweighs additional cost.	3.4
Vessels, when safe to do so, will also adopt measures consistent with the DPaW Whale Shark Management Programme (2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark • Not exceeding eight knots within 250 m of a whale shark.	Yes	In addition to implementing the EPBC Regulations avoidance measures for cetaceans, CGG has extended avoidance measures to whale sharks. Good industry practice, environmental benefit outweighs additional cost.	3.5
Extend the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for helicopters to turtles and whale sharks.	No	Helicopter transfers will be infrequent. Extending the legislative requirements of the regulations for cetaceans to other fauna could prevent the helicopter from landing, should fauna be observed. When making a descent towards the helideck of the vessel, the pilot's attention is on landing the helicopter and the relative position of the craft with the vessel. For safety and practicality reasons, the helicopter needs to land safely and the pilot or others on-board should not need to observe for additional fauna. The potential impacts and risks associated with occasional helicopter landings are low given the short-term and localised behavioural response that may occur to individual or small numbers of animals. No significant impacts are expected, and the risk is deemed acceptable. Therefore, applying measures to other fauna is impractical, unnecessary and disproportionate to the limited additional benefit it may provide to reducing the already low level of risk.	N/A
ALARP Statement			
The residual risk associated with the generation of noise from seismic vessel, support vessels and mechanical equipment has been determined to be Low. CGG considers the adopted control measures appropriate to manage the impacts and risks of noise from seismic vessel, support vessels and mechanical equipment. As the impact/risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

7.3.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing noise emissions from seismic vessel, support vessels and mechanical equipment operation, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: Contractor and Supplier Management (Section 9.6); Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	EPBC Policy Statement 1.1. – Significant guidelines The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. Conservation Advice, Recovery Plans, and Other Guidelines: Proposed control measures and the low residual risk of vessel and mechanical equipment noise are consistent with the various Conservation Advice, Conservation Management Plans and Recovery Plans for whales, whale sharks and turtles. Conservation values and objectives of the North-west Marine Parks Management Plan: No impacts are expected to the natural or cultural heritage values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs.
	Relevant persons Expectations	No feedback relating specifically to vessel noise has been received during relevant person consultation. This issue is considered to be addressed and will be managed to acceptable levels.
Legislation and Other	Legal Requirements	The impact/risk will comply with EPBC Regulations 2000 (Part 8 Division 8.1 'Interacting with cetaceans').
Industry Standards	Industry Standards and Best Practices	Compliance with best practice guidance is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with the generation of noise emissions from seismic vessel, support vessels and mechanical equipment operation during the Sauropod 3D MSS.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential impacts from noise emissions from vessels, helicopters and mechanical equipment meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, noise disturbance from the seismic vessel, support vessels and mechanical equipment operation are unlikely to result in potential impact greater than localised and temporary disruption to a small proportion of the population. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.3.4 are considered industry best practice and meet legislative requirements. CGG considers the adopted controls appropriate to manage the impacts of noise disturbance from the seismic vessel, support vessels and mechanical equipment operation to be of an acceptable level.

7.3.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	
EPO 3	Vessel and helicopter activities are undertaken in accordance with Part 8 of the EPBC Regulations 2000.	PS 3.1	PS 3.4
		PS 3.2	PS 3.5
		PS 3.3	

Number	Performance Standards	Measurement Criteria
PS 3.1	Marine navigation warnings and Notice to Mariners of survey presence and towed array are issued. Survey is compliant with EPBC Regulations 2000 – Part 8 Division 8.1, including: • Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale • Not exceeding a speed of six knots within the caution zone of a cetacean (300 m).	MFO records verify interaction between the seismic vessel and marine mammals comply with these requirements where safe to do so. Support vessel observation sheets verify interactions between the vessel and marine mammals comply with these requirements.
PS 3.2	Helicopter movements are undertaken in accordance with EPBC Regulations 2000 – Part 8 Division 8.1, including: • Helicopters not to operate at a height lower than 1650 feet within a horizontal radius of 500 metres of a cetacean. • Helicopters not to approach a cetacean from head on.	MFO records verify that helicopter movements comply with these requirements.
PS 3.3	Vessel engines maintained according to manufacturer's specification.	Records verify that engines and propulsion system maintenance meet this standard.
PS 3.4	In addition to the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for cetaceans, vessels also, where safe to do so: • Take action to avoid approaching or drifting closer than 50 m to a turtle • Not exceeding a speed of six knots within 300 m of a turtle.	MFO records verify interaction between the seismic vessel and marine turtles comply with these requirements where safe to do so. Support vessel observation sheets verify interactions between the vessel and marine turtles comply with these requirements where safe to do so.
PS 3.5	Vessels, when safe to do so, will also adopt measures consistent with the DPaW Whale Shark Management Programme (2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark • Not exceeding eight knots within 250 m of a whale shark.	MFO records verify interaction between the seismic vessel and whale sharks comply with these requirements where safe to do so. Support vessel observation sheets verify interactions between the vessel and whale sharks comply with these requirements where safe to do so.

7.4 Physical Presence: Disruption/Interference with Other Marine Users

7.4.1 Details of Impacts and Risks

7.4.1.1 Source of Impact/Risk

There is potential for disruption/interference with other marine users associated with the physical presence of the seismic vessel, in-water equipment and support vessels in the Operational Area.

The seismic vessel will typically move along pre-determined seismic lines at a constant speed of approximately 4.5 knots and will proactively and collaboratively manage operational information between the seismic vessel and other marine users in the Operational Area. The seismic vessel and towed array will be comprised of the airgun array and streamer array, which includes header buoys, starboard and port spreaders or vanes, streamers and tail buoys.

This section deals with disruption/interference with other marine users. Risk associated with vessel collision/diesel spill is addressed in Section 8.2 and potential underwater sound impacts on commercial fishing is addressed in Section 7.1 and 7.2.

7.4.1.2 Receptors

- Commercial fishing
- Commercial shipping
- Tourism/recreational activities
- Petroleum exploration and production operations.

7.4.2 Impact/Risk Evaluation

A range of activities associated with other marine users may occur within or near to the Operational Area, including:

- Commercial fishing – WA State commercial fishing licence holders may be encountered during the Sauropod 3D MSS (Section 4.4.4)
- Tourism and recreational operations – Tourism and recreational activities take place to the north of the Operational Area at Rowley Shoals. No activities are known to take place in the Operational Area; however, vessels may traverse the area in low numbers (Section 4.4.5)
- Petroleum exploration and production operations, including associated vessel activities (Section 4.4.6)
- Commercial shipping - Trading vessels may pass through on occasion; however, a relatively low density of shipping is expected in the Operational Area (Section 4.4.10).

The limited manoeuvrability of the seismic vessel means that vessels associated with shipping, commercial fisheries, tourism operations and existing oil and gas operations may be asked to take measures to avoid the immediate vicinity of the seismic vessel and associated equipment. Skippers of commercial fishing vessels may be asked to remove fishing gear such as traps and lines to avoid interaction with the seismic vessel and in-water equipment. A chase vessel will be employed for the survey to ensure that third party vessels are informed and aware of the seismic activities.

7.4.2.1 Commercial Fishing

As described in Section 4.4.4, there are four WA State managed fisheries that have historically (in the past five years) had catch effort within the Operational or Acquisition Areas (MMF, PTMF, PFTIMF and NDSMF; Section 4.4.4).

The physical presence of the seismic vessel, in-water equipment and the support vessels have the potential to interfere with the movements and operations of fishing vessels or to cause loss or damage to fishing gear e.g. buoyed fish traps. There is a possibility that commercial fishing vessels will be displaced from the area whilst the seismic vessel is conducting seismic acquisition.

An analysis has been conducted to determine the area of overlap of historic fishing activity (effort) and the Operational Area (refer to Table 7-19).

Table 7-19 – Spatial Overlap of the Operational Area with Fishing Effort for Relevant Commercial Fisheries

Relevant Commercial Fisheries	Actively fished area (2020-2024) (km^2)	Maximum Potential Spatial Overlap	
		Overlap (km^2)	%
Pilbara Fish Trawl (Interim) Managed Fishery	27,791.7	1,958.0	7.0
Mackerel Managed Fishery	119,844.9	29.3	0.02
Pilbara Trap Managed Fishery	162,305.1	4,863.3	3.0
Northern Demersal Scalefish Managed Fishery	113,129.7	647.6	0.6

As shown in Table 7-19, the spatial overlap between the Operational Area and historic fishing effort in the WA commercial fisheries ranges from 0.02% for the Mackerel Managed Fishery (MMF) to 7.0% for the Pilbara Fish Trawl Interim Managed Fishery (PFTIMF). Except in the case of the MMF, fishing effort occurs relatively consistently across the entire year with no identified peak periods. However, in the case of the MMF, peak fishing activity in the Pilbara sector occurs from July to October and is lowest from December to March (Section 4.4.4.1.1). The Sauropod 3D MSS is expected to take 60 days to acquire, therefore the temporal overlap is approximately 16%.

In addition, as noted in Section 4.4.4, fishing effort is highest in eastern areas compared to western areas of the fisheries where the Sauropod 3D MSS is located, with fishing effort by all PFTIMF fishers (combined) in the Operational Area averaging 22 fishing days during the ten years from 2015 to 2024. Therefore, interactions and disturbances to commercial fishing vessels in the Operational Area may be infrequent or may not occur at all. The distribution of fishing effort as well as CPUE (Section 4.4.4) indicates that more viable fishing grounds are available and accessible elsewhere.

The Operational Area overlaps with a small proportion of the Pilbara Trap Managed Fishery (PTMF) (3 %; Table 7-19). The PTMF uses baited fish traps which are set on the sea floor and marked with a floating buoy (DPIRD 2020b). In addition, it is possible that fishers may leave open traps (i.e. unbaited and with open doors) on fishing grounds for extended periods (DoF 2008). This poses a risk of fishing gear entanglement with the seismic survey streamers. However due to the small overlap between fishing and survey areas an entanglement incident is unlikely.

Whilst the Acquisition Area does not overlap with the actively fished area of the Northern Demersal Scalefish Managed Fishery (NDSMF) there is a very small overlap with the Operational Area (0.6%). However, less than eight vessels in total reported fishing activity in reporting blocks overlapped by the Operational Area during the five-year period 2020 – 2024 (inclusive of repeat counts of the same vessels each year; refer to Section 4.4.4), with the majority of fishing effort in the NDSMF occurring in the north Kimberley area. It is therefore unlikely that disturbance to fishers in the NDSMF will occur during the proposed seismic survey. Furthermore, activity by survey vessels in the Operational Area will predominantly occur during turns at the northern and southern ends of each survey run and not along the sides of this area where the overlap occurs. Nevertheless, it is possible that trap fishers may be active within this overlap and thus there is a slight risk of fishing gear entanglement with the seismic survey equipment.

There is also a very small overlap between the Operational Area and the Pilbara sector of the MMF (0.02%), with no overlap by this sector with the Acquisition Area. As described above, the seismic survey will also occur at a time of lower fishing effort by fishers operating within this fishery. Therefore, given the low vessel count within the area of overlap during the past five years (< 11 for data pooled, inclusive of repeat counts of the same vessels), it is unlikely that disturbances to fishers in the MMF will occur.

In addition to the limited overlap between the Operational Area and commercial fishing effort, it is important to note that the spatial overlaps in Table 7-13 are conservative as this assumes that disturbance / reduced access to fishing grounds occurs across the entire CAES reporting block (up to 12,348 km^2). However, in reality the area where the seismic vessel and towed streamers will be operating at any one time during the survey will be significantly less. For example, the area where disruption to fishers may occur during an entire week of seismic acquisition (based on the proposed racetrack formation and a 3 nm [5.5 km] buffer applied around the seismic vessel towed array to represent the avoidance distance typically requested of other vessels) would be equivalent to 2,176 km^2, or approximately one third of the total Operational Area.

Furthermore, the Acquisition Area has been divided into sections (zones) that will be completed successively, and this information will be communicated to other marine users so that it can be used to inform fishing activities. Pre-survey notifications will commence four weeks prior to the start of the survey for this purpose, with ongoing communication happening 7 to 10 days prior to the survey and daily during the survey period, as described in Section 9.5.

Therefore, whist localised and temporary disturbances to fishing activities from seismic survey activities can occur, any disruption occurring as a result of the Sauropod 3D MSS would be temporary and insignificant for the following reasons:

- The fisheries cover wide spatial areas with only a small portion of the fished areas overlapping with the Operational or Acquisition Areas (refer Section 4.4.4), and with significantly smaller areas being affected by seismic survey activities and temporarily unavailable to fishing operations at any one time. Therefore, interactions and disturbances to commercial fishing vessels in the Operational Area may be infrequent or not occur at all.
- The distribution of fishing effort as well as CPUE (Section 4.4.4) indicates that more viable fishing grounds are available and accessible elsewhere.
- The seismic survey will occur outside of the period of peak fishing activity in the MMF.
- Completion of spatially distinct survey zones in an order that is communicated well in advance of survey activity to fishing licence holders and their peak bodies will enable pre-planning of fishing activities to avoid disruption.
- Radar detection systems, survey support vessels and ongoing radio communications with licence holders will provide advanced and timely notice to fishers during operations.

7.4.2.2 Commercial Shipping

Some commercial shipping may also need to deviate from intended routes to avoid the seismic vessel, in-water equipment and the support vessels. Consultation with AMSA confirms that only light traffic occurs within the Operational Area. The closest shipping fairway is located to the north-western corner of the Operational Area (Section 4.4.11). The use of the fairways is strongly recommended by AMSA but is not mandatory and shipping vessels still have to adhere to the International Regulations for Preventing Collisions at Sea 1972 (COLREGS). Based on this and the inherent controls identified above, no significant navigational implications or changes in shipping traffic patterns are expected.

7.4.2.3 Tourism/Recreational Activities

Tourism/recreational activities are known to take place approximately 62 km north of the Operational Area at Imperieuse and Clerke reefs in the Rowley Shoals Marine Park (state waters), however no tourism/recreational activities have been identified to take place within the Operational Area. In the event that tourism/recreational activities are present within the Operational Area, displacement would be minimal given the transient nature of the seismic activities. Therefore, no significant implications are expected.

7.4.2.4 Petroleum Exploration and Production Operations

Apart from WA-527-P, the Operational Area overlaps three other exploration permits (WA-487-P, WA-436-P and WA-438-P) that are operated by Pathfinder Energy Pty Ltd and Santos WA Northwest Pty Ltd. The potential for concurrent seismic activities has been identified in Section 4.4.6. There are no accepted EPs covering seismic surveys that could be undertaken within the same timeframe as the Sauropod 3D MSS, and potentially occur within 150 km of the Operational Area. Prior to commencement of the Sauropod 3D MSS, CGG will consult with the titleholders/proponents of these EPs to establish whether there is any likelihood of concurrent operations. Concurrent seismic surveys within close proximity to each other (i.e. within tens of kilometres) are routinely managed via CONOPS (concurrent operations plans) and time-sharing arrangements. The potential impact is considered to be slight and short-term.

Cumulative impacts from concurrent seismic surveys are described in Section 7.2.

7.4.2.5 Summary

Based on the assessment presented above and the implementation of the identified controls (Section 7.4.4), it is expected that localised and temporary disruptions to other users and activities will be Minor (1), with fishing vessels and other users able to return to a particular area once the seismic vessel has passed. The likelihood of interaction is considered to be Unlikely (B), resulting in a Low residual risk to other users in the Operational Area.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.4.3 Decision Context

The decision context for disruption/interference with other marine users, has been assessed as ‘Type A’ for most receptors, given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest. However, given the level of interest and nature of issues raised by fisheries relevant persons during consultation, the decision context is ‘Type B’ for commercial fisheries.

7.4.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation and communication to inform other users • Use of radar and 24/7 watch.	Yes	Legislative requirement for vessels operating in Commonwealth waters. All vessels associated with the Sauropod 3D MSS are required to comply with the *Navigation Act 2012*.	4.1
Good Industry Practice			
Issue of marine navigation warnings and Notice to Mariners of survey presence and towed array	Yes	AHO will be contacted 4 weeks prior to the commencement of the survey for the publication of related Notices to Mariners. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of interactions with other marine users. Good industry practice, environmental benefit outweighs additional cost.	2.1
Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings	Yes	The AMSA JRCC will be contacted 24-48 hrs before operations commence for issuing of radio-navigation warnings. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of interactions with other marine users. Good industry practice, environmental benefit outweighs additional cost.	2.2
Streamers marked with tail buoys.	Yes	Tail buoys will be used to mark ends of the streamers so that they can be detected by other vessels. Good industry practice, environmental benefit outweighs additional cost.	4.2
Notification will be provided to fisheries relevant persons, prior to commencement of the survey, indicating location and expected timing. Notification will also be provided to fisheries relevant persons upon completion of the survey.	Yes	Notification will be provided to fisheries relevant persons 4 weeks prior to commencement of the survey and 2 weeks following completion of the survey. Implementation of the control will reduce the likelihood of interactions with marine users and entanglement with fishing gear. Good industry practice, environmental benefit outweighs additional cost.	2.3
A communications protocol will be in place between the survey and support vessels and other users (e.g. known commercial fishing vessels within the Operational Area), to actively manage concurrent activities.	Yes	The survey vessel operator will provide effective 'look-aheads' to commercial fisheries fleet managers and vessel skippers to inform them of the current positions of the survey and support vessels, and of proposed operations for the next 48-72-hour period. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	4.3
At least one additional vessel (support or chase vessel) will accompany the survey vessel when in operation and when safe to do so (e.g. outside of inclement weather periods).	Yes	The chase vessel will conduct advanced scouting when safe to do so (e.g. outside of inclement weather periods) to ensure that other marine users in the area are provided with advance notice of seismic activities. The chase vessel will provide effective communications with other activities and users. Good industry practice, socio-economic benefit outweighs the additional cost.	4.4
CGG will engage with proponents identified as having potential concurrent seismic activities prior to commencing the Sauropod survey and develop a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area.	Yes	Engagement with titleholders for potential concurrent MSS activities prior to acquisition commencing, and development of a concurrent operations plan, which will include the following aspects: • Communications protocols • SIMOPS and work programming • Hazard management • Emergency response. Good industry practice, environmental benefit outweighs additional cost.	1.5
Survey activity within the Acquisition Area is separated into sections (zones) that will be completed in an order that is communicated to fishers a minimum four weeks ahead of survey start in each zone.	Yes	Enables fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	4.5
Seismic acquisition will only occur outside key fishing seasons	No	Fishing activities occur all year round and availability of the seismic survey vessel is limited. Costs outweigh benefits.	N/A
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the acquisition or the good practice controls have been identified	N/A	N/A	N/A

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Additional Controls Considered			
Implementation of the NERA (2021 – Revision 1) CSEP Commercial Fishing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities.	Yes	Compensation for short term loss of catch and displacement has been identified as a key issue during relevant person consultation and the NERA Protocol (Revision 1, 2021) provides a practical, evidence-based process that has been developed by the CSEP in consultation with the commercial fishing industry (including WAFIC and CFA), government bodies and seismic industry representatives. Benefit to fishers' livelihoods and industry reputation outweighs the cost of compensation.	1.11
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified	N/A	N/A	N/A
ALARP Statement			
The residual risk associated with the disruption/interference with marine users has been determined to be Low. CGG considers the adopted control measures appropriate to manage the risks of disruption/interference with other marine users. As the risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the risk, without jeopardising the objectives of the survey, the risk is considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Minor (1)	Unlikely (B)	Low

7.4.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing interactions between the seismic vessel, survey equipment, support vessels and other vessels/activities, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible, managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6); • Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	EPBC Policy Statement 1.1. – Significant guidelines The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines.
		Conservation Advice, Recovery Plans, and Other Guidelines N/A: No advice or guidelines have been identified that are relevant to the disruption/interference with other marine users
		Conservation values and objectives of the North-west Marine Parks Management Plan No impacts are predicted to occur to the cultural and socio-economic values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs as a result of disruption/interference with other marine users.
	Socio-economic Environment – Commercial Fisheries	The assessment of impacts to commercial fisheries has been undertaken based on relevant external context, including the following data and publications: • North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017), which describes the stock assessment and management approach (consistent with the principles of ESD), including annual fishing effort allocations and catch tolerance levels; • Spatial and temporal patterns in fisheries catch and effort distribution (based on DPIRD 2016-2022 FishCube data);
	Relevant Persons Expectations	Relevant person concerns have been assessed, responded to and controls adopted for objections and claims which hold merit. The proposed control measures have been developed based on the advice of AMSA and AHO.
Legislation and Other	Legal Requirements	All requirements under the *Navigation Act 2012* and associated Marine Orders for navigation, collision, and support vessels are identified as control measures.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practice is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with disruption/interference with other users during the Sauropod 3D MSS.

7.4.5.1 Defined acceptable levels of impact

Receptor Category	Relevant External Context	Defined Acceptable Level	Comparison with Predicted Levels of Impact
Commercial Fisheries	Commercial fisheries relevant person objections, claims and concerns regarding the effects of seismic surveys on commercial catch levels and displacement from fishing grounds. Commercial fisheries data and publications: • North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017), which describes the stock assessment and management approach (consistent with the principles of ESD), including annual fishing effort allocations and catch tolerance levels • Spatial and temporal patterns in fisheries catch and effort distribution (based on DPIRD 2020-2024 FishCube data). • Status Reports of the Fisheries and Aquatic Resources of Western Australia 2019/20: The State of the Fisheries (Newman et al. 2024).	Seismic activities are undertaken in a manner that: • Does not interfere with fishing to a greater extent than is necessary for the exercise of right conferred by the titles granted to carry out exploration activities. • Does not prevent each of the licenced commercial fisheries that overlap with the survey area from a catch that meets (or exceeds) the acceptable annual catch tolerance ranges for the fishery , as defined in the North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017) (where catch below these tolerance levels cannot be adequately explained by other factors, such as changes in annual fishing effort allocations, changes in active vessel numbers, environmental conditions, or market induced impacts).	CGG considers the level of impact to commercial fisheries to be of an acceptable level. CGG recognises that clear and regular communication with fisheries relevant persons is required in order to facilitate better planning and resource sharing. CGG acknowledges that localised and temporary disturbances to fishing activities from seismic survey activities may occur. However, the level of impact from the Sauropod 3D MSS is considered to be acceptable due to the following reasons: • Based on DPIRD FishCube data and CPUE data (Newman et al. 2023), the Sauropod 3D MSS Operational Area overlaps with areas fished by the PFTIMF, the PTMF, the MMF (0.05%) and the NDSMF, and fishing effort is low in these areas of overlap compared to other areas of the fisheries. • The level of interference CGG may have on commercial fisheries is no greater than is necessary to exercise of right conferred by the titles granted to carry out exploration activities. • Disturbances to fisheries are likely to be infrequent and short-term. These are not expected to impact the overall annual catch rates and annual performance of the fisheries to the degree that it prevents the fisheries from achieving (or exceeding) the acceptable annual catch tolerance ranges for the fishery, as defined in the North Coast Demersal Scalefish Resource Harvest Strategy 2017 – 2021 (DPIRD 2017). • CGG has based its risk assessments on information and advice provided or published by DPIRD and the FRDC. • The NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) will be implemented to formally manage claims by commercial fishers for loss of catch, displacement and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as ‘Decision Type B’ are considered acceptable if the criteria outlined in Table 6-7 are met and it can be demonstrated that the predicted levels of impact and/or residual risk, are at or below pre-defined acceptable level(s) for that impact or risk. The evaluation of potential impacts from the physical presence meets these requirements as outlined above. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 0 are considered industry best practice and meet legislative requirements. CGG considers the adopted controls appropriate to manage the impacts of the physical presence of the vessel and subsequent disruption or interference with other marine users to be of an acceptable level.

7.4.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID		
EPO 4	Marine users are aware of the survey location, timing and safety navigation zone	PS 4.1 PS 2.1 PS 2.2	PS 4.2 PS 2.3 PS 4.3	PS 4.4 PS 4.5 PS 1.5 PS 1.11
EPO 1.5	Seismic acquisition is undertaken in a manner that: • Prevents serious or irreversible impacts to key indicator commercial fish populations, such that sufficient spawning fish biomass and recruitment of the stocks may be maintained, and the stocks continue to be assessed by DPIRD as Sustainable. • Does not prevent each of the licenced commercial fisheries that overlap the Adjustment Area from a catch that meets (or exceeds) the acceptable annual catch tolerance ranges for the fishery, as defined in the relevant harvest strategy (where catch below these tolerance levels cannot be attributed to other factors, such as changes in annual fishing effort allocations, changes in active vessel numbers, environmental conditions, or market induced impacts). • Does not result in financial loss to commercial fishers due to reduced catchability of target species, decreased catch or catch per unit effort, loss or damage to fishing equipment, or decreased ability to fish within the area impacted by seismic noise emissions.	PS 1.1 PS 1.2 PS 1.3 PS 1.4	PS 1.5 PS 1.6 PS 1.7	PS 1.8 PS 1.9 PS 1.11

Number	Performance Standards	Measurement Criteria
PS 4.1	Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation and communication to inform other users. • Use of radar and 24/7 watch.	No records of survey or support vessels failing to comply with appropriate navigation, lighting and communication requirements under the *Navigation Act 2012* or its associated Marine Orders.
PS (refer to PS 2.1)	The AHO is advised 4 weeks prior to survey commencement to allow for the issue of a Notice to Mariners.	Records verify that Notice to Mariners issued by AHO prior to survey commencement.
PS (refer to PS 2.2)	AMSA JRCC is notified of survey activities 24-48 hours before operations commence, to allow for issue of AUSCOAST warning, at survey commencement and at completion.	Records verify AMSA JRCC notifications have been made.
PS 4.2	Streamers are marked with tail buoys.	Records confirm tail buoys are fitted to each streamer.
PS (refer to PS 2.3)	Notification has been provided to fisheries relevant persons four weeks prior to commencement of the survey, indicating location and expected timing. Notification has also been provided to fisheries relevant persons within two weeks of cessation of the survey.	Consultation records confirm that fisheries relevant persons were notified four weeks prior to survey commencement within each zone and within two weeks of cessation of activities.
PS 4.3	A communications protocol is in place between the survey and support vessels and other users (e.g. known commercial fishing vessels within the Operational Area), to actively manage concurrent activities.	Records demonstrate that 48-72-hour 'look-aheads' have been provided to relevant persons that have requested to receive them.
PS 4.4	At least one chase vessel is employed to assist the seismic vessel to mitigate interference associated with third party vessel operations.	Records demonstrate that a dedicated chase vessel is employed for the survey
PS (refer to PS 1.5)	CGG has engaged with proponents identified as having potential concurrent seismic activities prior to commencing the Sauropod survey and develop a concurrent operations plan for any concurrent surveys identified within 40 km of the Acquisition Area.	Records verify that CGG has engaged with proponents prior to acquisition commencement (if relevant), and a concurrent operations plan has been developed.
PS (refer to PS 1.11)	Implementation of the NERA CSEP Commercial Fishing Industry Adjustment Protocol (2021 - Revision 1) (NERA Protocol) to formally manage claims by commercial fishers for loss of catch, displacement, and lost or damaged fishing gear as a consequence of the Sauropod 3D MSS, in accordance with the following performance parameters: 1. A claim can only be lodged by an eligible commercial fisher (as defined by NERA, 2021) or a person authorised to do so on behalf of the commercial fisher. 2. The Sauropod 3D MSS Adjustment Area (extending 10 km around the perimeter of the area in which the seismic source can be active) establishes the spatial extent of a claim. 3. A commercial fisher (or fishing vessel or licence) must have previous fishing history in fishing blocks/events overlapping the Adjustment Area for which they make a claim for loss of catch or displacement. The minimum fishing history is two out of the five years within fishing blocks/events which overlap the Adjustment Area, prior to the Sauropod 3D MSS. 4. Loss of Catch adjustment is available to eligible commercial fishers for a loss experienced during the period of the Sauropod 3D MSS and for 6 months after this period. 5. Displacement or Loss of Gear adjustment may be claimed for a loss experienced during the period of the Sauropod 3D MSS. 6. A Loss of Catch claim may be submitted up to 12 months after completion of the Sauropod 3D MSS. 7. A Displacement or Loss of Gear claim may be submitted up to 6 months after completion of the Sauropod 3D MSS. 8. CGG will notify relevant commercial fishing licence holders and respective peak commercial fishing industry bodies of the establishment of the claims process, the survey timing and the Adjustment Area no less than 28 days before commencement of the Sauropod 3D MSS. Notification will be in writing and include a map and digital files in KML, GPX and shapefile format as well as contact details for lodgement of a claim. 9. Full details on the information required to be lodged with a claim are contained in the application forms provided in the NERA Protocol (Appendix 2- Loss of catch, Appendix 3- Displacement, Appendix 4 – Fishing gear loss or damage). 10. CGG will confirm with a commercial fisher that their claim has been received within 7 days of its receipt. 11. Claims will be assessed by an independent assessor with experience in fisheries management or claim assessment. 12. If an assessor believes the information lodged with a claim is not sufficient to conduct a meaningful assessment or support the application, then the claimant will be advised in writing and given 14 days to respond to the assessor. If no response is received within 14 days, then the assessment will be completed, and the claimant advised of the outcome. 13. An appropriately documented claim (including relevant catch and effort information) will be assessed, and a report provided to the claimant within 60 days of the lodgement date of the claim. The 60-day time period begins upon receipt of the necessary catch and effort data. The 60-day period may be extended if mutually agreed between CGG and the claimant, however if no agreement is possible CGG shall appoint an expert reviewer (independent of both parties and the assessor) (at CGGs expense and in consultation with the claimant). The expert reviewer must have experience in fisheries management or claims assessment. 14. The assessment report will include the following information: • a copy of the letter of instruction/project brief received by an assessor when engaged to carry out the independent assessment, • confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment, • a summary of the claim details (survey, applicant, vessel, month(s)), • for a loss of catch claim, monthly CPUE assessments as outlined in this protocol including an estimation of any loss of catch (in kilograms) and its market price, and • any other information, comments, or views relevant to the assessment that the assessor may wish to include.	Records demonstrate that: 1. Commercial fishers or their authorised persons have been able to submit a claim if desired for loss of catch, displacement or lost or damaged fishing gear resulting from the Sauropod 3D MSS. 2. Eligible commercial fishers and their respective commercial fishing industry peak bodies have been notified of the establishment of the claims process and the Adjustment Area in writing no less than 28 days prior to commencement of the Sauropod 3D MSS. Notification has included a map and digital files in KML, GPX and shapefile format, and included contact details for lodgement of a claim. 3. A claim by a commercial fisher was considered valid if evidence confirmed that: • They were eligible to do so. • They had the required catch history. • The claim was for the applicable period. • The claim was lodged within the time frames described in PS 1.11. 4. Claimants were notified within 7 days of receipt of their claim. 5. A claim, made using forms provided in Appendices 2 – 4 of the NERA Protocol, was assessed: • By an independent assessor with experience in fisheries management or claim assessment. • In accordance with the process and reporting requirements described in points 12 – 14 of PS 1.11. 6. If requested by the claimant the assessment outcome was reviewed by an independent expert reviewer in accordance with point 15 of PS 1.11. 7. Once a claimant and titleholder agreed with a claim outcome or an expert reviewer had issued a report CGG provided monetary adjustment to the claimant within 60 days. 8. Revision 1 of the NERA Protocol was the reference document for the commercial fisher claims process.

Number	Performance Standards	Measurement Criteria
	15. If a claimant disagrees with a claim assessment outcome and cannot reach agreement with CGG they may request an expert reviewer (independent of both parties and the assessor) (funded by CGG). The expert reviewer must have experience in fisheries management or claim assessment. As part of that process both the claimant and CGG shall be given the opportunity to address the expert reviewer to state their position, prior to a decision being reached. The expert reviewer will provide opinion as to whether the claim assessment process has been conducted in line with the requirements of the protocol, and their decision will be binding on the claimant and CGG. 16. Once a claimant and CGG agree on the claim outcome, or an expert reviewer has issued a report, CGG will provide monetary adjustment to the claimant within 60 days. 17. Revision 1 of the NERA Protocol provides full detail of and is the ultimate reference for the commercial fisher claims process.	
PS 4.5	Survey activity within the Acquisition Area is separated into zones that will be completed in an order that is communicated to fishers a minimum four weeks ahead of survey start in each zone.	Consultation records confirm that fisheries relevant persons were notified four weeks prior to survey commencement within each zone and within two weeks of cessation of activities.

7.5 Discharge: Treated Sewage, Grey Water and Putrescible Waste

7.5.1 Details of Impacts and Risks

7.5.1.1 Source of Impact/Risk

Discharge of treated sewage, grey water and putrescible wastes to the marine environment from the seismic and support vessels has the potential to cause temporary/localised reduction in water quality, and minor/temporary toxicity on marine biota.

The seismic and support vessels employed for the Sauropod 3D MSS will generate liquid wastes (i.e. treated sewage, grey water and putrescible food waste). These vessels will routinely generate/discharge small volumes (up to 15 m^3 per vessel per day) of domestic waste to the marine environment. Routine discharges generated from the survey have the potential to cause temporary and localised reduction in water quality.

Potential impacts associated with the discharge of deck and bilge water from vessels is addressed in Section 7.6.

7.5.1.2 Receptors

- Water quality
- Marine biota
- Cultural features and heritage values.

7.5.2 Impact/Risk Evaluation

Routine discharges of domestic wastes have the potential outcome of temporary and localised increased nutrient levels resulting in localised, minor and temporary ecological impacts (e.g. changes in certain nutrients and/or dissolved oxygen) that may conceivably affect cultural features and/or heritage values.

Impacts resulting from the discharge of domestic liquid wastes are expected to be negligible, as treated discharges would rapidly disperse in close proximity to the release location given surface currents and the assimilative capacity of the open ocean environment. The resulting change in water quality in the water column will be highly localised and short term, with nutrient concentrations returning to background levels shortly after discharge. Thus, significant impacts to marine biota are not expected.

Considering the required controls, the consequence of occasional short term and localised disturbance to water quality and marine biota, as well as to cultural features and heritage values, is Minor (1). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.5.3 Decision Context

The decision context for discharge of sewage, grey water and putrescible wastes from the seismic vessel and support vessels to the marine environment has been assessed as ‘Type A’, given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest.

7.5.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Seismic vessel and support vessels will be compliant with Marine Order 96 - pollution prevention – sewage (as appropriate to vessel class): • A valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when 3 nm from land and when the vessel is moving at four knots: or • Sewage that has not been comminuted/disinfected via an IMO-approved system will only be discharged when 12 nm from land and when the vessel is moving at 4 knots.	Yes	Sewage discharges to the marine environment during the survey will be undertaken in accordance with the requirements of MARPOL Annex IV and AMSA Marine Order 96, including via approved systems and the required discharge rates to ensure adequate dispersion of discharges to reduce the potential for impacts. It is a legislative requirement for vessels to comply with AMSA Marine Orders.	5.1
Seismic vessel and support vessels will be compliant with Marine Orders 95 – pollution prevention – Garbage (as appropriate to vessel class), specifically: • Putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm, prior to discharge while the vessel is moving and 3 nm from land.	Yes	Discharges of putrescible waste (e.g. food waste) will be undertaken in accordance with the requirements of MARPOL Annex V and AMSA Marine Order 95 to ensure adequate dispersion of discharges to reduce the potential for impacts. It is a legislative requirement for vessels to comply with AMSA Marine Orders.	5.2
Good Industry Practice			
No additional good industry practice measures have been identified	N/A	N/A	N/A
Alternatives/Substitutes Considered			
Alternative to the discharge of domestic waste to the marine environment is the retention of all liquid wastes on-board and transfer to a licensed onshore disposal site.	No	The alternative was discounted as being impractical for the following reasons: • Environmental risks associated with offshore discharge are low given the use of IMO-standard sewage systems and macerator, and the commitment to discharge offshore in accordance with MARPOL and associated Marine Orders. • Retaining wastes on-board for transfer to shore would require additional supply vessel journeys to be made during the survey, resulting in additional vessel movements and associated increased risks of physical presence, noise, atmospheric emissions etc. • Transfer and disposal of liquid wastes to shore would have significant additional cost and time implications. Given the already low environmental risk associated with proposed discharges, the planning, time and cost implications are grossly disproportionate to the negligible reduction in risk that would be achieved and the already low level of risk.	N/A
Additional Controls Considered			
In addition to vessels complying with the requirement to be fitted with an IMO-approved sewage treatment plant or sewage holding tank (where applicable), vessels may be required to have an IMO-approved sewage treatment plant regardless of vessel size and people capacity.	No	This additional control would add to the overall cost of the survey, impacting on the commerciality. Given the already low environmental risk associated with proposed discharges, the planning, time and cost implications are grossly disproportionate to the negligible reduction in risk that would be achieved and the already low level of risk.	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No further practicable improvements to the above controls have been identified.	N/A	N/A	N/A
ALARP Statement			
The residual risk associated with the discharge of treated sewage, grey water and putrescible wastes has been determined to be Low. CGG considers the adopted control measures appropriate to manage the impacts and risks of discharge of sewage, grey water and putrescible wastes. As the impact has been classified as ‘Type A’ and no reasonable additional or alternative controls were identified that would further reduce the impacts, without jeopardising the objectives of the survey, the impacts are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Residual Risk Ranking
Residual Risk	Minor (1)	Rare (A)	Low

7.5.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing discharge of domestic liquid wastes is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6); • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines.
		Conservation Advice, Recovery Plans, and Other Guidelines: No species Recovery Plans or Conservation Advice set requirements relating to the management of liquid waste discharges.
		Conservation values and objectives of the North-west Marine Parks Management Plan Although the Operational Area is not located within any AMPs, management of discharges in accordance with the requirements of MARPOL meets the management prescriptions for MUZ in the North-west Marine Parks Network Management Plans. Vessel discharges will also not occur in AMP Sanctuary Zones.
	Relevant Persons Expectations	No feedback relating specifically to liquid waste has been received during relevant person consultation.
Legislation and Other	Legal Requirements	The impact/risk mitigation will comply with International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and associated AMSA Marine Orders made under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* for the management of discharges at sea.
Industry Standards	Industry Standards and Best Practices	Compliance with best practice is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with discharge of treated sewage, grey water and putrescible wastes from the seismic vessel and support vessels.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential impacts from the discharge of sewage, grey water and putrescible wastes meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, discharge of sewage, grey water and putrescible wastes are unlikely to result in potential impact greater than localised and short-term local concern to water quality and marine biota. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.5.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

7.5.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID
EPO 5	No impact to water quality greater than Minor (1) from discharge of sewage, grey water and putrescible waste to the marine environment during the survey.	PS 5.1 PS 5.2

Number	Performance Standards	Measurement Criteria
PS 5.1	Seismic vessel and support vessels are compliant with Marine Order 96 - pollution prevention – sewage (as appropriate to vessel class): • A valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when 3 nm from land and when the vessel is moving at four knots: or • Sewage that has not been comminuted/ disinfected via an IMO-approved system will only be discharged when 12 nm from land and when the vessel is moving at four knots.	Records demonstrate seismic vessel and support vessels are compliant with Marine Orders 96 - pollution prevention – sewage (as appropriate to vessel class).
PS 5.2	Seismic vessel and support vessels are compliant with Marine Orders 95 – pollution prevention – Garbage (as appropriate to vessel class), specifically: • Putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm.	Records demonstrate Survey and support vessels are compliant with Marine Orders 95 – pollution prevention (as appropriate to vessel class).

7.6 Discharge: Drains, Deck and Bilge Water

7.6.1 Details of Impacts and Risks

7.6.1.1 Source of Impact/Risk

Discharge of deck drainage and oily water to the marine environment from the seismic and support vessels has the potential to cause temporary/localised reduction in water quality, and minor/temporary toxicity on marine biota.

The seismic and support vessels routinely generate/discharge:

- Relatively small volumes of bilge water. Bilge tanks receive fluids from many parts of the vessel. Bilge water can contain water, oil, detergents, solvents, chemicals, particles and other liquids, solids or chemicals. The amount of bilge wastes accumulated on-board is dependent on vessel characteristics, such as size, engine room design, and preventative maintenance schedule.
- Variable volumes of wastewater from decks directly overboard or via deck drainage systems. Water sources could include rainfall events and/or from deck activities such as cleaning/wash-down of equipment/decks. The volume of drain discharge during the survey is dependent on the amount of rainfall received and the frequency of the deck washing activities. Discharge from open drain areas will be conducted directly overboard.

The discharge of deck drainage and bilge from the seismic and support vessels has the potential to result in a reduction in water quality (through an increase in nutrient levels or contaminants such as hydrocarbons), which has the potential to affect marine biota.

Potential impacts associated with the accidental discharge of solid wastes is addressed in Section 8.7.

7.6.1.2 Receptors

- Water quality
- Marine biota
- Cultural features and heritage values.

7.6.2 Impact/Risk Evaluation

Routine discharge of deck drainage and bilge water, if not managed or treated, has the potential to temporarily reduce water quality resulting in localised toxicity impacts on marine biota through an increase in nutrient levels or contaminants such as hydrocarbons. This therefore has potential to affect cultural features and heritage values in the vicinity of the discharge.

Areas of potential contamination on vessels such as machinery and bulk liquid storage areas are contained or bunded to capture any spilled chemicals or oil residues. Drainage from these areas will be directed to holding tanks for either treatment through an oil-in-water separator prior to discharge or disposed of onshore. All vessels ≥400 gross tonnes will hold a current International Oil Pollution Prevention (IOPP) Certificate demonstrating that vessels are fitted with an oil discharge monitoring and control system and oil filtering equipment, which will be maintained and operated to 15 ppm standard. The bilge stream is treated to reduce hydrocarbon concentrations below 15 ppm prior to discharge overboard. Discharges would rapidly disperse in close proximity to the release location, given the surface currents and the assimilative capacity of the open ocean environment. Given the minor quantities of contaminants expected from the open drains, the expected rapid dispersal of both open drain and treated bilge discharges, and the management measures to be implemented for the bilge waste stream, toxicity impacts to marine biota are not expected.

Considering the required controls, the consequence of occasional short term and localised disturbance to water quality and marine biota, as well as to cultural features and heritage value, is Negligible (0). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.6.3 Decision Context

The decision context for the discharge of deck drainage and bilge water has been assessed as ‘Type A’, given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest.

7.6.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
In accordance with MARPOL Annex 1 and Marine Order 91 (Under agreement 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972), vessels ≥400 gross tonnes will have an oil discharge monitoring and control system and oil filtering equipment on-board, hold a current IOPP Certificate and maintain an oil usage management logbook. Treated bilge water will be discharged only when the vessel is moving, and the oil discharge monitoring and control system and oil filtering equipment is operating. If oil discharge monitoring and control system and oil filtering equipment is unavailable, bilge water mixtures will be retained on-board for on shore disposal.	Yes	Vessels employed for the Sauropod 3D MSS ≥400 gross tonnes will hold a current IOPP certificate and have an oil discharge monitoring and control system in accordance with the requirements of MARPOL Annex I and AMSA Marine Order 91. Bilge water discharges will be undertaken in accordance with the requirements of MARPOL Annex I and AMSA Marine Order 91. It is a legislative requirement for vessels to comply with MARPOL and AMSA Marine Orders.	6.1
Good Industry Practice			
No additional good industry practice measures have been identified.	N/A	N/A	N/A
Alternatives/Substitutes Considered			
Seismic and support vessels discharge treated bilge or all contaminated bilge to onshore facilities for treatment and disposal.	No	For the seismic vessel there is substantial additional cost due to onshore treatment and disposal, acquisition downtime, increase in survey duration, increased fuel consumption given the additional transits required by support vessel. Risk of spills and leaks during transfer operations and additional safety risks to personnel during vessel transfer activities. No net benefit observed if treated bilge can be discharged in accordance with MARPOL requirements.	N/A
Additional Controls Considered			
Oil discharge monitoring and control systems on-board the survey vessels will be maintained and calibrated to ensure monitoring readings are accurate.	Yes	Records of equipment calibration can be retained and checked to confirm that equipment is operating to the standard it should be to meet the requirements of MARPOL and associated Marine Orders. The environmental benefit outweighs the additional cost.	6.2
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No further practicable improvements to the above controls have been identified.	N/A	N/A	N/A
ALARP Statement			
The residual risk associated with the discharge of deck drainage and bilge water has been determined to be Low. CGG considers the adopted control measures appropriate to manage the impacts and risks of discharge of deck drainage and bilge water. As the impact/risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

7.6.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing discharge of deck drainage and bilge water, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible, managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines.
		Conservation Advice, Recovery Plans, and Other Guidelines: No species Recovery Plans or Conservation Advice set requirements relating to the management of deck drainage and bilge water discharges.
		Conservation values and objectives of the North-west Marine Parks Management Plan The Operational Area is not located within any AMPs. All vessel discharges will comply with the management prescriptions for AMPs. Vessel discharges will also not occur in AMP Sanctuary Zones.
	Relevant Persons Expectations	No feedback relating specifically to deck drainage and bilge water discharges has been received during relevant person consultation. This issue is considered to be addressed and will be managed to acceptable levels.
Legislation and Other	Legal Requirements	The proposed controls meet or exceed the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and associated AMSA Marine Orders made under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* for the management of discharges at sea.
Industry Standards	Industry Standards and Best Practices	Compliance with best practice guidance is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with discharge of discharge of deck drainage and bilge water from the seismic vessel and support vessels.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential impacts from the discharge of deck drainage and bilge water meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, discharge of deck drainage and bilge water are unlikely to result in potential impact greater than localised and short-term local concern to water quality and marine biota. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.6.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

7.6.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID
EPO 6	No impact to water quality greater than Negligible (0) from discharge of bilge and deck drainage to the marine environment during the survey.	PS 6.1 PS 6.2

Number	Performance Standards	Measurement Criteria
PS 6.1	Seismic and support vessels are compliant with MARPOL Annex I and AMSA Marine Order 91: • A valid IOPP Certificate, as required by vessel class • Mandatory measures for the processing of oily water prior to discharge • Machinery space bilge/oily water has International Maritime Organisation (IMO) approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge • IMO approved oil filtering equipment also has an alarm and an automatic stopping device or be capably of recirculating in the event that OIW concentration exceeds 15 ppm • In the event that machinery space bilge and deck drainage discharges cannot meet the oil content standard of 15 ppm without dilution or be treated by an IMO approved oil/water separator, they are contained on-board and disposed of onshore • Treated bilge water is discharged only when the vessel is moving, and the oil discharge monitoring and control system and oil filtering equipment is operating to specification.	Records demonstrate compliance with the requirements of MARPOL Annex I and AMSA Marine Order 91.
PS 6.2	Oil discharge monitoring and control systems on-board the survey vessels are maintained and calibrated to ensure monitoring readings are accurate.	Records demonstrate oil discharge monitoring and control systems have been maintained.

7.7 Artificial Light Emissions: Vessels

7.7.1 Details of Impacts and Risks

7.7.1.1 Source of Impact/Risk

Navigational and safety lighting on the seismic and support vessels emit light, which may disrupt marine fauna normal behaviours.

The seismic and support vessels present in the Operational Area will display artificial lighting to meet navigational and safety requirements under the Prevention of Collision Convention (Marine Order 30). Essential lighting from work related areas and navigational beacons, mainly during night-time operations, has the potential to result in the disruption of marine fauna behaviours.

7.7.1.2 Receptors

- Marine fauna sensitive to artificial lighting (i.e. turtles, fishes and seabirds)
- Cultural features and heritage values.

7.7.2 Impact/Risk Evaluation

Essential lighting from work related areas and navigational beacons, mainly during night-time operations, has the potential to result in the disruption of marine fauna behaviours. The extent of impacts to marine fauna from artificial light emissions is dependent on the:

- Density and wavelength of the light source
- Extent to which the light spills into areas that are significant for breeding and foraging
- Timing of the light spill relative to breeding and foraging activity
- Ability of the fauna populations to return to their original state following the activity.

Due to the size of the seismic vessel and the height above sea level where lights will be positioned, it is expected that light emissions, particularly the area that is directly lit by lights on the vessel, will be localised and limited to the immediate vicinity of the vessel.

7.7.2.1 Turtles

Artificial light has the potential to disrupt critical behaviours in turtles, particularly in relation to nesting at the shoreline. Light has been shown to affect how turtles choose nesting sites, how they return to the sea after nesting and how hatchlings find the sea following emergence from nests (Witherington and Martin 2003). Artificial lighting may affect the location that turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and even the seaward return of adults (Salmon *et al.* 1995). However, the Operational Area is approximately 120 km away from the closest known turtle nesting beach (Eighty Mile Beach) and impacts to turtle hatchlings and nesting turtles are therefore not anticipated (Section 4.3.8.1).

Adult and hatchling turtles that may be present within the Operational Area may be attracted to the survey and support vessel lighting. However, attraction of turtles to the vessels would be localised, short-term and affect a small proportion of the population due to the:

- Transient nature of the survey (moving at 4.5 knots)
- Limited distance of visible light from the seismic vessel
- Operational Area being located outside of any turtle internesting or foraging BIAs.

In addition, during acquisition, sound emissions from the survey and support vessels, and from the seismic source, are expected to act as a localised and temporary deterrent to approaching adult turtles (refer to Section 7.1).

7.7.2.2 Fishes

Light emissions from the vessels in the Operational Area may result in localised aggregation of fishes in the immediate vicinity of the vessels at night. This may result in an increase in predation on prey species aggregating in the area, or

exclusion of nocturnal foragers/predators (Marchesan et al. 2006). These aggregations of fishes are considered localised and temporary and any long-term changes to fish species composition or abundance is considered highly unlikely. Light emission impact to fishes within the Operational Area would be highly localised and short-term due to the transient nature of the survey, the limited distance of visible light from the survey and support vessels and light use being limited to night-time operations. Sound emissions from the survey and support vessels, and from the seismic source, are also expected to act as a localised and temporary deterrent to fishes (refer to Section 7.1).

7.7.2.3 Seabirds

Studies conducted in the North Sea indicate that migratory birds may be attracted to offshore lights when travelling within a radius of 3 to 5 km from the light source. Outside this area, their migratory paths are likely to be unaffected (Marquenie *et al.* 2008). Light emission effects to birds within the Operational Area (including those migrating through and those foraging within the Lesser frigatebird foraging BIA and the White-tailed tropicbird breeding/foraging BIAs) are expected to be localised and temporary based on the transient nature of the survey and limited distance of visible light from the survey and support vessels. Any behavioural effects to migratory and foraging birds while in transit to/from these locations, such as attraction to the light source are expected to be highly localised and short-term and therefore are not expected to have any discernible impacts on migration or behavioural patterns.

7.7.2.4 Cultural features and heritage values

As described above light emissions from vessels in the Operational Area may have localised and short-term effects on culturally important species, although as concluded above the impacts on these species will be negligible.

7.7.2.5 Summary

Given the transient nature of the survey, the limited number of vessels operating in the Operational Area, together with the short duration of the survey (60 days) and the predominantly open oceanic and offshore location of the Operational Area, the potential impacts are expected to be localised with no lasting effect, with light spill limited to the immediate vicinity of vessels. The consequence of occasional short-term and localised disturbance to marine fauna sensitive to artificial lighting (and of cultural importance) is Negligible (0). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measure, the ALARP evaluation, and the evaluation of Acceptability are provided below.

7.7.3 Decision Context

The decision context for artificial light emissions has been assessed as ‘Type A’, given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest.

7.7.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation and communication to inform other users. • Use of radar and 24/7 watch.	Yes	Legislative requirement for vessels operating in Commonwealth waters. All vessels associated with the Sauropod 3D MSS are required to comply with the *Navigation Act 2012*	4.1
Good Industry Practice			
No additional good industry practice measures have been identified.	N/A	N/A	N/A
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the above controls have been identified	N/A	N/A	N/A
Additional Controls Considered			
Restriction on night-time activities or activities in low light conditions.	No	Significant light impacts to birds and turtles are not expected due to the transient nature of the survey and support vessels and the offshore location of the survey. Given the resulting increase in survey time and cost, this option was considered impractical and disproportionate to the limited benefit that would be gained.	N/A
Survey crews shall be instructed to minimise unnecessary external lighting where practicable during the activity.	Yes	Survey crews will be instructed to minimise unnecessary external lighting where practicable during the activity. Lighting for the purpose of safety or navigation purposes is necessary. The environmental benefit outweighs the additional cost.	7.1
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No further practicable improvements to the above controls have been identified.	N/A	N/A	N/A

ALARP Statement
The residual risk associated with the artificial light emissions has been determined to be Low. CGG considers the adopted control measures appropriate to manage the impacts and risks of artificial light emissions. As the impact/risk has been classified as ‘Type A’ and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

7.7.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing artificial light emissions, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6); • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines:** CGG has reduced any adverse impacts of artificial lighting from the activities on Australian turtle species noting the linkages with the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017). **Conservation values and objectives of the North-west Marine Parks Management Plan** The Operational Area is not located within any AMPs. The management prescriptions for AMPs do not include information on artificial light emissions from commercial vessels.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to artificial light emissions.
Legislation and Other	Legal Requirements	Artificial lighting will be managed in accordance with the requirements of the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS) and associated AMSA Marine Orders under the *Protection of Sea (Prevention of Collisions) Act 1983*.
Industry Standards	Industry Standards and Best Practices	No industry standards and best practice have been identified that relate to artificial light emissions.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with artificial light emissions during the Sauropod 3D MSS.
Acceptability Statement		
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential impacts from artificial light emissions meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, artificial light emissions are unlikely to result in potential impact greater than localised and short-term local concern to marine fauna. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.7.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.		

7.7.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID
EPO 7	Lighting reduced to levels required for navigational and safety purposes, so as to not disrupt behaviour patterns of marine fauna.	PS 4.1 PS 7.1

Number	Performance Standards	Measurement Criteria
PS (refer to PS 4.1)	Vessels will comply with *Navigation Act 2012* and associated Marine Orders 21, 30, 58 - safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation and communication to inform other users • Use of radar and 24/7 watch.	No records of survey or support vessels failing to comply with appropriate navigation, lighting and communication requirements under the *Navigation Act 2012* or its associated Marine Orders.
PS 7.1	Survey crews are instructed to minimise unnecessary external lighting where practicable during the activity (note that lighting for the purpose of safety or navigation purposes is necessary).	Survey crew induction materials include a summary of the requirements to minimise artificial lighting. Survey induction attended by all crew as demonstrated by induction records.

7.8 Atmospheric Emissions: Vessels and Mechanical Equipment

7.8.1 Details of Impacts and Risks

7.8.1.1 Source of Impact/Risk

Atmospheric emissions from the seismic and support vessels during the survey may result in a temporary and localised reduction in air quality.

The seismic survey vessel and support vessels present in the Operational Area will generate atmospheric emissions from power generation equipment, engine exhaust and waste incinerators. Atmospheric emissions generated from internal combustion engines of seismic vessel and support vessels and machinery used during the survey will include SO2, NOX, ozone depleting substances, CO2, particulates and volatile organic compounds (VOCs). Based on activity details and schedule described in Sections 3.2 and 3.3, the total estimated fuel consumption by a seismic vessel and support vessels typical of those likely to be used during the survey would be 2,160 and 315 tonnes, respectively (the latter for both chase and supply vessel combined). Based on the use of low sulphur (1000 ppm) Marine Diesel Oil (MDO), this would result in a total of 7006.9 tonnes of CO_2 emissions by the seismic vessel and 1,021.8 tonnes of CO_2 emissions by the two support vessels (combined) during the survey (Scope 1 CO2e using AR5 GWP100). This compares with Australia's total emissions of 463.9 million tonnes of carbon dioxide equivalent in 2022, with Australia contributing to just over one percent of global emissions (https://www.dcceew.gov.au/about/news/australias-greenhouse-gas-emissions-dec-2022-quarterly-update; accessed 18/12/2023).

7.8.1.2 Receptors

- Air quality in the immediate vicinity of the vessel exhaust.
- Contribution of greenhouse gases (GHG) and pollutants to the atmosphere.

7.8.2 Impact/Risk Evaluation

The seismic survey vessel and support vessels present in the Operational Area will generate atmospheric emissions from power generation and waste incineration. Atmospheric emissions have the potential to result in a localised reduction in air quality in the immediate vicinity of the vessel exhaust and to contribute to Australian and global levels of GHG in the atmosphere.

As described in Section 7.8.1.1, overall emissions from the seismic and support vessels are expected to be low given the class of vessels to be used and the duration of the survey (60 days). Given the location of the Operational Area offshore is approximately 120 km from the mainland coastline, any emissions are expected to disperse rapidly in the open oceanic conditions and background levels of atmospheric pollutants are expected to be low. Due to the low emissions levels and very low background levels of pollutants, it is anticipated that emissions resulting from the survey will only result in a short term and localised reduction in air quality, with emissions quickly dispersing and decreasing to within background levels. No lasting effect on sensitive receptors is likely. Given the low level of emissions anticipated, survey emissions only represent a very small contribution to overall Australian and global GHG emissions to the atmosphere (Section 7.8.1.1).

The consequence of occasional short term and localised disturbance to air quality is Negligible (0). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measure, the ALARP evaluation, and the demonstration of Acceptability are provided below.

7.8.3 Decision Context

The decision context for atmospheric emissions has been assessed as 'Type A', given the impacts/risks are well understood and uncertainty is minimal, with little or no relevant person interest.

7.8.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
In accordance with MARPOL 73/78 Annex VI (Prevention of Air Pollution) and Marine Order 97, vessels to have a valid IAPP Certificate (International air pollution prevention certificate) confirming: • Incinerators are certified to meet prescribed emissions standards • Diesel engines 130 kW are certified to meet prescribed emission standards	Yes	MARPOL is a legislative requirement for vessels operating in Australian Commonwealth waters and will be implemented by all vessels. Implementation of the regulations will reduce the atmospheric emissions released into the environment. It is a legislative requirement for vessels to comply with MARPOL and AMSA Marine Orders.	8.1
Vessels will use MGO or MDO grade fuel during the survey, which will have low sulphur content.	Yes	Vessels will use low sulphur Marine Gas Oil (MGO) or Marine Diesel Oil (MDO) during the survey. The current requirement of MARPOL Annex VI is that sulphur content of fuel oil is to not exceed 3.5% by mass (m/m). From 1 January 2020, the new limit for sulphur in fuel oil used on-board vessels will be 0.50% m/m. It is a legislative requirement for vessels to comply with MARPOL and AMSA Marine Orders.	8.2
Good Industry Practice			
Vessel engines maintained according to manufacturer's specification.	Yes	Vessel engines will be maintained to manufacturer's specification and in accordance with MARPOL 73/78 Annex VI to reduce the atmospheric emissions released into the environment. Good industry practice, environmental benefit outweighs additional cost.	3.3
Vessel incinerators maintained according to manufacturer's specification.	Yes	Vessel incinerators will be maintained to manufacturer's specification and in accordance with MARPOL 73/78 Annex VI to reduce the atmospheric emissions released into the environment. Good industry practice, environmental benefit outweighs additional cost.	8.3
Alternatives/Substitutes Considered			
No practical alternative or substitute to the above controls have been identified.	N/A	N/A	N/A
Additional Controls Considered			
Use of renewable fuels to provide vessel power and no incineration of waste offshore.	No	Adopting renewable energy sources would incur considerable cost associated with vessel modifications. Given the low-level of risk identified, this option is not considered commercially viable. Non-fuel powered engines are not considered technically efficient to execute.	N/A
Transferring non-hazardous combustible waste to shore for disposal.	No	If waste were not incinerated offshore, additional cost, safety and environmental implications would be incurred associated with transferring non-hazardous combustible waste to shore for disposal. This would also be unlikely to reduce overall emissions as additional supply vessel visit would be required to collect and transfer the waste to shore, where it would then need to be dealt with.	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No further practicable improvements to the above controls have been identified.	N/A	N/A	N/A
ALARP Statement			
The residual risk associated with atmospheric emissions has been determined to be Low. CGG considers the adopted control measures appropriate to manage the impacts and risks of atmospheric emissions. As the impact/risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

7.8.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for atmospheric emissions, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines:** No species Recovery Plans or Conservation Advice set requirements relating to the management of atmospheric emissions. **Conservation values and objectives of the North-west Marine Parks Management Plan** The Operational Area is not located within any AMPs. The management prescriptions for AMPs does not include information on atmospheric emissions from commercial vessels/operations.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to atmospheric emissions.
Legislation and Other	Legal Requirements	The proposed controls meet or exceed the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and associated AMSA Marine Orders under the *Protection of the Sea (Prevention of Air Pollution) Act 1983* for the management of emissions at sea.
Industry Standards	Industry Standards and Best Practices	No industry standards and best practice have been identified that relate to atmospheric emissions.
Ecological Sustainability Development (ESD)	ESD Application	There is no threat of serious or irreversible environmental damage or significant impact to biological diversity and ecological integrity associated with atmospheric emissions during the Sauropod 3D MSS.
Acceptability Statement		
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential impacts from atmospheric emissions meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, atmospheric emissions are unlikely to result in potential impact greater than localised and short-term local concern to air quality. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 7.8.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.		

7.8.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID
EPO 8	Atmospheric emissions to meet or exceed the requirements of MARPOL Annex VI and AMSA Marine Order 97	PS 8.1 PS 8.2 PS 8.3

Number	Performance Standards	Measurement Criteria
PS 8.1	In accordance with MARPOL 73/78 Annex VI (Prevention of Air Pollution) and Marine Order 97, vessels have a valid IAPP Certificate confirming: • Incinerators certified to meet prescribed emissions standards • Diesel engines 130 kW certified to meet prescribed emission standards.	Records of the pre-survey environmental checklist confirm that a current IAPP certificate is sighted on-board vessels.
PS 8.2	Vessels use MGO or MDO with a low sulphur content of ≤3.5% by mass (m/m). If the survey is completed after 1 January 2020 sulphur content is not to exceed 0.50% m/m.	Records / oil logbook confirm MGO or MDO grade fuel is used, and fuel data sheet confirms sulphur content.
PS (refer to PS 3.3)	Vessel engines are maintained according to manufacturer's specifications.	Records verify that engines and propulsion system maintenance meet this standard.
PS 8.3	Incinerators are certified and maintained according to manufacturer's specifications.	Records confirm that the incinerator's MARPOL 73/78 certification is current and sighted, and maintained as per maintenance records.

8 Environmental Risk Assessment – Unplanned Events

This section presents the evaluation of environmental impacts and risks completed for unplanned events associated with the Sauropod 3D MSS using the methodology described in Section 6, as required by OPGGS (E) Regulations 21(5) and 21(6).

A summary of the residual rankings for all impacts and risks identified and assessed in this section are summarised in Table 8-1.

Table 8-1 – Environmental Impact and Risk Ranking Summary

Impact/Risk	EP Section No.	Residual Risk		
		Consequence	Likelihood	Risk Ranking
Hydrocarbon Spill – Vessel Collision	8.2	Moderate (2)	Rare (A)	Low
Hydrocarbon Spill – Bunkering	8.3	Negligible (0)	Rare (A)	Low
Chemical Spill – Single Point Failure	8.4	Negligible (0)	Rare (A)	Low
Physical Presence: Entanglement / Collision with Marine Fauna	8.5	Major (4)	Rare (A)	Medium
Physical Presence: Loss of Equipment	8.6	Minor (1)	Rare (A)	Low
Discharge: Loss of Hazardous or Non-Hazardous Solid Waste	8.7	Minor (1)	Rare (A)	Low
Introduction of Invasive Marine Species: Ballast Water and Biofouling	8.8	Moderate (2)	Rare (A)	Low

8.1 Hydrocarbon and Chemical Spills

8.1.1 Hydrocarbon and Chemical Properties

The following types of hydrocarbons and chemicals are likely to be present on the seismic vessel and support vessels in varying quantities during the survey:

- Marine diesel (Marine Gas Oil [MGO] or Marine Diesel Oil [MDO]) used to fuel the vessels
- Hydraulic fluids such as engine and synthetic oils required for equipment and engine use
- Chemicals for cleaning and maintenance purposes.

8.1.2 Credible Spill Scenarios

Credible hydrocarbon and chemical spill scenarios were identified during the environmental risk assessment undertaken for this EP, taking into account:

- Survey activities
- Known volumes of hydrocarbons and chemicals stored on the vessels, as well as material transfer rates and reaction times for spill detection and mitigation
- Design features inherent to the vessel and storage areas (e.g. bunds)
- Proximity to sensitive receptors and features of conservation significance.

The resulting credible spill scenarios selected for assessment are summarised in Table 8-2.

Table 8-2 – Credible Hydrocarbon and Chemical Spill Scenarios

Scenario	Spilt material and volume	Description
Vessel fuel tank rupture	257 m^3 of marine diesel	A collision between the survey vessel, support vessel or a third-party vessel has the potential to result in the breach of the hull and subsequent rupture of a fuel tank. A major spill to sea as a result of vessel collision/grounding is only likely to occur under exceptional circumstances where these conditions resulted in significant damage to one or more of the fuel tanks in the hull of the vessel. These may include: • Navigational error • Vessel loss of power • Floundering due to weather. If a collision/grounding involving the seismic vessel occurred, the worst-case credible scenario would be the loss of the largest single fuel tank volume (consistent with AMSA (2013) guidelines), which is 257 m^3 of marine diesel. 3D Oil conducted hydrocarbon spill modelling for the largest fuel tank size in their planned vessel type (of 280 m^3). This scenario (results in Appendix G) is used for the basis of this risk assessment as it is larger than that of the proposed vessel (of 257 m^3) and therefore is considered to be a conservative assessment.
Vessel refuelling failure	1.2 m^3 to 25 m^3 of marine diesel	Vessel refuelling failure may result in the release of marine diesel to the marine environment. Through the use of dry-break couplings (which provide an automatic mechanism to seal off both the hose and the fixed pipe end when the hose is disconnected), the maximum credible spill volume from a refuelling failure is considered to be the maximum typical volume of a transfer hose (1.2 m^3). In the event dry break couplings fail, guidelines indicate the maximum credible spill volume from a refuelling incident with continuous supervision is equivalent to the volume of marine diesel transferred within a 15-minute period (AMSA 2013a), which represent the estimated time required to shut down refuelling operations following discovery of a spill. Based on a transfer volume of 100 m^3/hr, this may result in a spill volume of 25 m^3.
Single point failure (overboard)	1 m^3 of hydraulic fluids or chemicals	A single point failure may occur as a result of mechanical/ structural failure, human error or poor housekeeping. Should a spill occur on deck, controls such as equipment bunds, scupper plugs and on-board clean up should prevent the spilt material reaching the marine environment. However, in the event these controls fail, or are not implemented, spill volumes released to the environment are likely to be less than 1 m^3 based on the inventory typically used on deck.

Table 8-2.

Table 8-2 provides a representative range of spill sizes and locations. Other scenarios were either deemed non-credible, or else the risk of environmental impacts associated with spill scenarios involving fewer sensitive locations, shorter durations or smaller spill volumes was already captured through the assessment of the selected scenarios for consideration in this EP.

To understand the fate and trajectory of a potential spill, hydrocarbon spill modelling was undertaken on the identified worst-case credible scenario. Given the volumes involved, impacts and risks associated with a single point failure or a vessel refuelling spill would be expected to be considerably less than those described for a vessel collision scenario.

8.1.3 Spill Modelling Methodology

3D Oil commissioned RPS to undertake quantitative hydrocarbon spill modelling for the Sauropod 3D MSS, using a three-dimensional hydrocarbon spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program) (RPS 2019). SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface

releases (Spaulding *et al.* 1994; French *et al.* 1999; French-McCay 2003; French-McCay 2004; French-McCay *et al.* 2004; Spaulding *et al.* 2015).

The SIMAP model calculates two components: (i) the transport, spreading, entrainment, evaporation and decay of surface oil slicks and, (ii) the entrained and dissolved hydrocarbons released from the slicks into the water column. Input specifications for oil types include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges.

The SIMAP trajectory model separately calculates the movement of the material that: (i) is on the water surface (as surface slicks), (ii) in the water column (as either entrained whole oil droplets or dissolved hydrocarbons), (iii) has stranded on shorelines, or (iv) that has precipitated out of the water column onto the seabed. The model calculates the transport of surface slicks from the combined forces exerted by surface currents and wind acting on the oil. Transport of entrained oil (oil that is below the water surface) is calculated using the currents only.

SIMAP's stochastic model was used to quantify the probability of exposure to the sea surface and in-water and probability of shoreline contact from the hypothetical spill scenario.

Each simulation was configured with the same spill information (i.e. spill volume, duration and oil type) except for the start time and date. This approach ensures that the predicted transport and weathering of an oil slick is subject to a wide range of possible current and wind conditions.

During each spill trajectory, the model records the grid cells exposed to hydrocarbons, as well as the time elapsed. Once all the spill trajectories have been run, the model then combines the results from the individual simulations to determine the following:

- Maximum exposure (or load) observed on the sea surface
- Probability of contact to any shorelines
- Probability of contact to individual sections of shorelines
- Maximum volume of oil that may contact shorelines from a single simulation
- Maximum load that an individual shoreline may experience
- Maximum exposure from entrained hydrocarbons observed in the water column
- Maximum exposure from dissolved aromatic hydrocarbons observed in the water column.

The stochastic model output does not represent the extent of any one spill trajectory (which would be significantly smaller) but rather provides a summary of all trajectories run for the scenario.

Inputs for the modelling are summarised in Table 8-3.

Table 8-3 – Spill Modelling Inputs

Parameters	Modelling Inputs
Spill release locations	One – northern boundary of Operational Area
Spill volume	280 m^3
Hydrocarbon type	MDO
Release type	Surface
Spill duration	Six hours
Simulation duration	30 days
No. of simulations	One hundred randomly selected trajectories modelled per season (three) using a range of wind and current conditions. Three hundred simulations in total
Modelled seasons	Summer (December to February) Transitional (March, October and November) Winter (April to September)

8.1.3.1 Release Location Selection

The release location selected for the spill modelling is the closest point on the northern boundary of the Operational Area to the Argo-Rowley Terrace Marine Park, the Rowley Shoals Marine Park (State waters) and the Mermaid Reef Marine Park, which represent the nearest sensitive environmental receptors. The specific location is detailed in Table 8-4.

Table 8-4 – Location of the modelled spill Release Site

Latitude	Longitude	Water Depth (m)
-17°56”17.0’	119°30”14.8’	160

8.1.3.2 Seasonality

To ensure that modelling results are representative of the range of metocean conditions experienced during the survey period, random conditions were selected to represent different wind and current conditions. A total of 100 spill trajectories per season were modelled, resulting in a total of possible 300 spill trajectories.

8.1.3.3 Hydrocarbon Exposure Thresholds

Based on the modelling outcomes, nearby sensitive locations may be contacted by hydrocarbons either at the surface or in the water column. In order to determine the ecological effects of a spill, different thresholds were considered for the risk assessment as follows:

- Surface hydrocarbon thresholds, to assess physical effects on sensitive receptors offshore
- Shoreline accumulation thresholds, to assess physical effects on sensitive receptors onshore
- Water column exposure thresholds, to assess toxicity effects to sensitive receptors offshore from entrained and dissolved aromatic hydrocarbons.

The hydrocarbon exposure thresholds are summarised in Table 8-5, with further detail provided below. These thresholds are consistent with, and in some cases more conservative than, the exposure thresholds for floating, shoreline, dissolved and entrained hydrocarbons recommended by NOPSEMA in the Bulletin #1 “Oil spill modelling” April 2019.

Table 8-5 – Hydrocarbon Exposure Thresholds

Exposure Type	Hydrocarbon Concentration	Potential Level of Exposure
Surface Exposure (g/m^2)	1	Low
	10	Moderate
	25	High
Shoreline Contact (g/m^2)	10	Low
	100	Moderate
	1,000	High
Dissolved Hydrocarbon Concentration (ppb)[#]	6	Low
	50	Moderate
	400	High
Entrained Concentration (ppb)[#]	10	Low
	100	Moderate
	1,000	High

[#]These threshold values refer to a) instantaneous concentrations (i.e. exposure over a one-hour period) and b) time-averaged exposure over a 48-hour window. Both exposure durations are considered in the presentation of results below.

8.1.3.4 Hydrocarbon Characteristics

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point (-14 °C). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation. Approximately, 5% (by mass) of the oil is categorised

as a group II oil (light-persistent) based on categorisation and classification derived from AMSA (2015) guidelines. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

Table 8-6 details the physical properties of MDO, while Table 8-7 presents the boiling point ranges of the MDO used in the modelling study.

Table 8-6 – Physical Properties of MDO

Characteristic	Value
Density (kg/m^3)	829.1
API	37.6
Dynamic viscosity (cP)	4
Pour point (°C)	-14
Wax content (%)	1
Hydrocarbon property category	Group II
Hydrocarbon property classification	Light - Persistent

Table 8-7 – Boiling Point Ranges of MDO

Characteristic	Not Persistent			Persistent
	Volatile	Semi-volatile	Low volatility	Residual
Boiling point (°C)	180	180-265	265-380	380
Percent	6.0	34.6	54.4	5.0

Figure 8-1 shows weathering graphs for a 280 m^3 release of MDO over six hours (tracked for 30 days) during three static wind conditions. The prevailing weather conditions will influence the weathering and fate of the MDO. Under lower wind-speeds (five knots), the MDO will remain on the surface longer, spread quicker, and in turn increase the evaporative process. Conversely, sustained stronger winds (15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate.

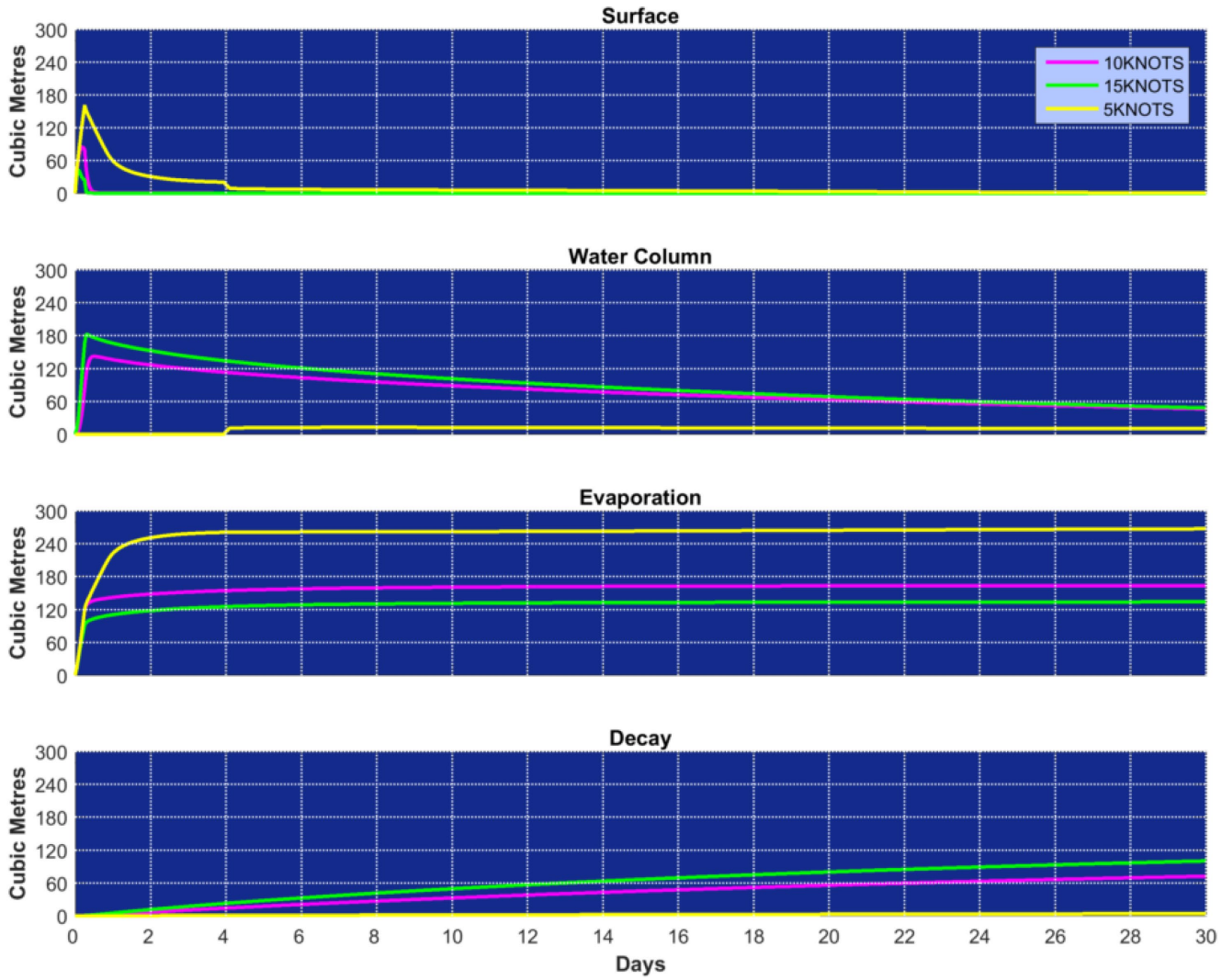


Figure 8-1 – Weathering of MDO under Three Static Wind Conditions (5, 10 and 15 Knots). The Results are Based on a 280 m^3 Surface Release of MDO Over Six Hours, Tracked for 30 Days

8.2 Hydrocarbon Spill – Vessel Collision

8.2.1 Details of Impacts and Risks

8.2.1.1 Source of Impact/Risk

Accidental hydrocarbon release to the marine environment due to a vessel collision, with the potential hazards of temporary and localised reduction in water quality and temporary toxicity effects to marine biota.

A seismic survey vessel can have a fuel capacity in excess of 1,000 m^3 that is distributed through multiple isolated tanks typically located mid-ship, and typically ranging in capacity from 22–280 m^3. There will be two support vessels utilised throughout the Sauropod 3D MSS. The marine diesel storage capacity of a support vessel can also be in the order of 1,000 m^3 in total, which is distributed through multiple isolated tanks typically located mid-ship and ranging in capacity from 22–105 m^3.

If a vessel collision occurred, the worst-case credible scenario would be the loss of the largest single fuel tank volume (consistent with AMSA (2013) guidelines), which is 257 m^3 of marine diesel. This is less than the modelled scenario of 280 in^3 therefore this scenario is considered to be conservative.

8.2.1.2 Receptors

- Marine fauna (cetaceans, marine reptiles, seabirds, fishes/elasmobranchs, planktonic communities).
- Water quality.
- Marine protected areas.
- Commercial fisheries.
- Cultural features and heritage values.

8.2.2 Impact/Risk Evaluation

8.2.2.1 Spill Modelling Results

8.2.2.1.1 Surface Hydrocarbons

Modelling indicated that, in the event of a 280 m^3 spill of MDO, sea surface hydrocarbons at low (1 g/m^2), moderate (10 g/m^2) and high (25 g/m^2) exposure levels may occur up to a maximum of approximately 66 km, 14 km and 7 km from the spill release locations, respectively (Table 8-8 and Figure 8-2). This result does not indicate a continuous slick, but that patches of the surface slick may exceed thresholds out to these distances from the spill release location. The evaporative nature of MDO and environmental conditions in the area result in short-lived surface hydrocarbon exposures, with surface exposures reduced to less than 10 g/m^2 after approximately 24–48 hours (RPS 2019). Generally, sea surface hydrocarbon volumes were negligible after approximately 10-15 days and did not persist beyond 17 days.

The area of potential instantaneous exposure to surface hydrocarbons for the low, moderate and high thresholds during the transitional season is presented in Figure 8-2. It is important to note that the area presented is based on 300 hypothetical spill trajectories and does not represent the predicted outcome of a single spill event. This area falls within the predicted annualised EMBA for entrained hydrocarbons, and hence no separate EMBA for surface hydrocarbons has been defined.

No sensitive receptors were predicted to be exposed to surface oil at the moderate and high thresholds. The Argo-Rowley Terrace Marine Park is the only sensitive receptor showing potential exposure to surface oil at the low threshold, with a low likelihood of 1–2% (during the summer and winter seasons only) (Table 8-8).

Table 8-8 – Summary of Spill Modelling Results for Surface Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations

Season	Distance and direction	Areas of potential sea surface exposure		
		1 g/m^2	10 g/m^2	25 g/m^2
Summer	Maximum distance from release site (km)	31	11	4
	Direction	N	SSE	NW
	Probability of oil exposure to Argo-Rowley Terrace Marine Park (%)	2	-	-
	Minimum time before oil exposure to Argo-Rowley Terrace AMP (hrs)	1	-	-
Transitional	Maximum distance from release site (km)	66	14	7
	Direction	WSW	SSE	SE
	Probability of oil exposure to Argo-Rowley Terrace AMP (%)	-	-	-
	Minimum time before oil exposure to Argo-Rowley Terrace AMP (hrs)	-	-	-
Winter	Maximum distance from release site (km)	31	12	6
	Direction	NNE	WNW	NW
	Probability of oil exposure to Argo-Rowley Terrace AMP (%)	1	-	-
	Minimum time before oil exposure to Argo-Rowley Terrace AMP (hrs)	1	-	-

A dash indicates that the threshold was not reached. The results were calculated from 300 possible spill trajectories and do not represent a single spill event.

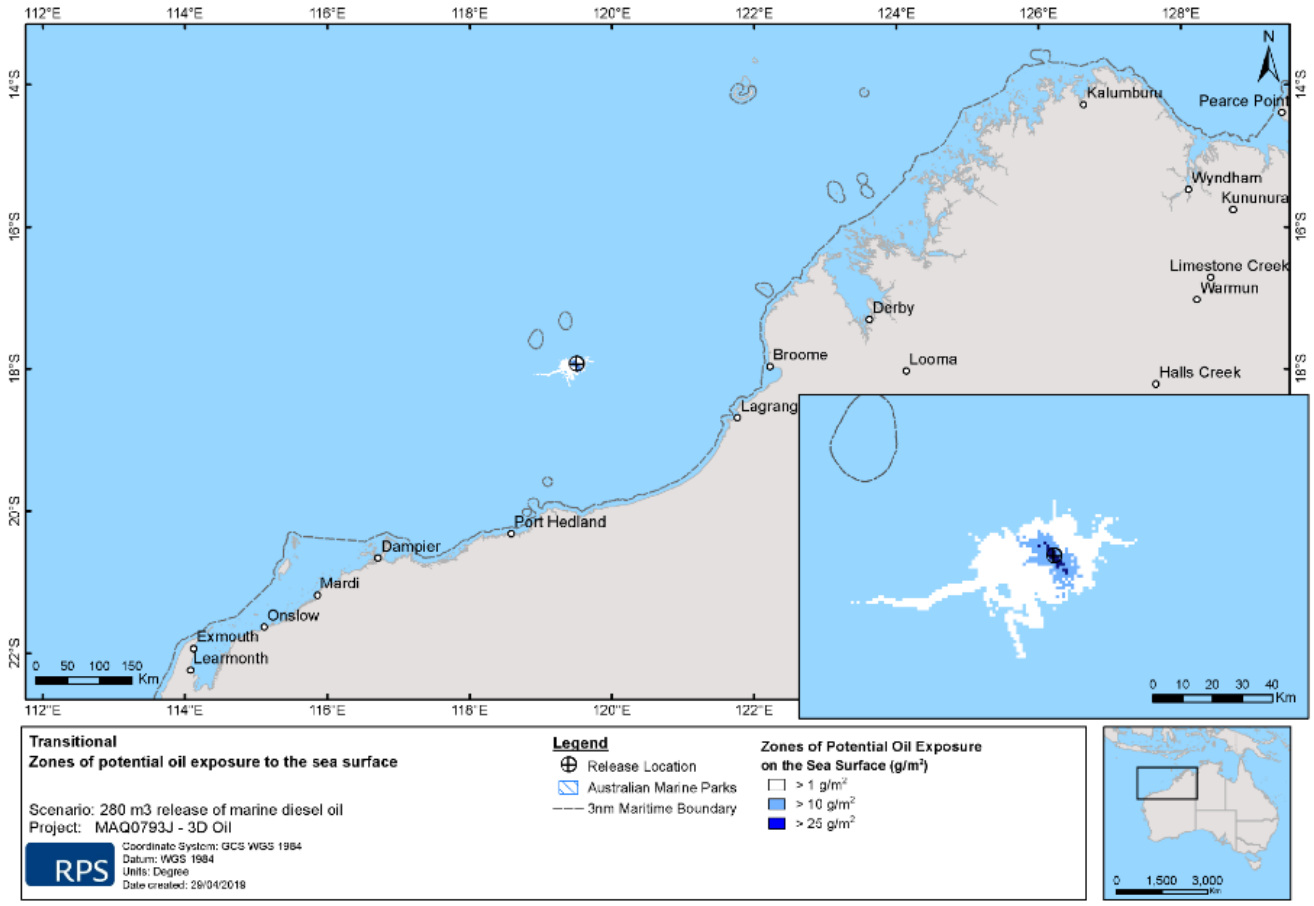


Figure 8-2 – Zones of Potential Oil Exposure on the Sea Surface, In the Event of a 280 m^3 MDO Spill Within the Operational Area During the Transitional Season

8.2.2.1.2 Shoreline Accumulation

No shoreline contact above the exposure thresholds was predicted by the modelling at any location. It is acknowledged that modelling was only conducted at a single location along the northern boundary of the Operational Area. Given the extent of the predicted EMBA (refer Figure 4-1) no shoreline contact at any mainland location is predicted to occur for a 280 m^3 marine diesel spill anywhere within the Operational Area, including at the southeast corner, which is closest to the coast.

8.2.2.1.3 Entrained Hydrocarbons

Modelling of entrained hydrocarbons considered exposure to receptors at 0–10 m water depth at or above the exposure thresholds discussed in Section 8.1.3.3. The maximum entrained hydrocarbon exposure was considered against the thresholds for both instantaneous exposure concentrations and time-averaged exposure concentrations over a 48-hour period.

The maximum time-averaged exposure to entrained hydrocarbons over 48 hours ranged from 402 ppb to 499 ppb for the transitional and summer seasons respectively. The maximum instantaneous exposure to entrained hydrocarbons ranged from 3,251 ppb to 6,287 ppb for the winter and summer seasons respectively (Table 8-9).

The zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO is presented in Figure 8.3 for the summer season. The predicted annualised (i.e. all seasons) EMBA for entrained hydrocarbons above the moderate threshold (100 ppb), based on instantaneous exposures, is presented in Figure 8-4. It is important to note that the area presented is based on 300 hypothetical spill trajectories (100 per season) and does not represent the predicted outcome of a single spill event. The EMBA for the north-west corner of the Operational Area was also extrapolated to the three other corners to encompass all environmental values and sensitivities that could potentially be affected in the event of a spill (Figure 8-4).

No sensitive receptors were predicted to be impacted by entrained hydrocarbons above the high threshold (1,000 ppb). Sensitive receptors potentially impacted above the low and moderate thresholds (10 ppb and 100 ppb respectively) are summarised in Table 8-9.

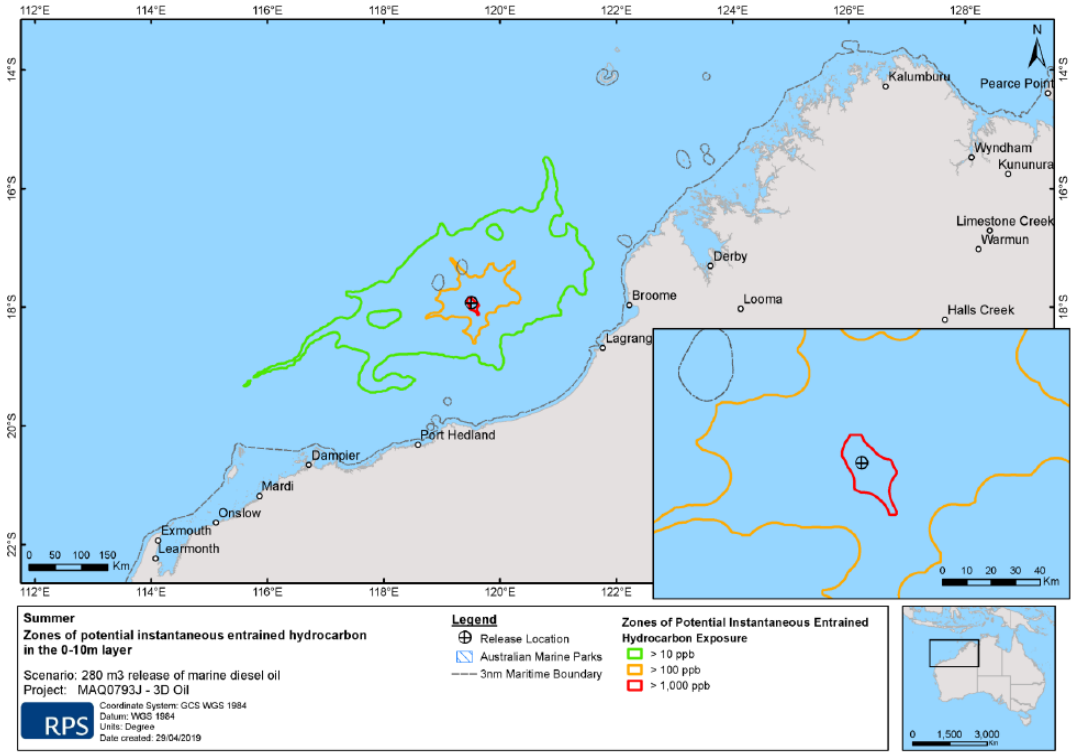


Figure 8-3 – Zones of Potential Instantaneous Entrained Oil Exposure at 1-10 m Below the Sea Surface, in the Event of a 280 m^3 MDO Spill Within the Operational Area During the Summer Season

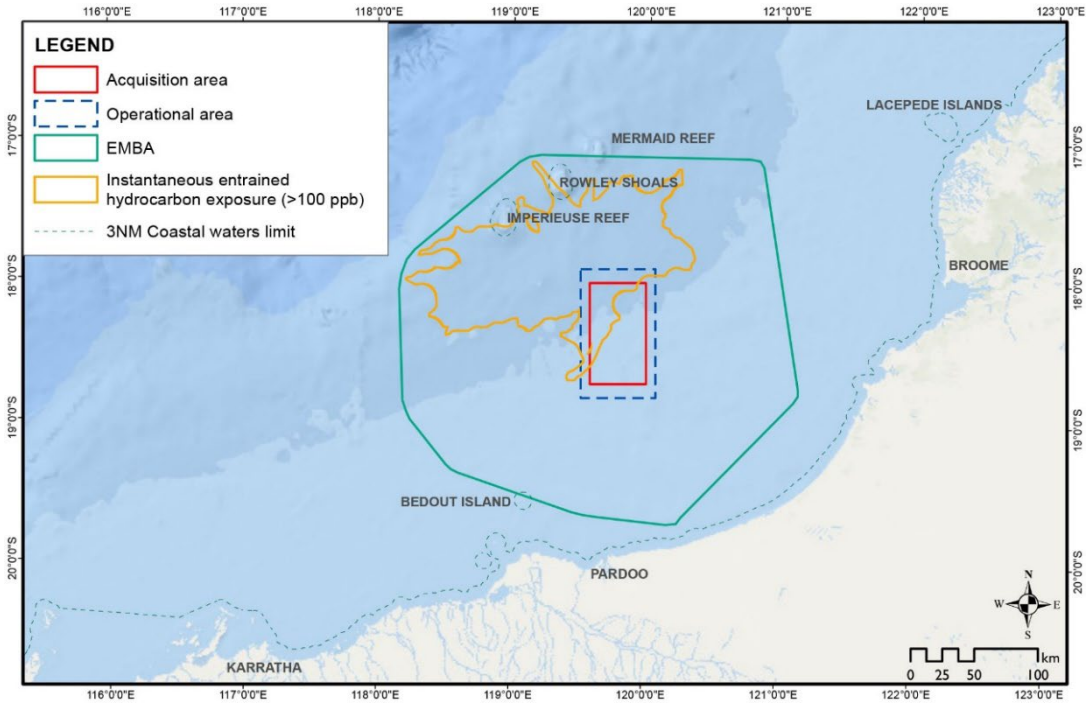


Figure 8-4 – Predicted Annualised EMBA for Entrained Hydrocarbons Above 100 ppb Resulting from a 280 m^3 MDO Spill Within the Operational Area

Table 8-9 – Summary of Spill Modelling Results for Entrained Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations

Season	Receptor	Time-averaged (48-hr) entrained hydrocarbon exposure			Instantaneous entrained hydrocarbon exposure		
		Maximum concentration (ppb)	Probability of exposure (%) at 10 ppb	Probability of exposure (%) at 100 ppb	Maximum concentration (ppb)	Probability of exposure (%) at 10 ppb	Probability of exposure (%) at 100 ppb
Summer	Argo-Rowley Terrace AMP	114	11	2	607	23	8
	Mermaid Reef AMP	21	2	-	66	3	-
	Rowley Shoals MP	49	5	-	185	8	2
	Imperieuse Reef	33	4	-	59	7	-
	Clerke Reef	40	2	-	158	7	1
	Mermaid Reef	20	1	-	55	2	-
	Mermaid Reef KEF	49	5	-	213	12	2
	North West Shelf IMCRA	402	66	14	6,287	89	74
Transitional	Argo-Rowley Terrace AMP	89	14	-	401	21	6
	Mermaid Reef AMP	26	5	-	76	10	-
	Rowley Shoals MP	30	7	-	94	14	-
	Imperieuse Reef	26	3	-	89	8	-
	Clerke Reef	26	6	-	84	14	-
	Mermaid Reef	8	-	-	28	3	-
	Mermaid Reef KEF	73	9	-	177	16	2
	North West Shelf IMCRA	499	49	16	3,251	79	54
Winter	Argo-Rowley Terrace AMP	95	13	-	338	17	6
	Mermaid Reef AMP	18	1	-	100	6	1
	Rowley Shoals MP	57	8	-	207	17	2
	Imperieuse Reef	42	4	-	105	11	1
	Clerke Reef	7	-	-	27	2	-
	Mermaid Reef	8	-	-	57	3	-
	Mermaid Reef KEF	57	13	-	261	18	6
	North West Shelf IMCRA	398	64	21	4,355	84	70

A dash indicates that the threshold was not reached. The results were calculated from 300 spill trajectories and do not represent a single spill event.

8.2.2.1.4 Dissolved Hydrocarbons

Modelling of dissolved hydrocarbons considered exposure to receptors at 0–10 m water depth at or above the exposure thresholds discussed in Section 8.1.3.3. The maximum dissolved hydrocarbon exposure was considered against the thresholds for both instantaneous exposure concentrations and time-averaged exposure concentrations over a 48-hour period.

The maximum time-averaged exposure to dissolved hydrocarbons over 48 hours remained below the low threshold value of 6 ppb for all modelled seasons. The maximum instantaneous exposure to dissolved hydrocarbons ranged from 6 ppb to 73 ppb for the transitional and summer seasons respectively (Table 8-10).

The area of potential instantaneous exposure to dissolved hydrocarbons for the low and moderate thresholds during the winter season is presented in Figure 8.5 (the high threshold was not exceeded). It is important to note that the area presented is based on 100 hypothetical spill trajectories and does not represent the predicted outcome of a single spill event. This area falls within the predicted annualised EMBA for entrained hydrocarbons (Figure 8-4), and hence no separate EMBA for dissolved hydrocarbons has been defined.

No sensitive receptors were predicted to be exposed above the low threshold of 6 ppb to dissolved hydrocarbons over a time-averaged period of 48 hours (Table 8-10).

No sensitive receptors were predicted to be exposed instantaneously to dissolved hydrocarbons at the moderate threshold (50 ppb). The Argo-Rowley Terrace Marine Park, Rowley Shoals Marine Park, Mermaid Reef Marine Park and Commonwealth waters KEF showed potential instantaneous exposure to dissolved hydrocarbons at or above the low threshold (6 ppb), with a low likelihood of 1–2% (during the summer and winter seasons only, refer to Table 8-10).

Table 8-10 – Summary of Spill Modelling Results for Dissolved Hydrocarbons, Including Sensitive Receptors with Predicted Exposure Above Threshold Concentrations

Season	Receptor	Time-averaged (48-hr) dissolved hydrocarbon exposure		Instantaneous dissolved hydrocarbon exposure	
		Maximum concentration (ppb)	Probability of exposure (%) at 6 ppb	Maximum concentration (ppb)	Probability of exposure (%) at 6 ppb
Summer	Argo-Rowley Terrace AMP	1	-	8	1
	North West Shelf	4	-	73	21
Transitional	Argo-Rowley Terrace AMP	<1			-
	North West Shelf	3	-	37	16
Winter	Argo-Rowley Terrace AMP	1	-	19	2
	Rowley Shoals	<1	-	13	1
	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF	<1	-	14	1
	North West Shelf IMCRA	4	-	48	36

The results were calculated from 300 spill trajectories and do not represent a single spill event.

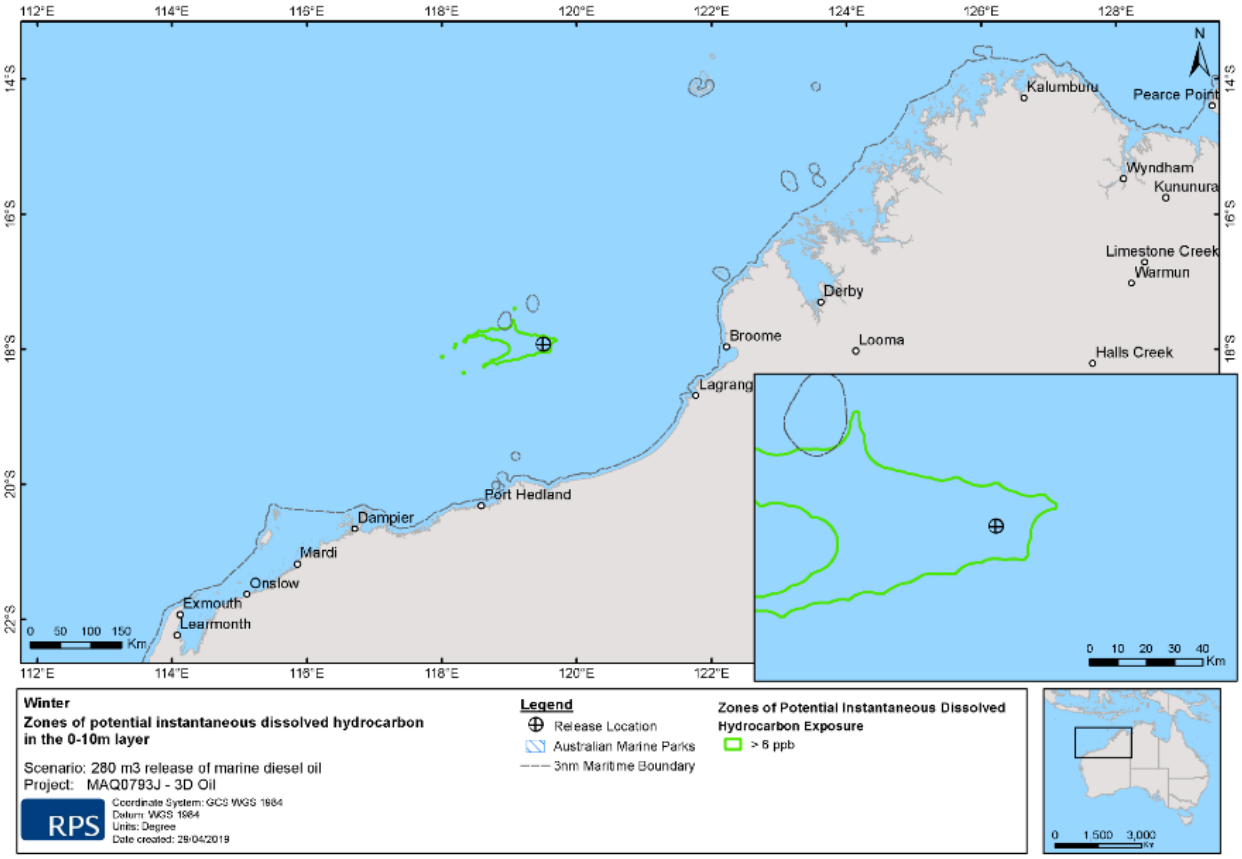


Figure 8-5 – Zones of Potential Instantaneous Dissolved Hydrocarbon Exposure at 0– 10 M Below the Sea Surface in the Event of a 280 m^3 Within the Operational Area During Winter

8.2.2.1.5 Summary of Modelling Results

- No shoreline contact above the low (1 g/m^2) surface oil threshold was predicted for the modelled scenario, for any season.
- Modelling results demonstrated that surface oil at low (1 g/m^2), moderate (10 g/m^2) and high (25 g/m^2) exposure levels could potentially travel greater distances during the transitional period, compared to the summer and winter periods. The maximum distance travelled by surface oil during the transitional season for the low, moderate and high threshold was 66 km, 14 km and 7 km, respectively.
- The modelling results demonstrated a low probability (1–2%) of surface oil exposure at the low threshold to the Argo-Rowley Terrace Marine Park and zero probability of surface oil exposure (at any threshold) to the Rowley Shoal Marine Park and the Mermaid Reef Marine Park.
- The maximum time-averaged exposure to entrained hydrocarbons ranged from 4 ppb to 499 ppb for the transitional and winter seasons respectively. The maximum instantaneous exposure to entrained hydrocarbons ranged from 3,251 ppb to 6,287 ppb for the transitional and summer seasons respectively.
- The maximum time-averaged exposure to dissolved hydrocarbon at the depths of 0-10 m remained less than 1 ppb for the winter and transitional seasons while reaching 4 ppb for the summer and winter seasons for various receptors. The maximum instantaneous exposure to dissolved hydrocarbons ranged from 6 ppb to 73 ppb for the transitional and summer seasons, respectively.
- There were no zones of potential time-averaged exposure to dissolved hydrocarbons above the low exposure threshold (6 ppb).

8.2.2.2 Potential Impacts to Environmental Values

8.2.2.2.1 Planktonic Communities

Planktonic communities within the entrained hydrocarbons EMBA for a 280 m^3 marine diesel spill within the Operational Area will include zooplankton, fish eggs and larvae, and potentially coral spawn and larvae. Spatially, the EMBA has the potential to overlap with spawning aggregations of some fishes. Given the year-round spawning of some species, the Sauropod 3D MSS has the potential to overlap spawning periods for some fish species.

The entrained hydrocarbons EMBA for all seasons partially overlaps Imperieuse and Clerke reefs, and the proposed acquisition period for the survey (January to May) means that the activity could potentially overlap the main spawning episode for corals in the region (March–April). The reproductive cycles of the broadcast spawning species at the Rowley Shoals have been described, with mass spawning occurring biannually in spring (October) and autumn (March) (Gilmour *et al.* 2016). The entrained hydrocarbons EMBA for the transitional period (which includes March) does not overlap either Imperieuse or Clerke reefs.

There is potential for localised mortality of plankton due to reduced water quality and toxicity from entrained hydrocarbons. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.

In the unlikely event of a spill occurring, fish and coral eggs and larvae may be impacted by hydrocarbons entrained in the water column. However, following release, the marine diesel will rapidly evaporate and disperse in the offshore environment, reducing the concentration and toxicity of the spill. Given duration of fish spawning periods, lack of suitable habitat for fish spawning aggregating near the surface, combined with the quick evaporation and dispersion of marine diesel, impacts to fish eggs and larvae are not expected to be significant.

Any planktonic communities impacted by entrained hydrocarbons are expected to recover quickly (weeks/months) due to fast population turnover (ITOPF 2011), and high rates of natural mortality. Given the relatively small EMBA and the fast population turnover of open water planktonic populations, it is considered that any potential impacts will be low and temporary.

8.2.2.2.2 Water Quality

It is likely water quality will be reduced within a localised area around the marine diesel spill, with contamination levels above background levels and/or national/international water quality standards. However, such impacts to water quality would be temporary and highly localised spatially due to the relatively small EMBA and the rapid dispersion of marine diesel. The potential impact is therefore considered low.

8.2.2.2.3 Protected Species

As identified in Section 4.3.5, a range of protected species may be encountered within and adjacent to the Operational Area and therefore could be impacted by a marine diesel spill.

8.2.2.2.4 Cetaceans

No critical habitats or aggregation areas (feeding, breeding, resting) for cetaceans have been identified within the EMBA for a 280 m^3 diesel spill within the Operational Area and it is therefore considered that any cetacean species that are present will be in low numbers and transient, as they traverse the area. The Humpback whale migration BIA is located approximately 15 km south of the Operational Area. The breeding, nursing and calving BIA for Humpback whales along the Kimberley coastline is located 255 km east of the Operational Area.

The entrained hydrocarbons EMBA partially overlaps the Humpback whale migration BIA (refer Figure 4.10). However, the proposed timing for acquisition of the Sauropod 3D MSS (January to May) means that there will be no overlap with either the northbound or southbound migration of Humpback whales through the region (June to October). The Pygmy Blue Whale migration BIA passes along the shelf edge at depths between 500 m and 1,000 m. The migration BIA is located approximately 72 km from the Operational Area. The entrained hydrocarbons EMBA partially overlaps the Pygmy whale migration BIA (refer Figure 4.10). Hence, there is a low probability of isolated individuals transiting through the entrained hydrocarbons EMBA during the beginning of their northbound migration (April to July). The proposed acquisition period avoids the southbound migration of Pygmy Blue Whales in the region (September to November).

As summarised in Table 4-6, there is the possibility that a number of other cetacean species may be present in the Operational Area and surrounding waters during acquisition of the survey (e.g. Bryde's, Fin, Sei, Killer and Sperm whales,

Spotted bottlenose dolphin). The presence of these cetacean species within the Operational Area during acquisition of the survey is likely to be limited to occasional transits of isolated individuals or small pods.

Marine mammals are highly mobile, and a number of field and experimental observations indicate whales and dolphins may be able to detect and avoid surface slicks. However, instances have been observed where animals have swum directly into oiled areas without seeming to detect the slicks or because the slicks could not be avoided. Cetaceans may exhibit avoidance behaviour and move away from the spill-affected area.

Marine mammals that have direct physical contact with surface slicks and entrained hydrocarbons may suffer surface fouling or ingestion of hydrocarbons and inhalation of toxic vapours. This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts and organs, impairment of the immune system or neurological damage (Etkins 1997; IPIECA 1995). For example, fouling of baleen whales (e.g. Humpback and Pygmy Blue Whales) may disrupt feeding by decreasing the ability to intake prey. If prey (fish and plankton) is also contaminated, this can result in the absorption of toxic components of the hydrocarbons (polycyclic aromatic hydrocarbons - PAHs). Toothed whales (including dolphins) are ‘gulp-feeders’ targeting specific prey at depth in the water column away from any potential surface slick and are likely to be less susceptible to the ingestion of hydrocarbons. Furthermore, given cetaceans are smooth skinned and hydrocarbons would not tend to adhere to body surfaces, the likely biological consequences of physical contact with surface hydrocarbons are likely to be in the form of irritation and sub-lethal stress.

In the unlikely event of a hydrocarbon release, it is considered that contact will be low and temporary in nature due to the relatively small EMBA, the rapid dispersion of marine diesel, and the fact that only isolated individuals transiting the area could come into contact with surface slicks.

8.2.2.2.5 Fishes, Sharks and Rays

Hydrocarbon droplets can physically affect fishes and elasmobranchs (sharks and rays) exposed for an extended duration (weeks to months). Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food leading to reduced growth.

Near the sea surface, fishes are able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from surface spills (Kennish 1997; Scholz *et al.*1992). Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills. In offshore waters near to the release point, pelagic fish are potentially at risk of exposure to the more toxic aromatic components of marine diesel. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods of time. The more toxic components would also rapidly evaporate, and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact.

Whale sharks located in open offshore waters are most likely transiting the region. The Operational Area overlaps the whale shark foraging BIA that extends north from North West Cape across the North West Shelf (Figure 4-12); however the survey does not overlap with the foraging season which occurs from August - November for the region (see Table 4-7 for details on seasonality). If individuals are present in the Operational Area, their abundance is not expected to be high. The zone of surface hydrocarbons (all thresholds) and the entrained hydrocarbon EMBA overlap the whale shark foraging BIA (Figure 4-12).

Hydrocarbon contact may affect whale sharks through direct physical coating (surface slicks) and ingestion (surface slicks and entrained/dissolved hydrocarbons), particularly if feeding. Whale sharks are vulnerable to surface, entrained and dissolved aromatic hydrocarbon spill impacts, as they filter large amounts of water over their gills, catching planktonic and nektonic organisms (Jarman and Wilson 2004). Whale sharks at Ningaloo Reef have been observed using two different feeding strategies, including passive subsurface ram-feeding and active surface feeding (Taylor 2007). Passive feeding consists of swimming slowly at the surface with the mouth wide open. During active feeding sharks swim high in the water with the upper part of the body above the surface with the mouth partially open (Taylor 2007). These feeding methods would result in the potential for individuals that are present in worse affected spill areas to ingest potentially toxic amounts of surface, entrained or dissolved aromatic hydrocarbons. Large amounts of ingested hydrocarbons may affect their endocrine and immune system in the longer term. The presence of hydrocarbons may cause displacement of whale sharks from the area where they normally feed and rest, and potentially disrupt migration and aggregations to these areas in subsequent seasons. Whale sharks may also be affected indirectly by surface, entrained or dissolved aromatic hydrocarbons through the contamination of their prey. The contamination of their food supply and the subsequent ingestion of prey by whale sharks may also result in long-term impacts as a result of bioaccumulation.

The offshore waters of the Operational Area are unlikely to represent important or significant foraging habitat for whale sharks, and it is most likely that their presence will be limited to isolated individuals transiting the Operational Area and surrounding waters. Individuals that have direct contact with hydrocarbons within the spill affected area may be impacted, but the consequences to migratory whale shark populations will be minor.

Fish populations in the open water, offshore environment of the Operational Area are highly mobile and have the ability to move away from a marine diesel spill. The spill affected area will likely be confined to the upper surface layers (0–10 m). It is therefore unlikely that demersal fish populations would be exposed to hydrocarbon contamination. Fish populations are likely to be distributed over a wide geographical area so impacts on populations or species level are considered to be negligible. Combined with these factors and the relatively small EMBA and the rapid dispersion of marine diesel, it is considered that any potential impacts will be negligible.

8.2.2.2.6 Marine Reptiles

At the closest point, the Operational Area is located at least 95 km from the nearest nesting BIA for turtles (flatback turtle nesting BIA adjacent to Eighty Mile Beach), and at least 105 km from the foraging BIA for green, flatback and loggerhead turtles adjacent to the Dampier Peninsula. At the closest point, the Operational Area is located at approximately 60 km from the 'Habitat Critical' for flatback turtles adjacent to Eighty Mile Beach. To the north of the Operational Area, there are no BIAs or 'Habitat Critical' for turtles surrounding the Rowley Shoals.

There is partial overlap between the entrained hydrocarbons EMBA and the flatback turtle 'Habitat Critical' adjacent to Eighty Mile Beach (Figure 4-14). The entrained hydrocarbon EMBA also partially overlaps the flatback turtle internesting buffer BIA adjacent to Eighty Mile Beach (Figure 4-13).

Adult sea turtles exhibit no avoidance behaviour when they encounter hydrocarbon slicks (Odell and MacMurray 1986). Contact with surface slicks, or entrained hydrocarbons, can therefore result in hydrocarbon adherence to body surfaces (Gagnon and Rawson 2010) causing irritation of mucous membranes in the nose, throat and eyes leading to inflammation and infection (NOAA 2010). Oiling can also irritate and injure skin, which is most evident on pliable areas such as the neck and flippers (Lutcavage *et al.* 1995). A stress response associated with this exposure pathway includes an increase in the production of white blood cells, and even a short exposure to hydrocarbons, such as crude oil, may affect the functioning of their salt gland (Lutcavage *et al.* 1995).

Hydrocarbons in surface waters may also impact turtles when they surface to breathe and inhale toxic vapours. Their breathing pattern, involving large 'tidal' volumes and rapid inhalation before diving, results in direct exposure to petroleum vapours which are the most toxic component of the hydrocarbon spill (Milton and Lutz 2002). This can lead to lung damage and congestion, interstitial emphysema, inhalant pneumonia and neurological impairment (Etkins 1997; IPIECA 1995).

Due to the absence of potential nesting habitat (i.e. no emergent islands) and the water depths (95–172 m), the Operational Area is highly unlikely to represent important habitat for marine turtles. The 280 m^3 diesel release scenario indicates a relatively small EMBA and a rapid dispersion and evaporation of marine diesel that will be confined to offshore waters, with no contact between surface, dissolved or entrained hydrocarbons and any turtle nesting beaches in the region.

Impacts to sea snakes from direct contact with surface hydrocarbons are likely to result in similar physical effects to those recorded for marine turtles and may include potential damage to the dermis and irritation to mucous membranes of the eyes, nose and throat (ITOPF 2011). They may also be impacted when they return to the surface to breathe and inhale the toxic vapours associated with the hydrocarbons, resulting in damage to their respiratory system.

In general, sea snakes frequent the waters of the continental shelf area, around offshore islands and potentially submerged shoals (water depths 100 m) and while individuals may be present in the Operational Area, their abundance is not expected to be high, given the deep water and offshore location of the activity. Therefore, a hydrocarbon spill may have a minor disruption to a portion of the population however there is no threat to overall population viability.

8.2.2.2.7 Seabirds

There is overlap between the zone of surface hydrocarbons at low, moderate and high exposure thresholds and the breeding and foraging BIA for the White-tailed tropicbird around the Rowley Shoals. There is no overlap between the zone of surface hydrocarbons (at any threshold) and the breeding BIA for the Lesser frigatebird around Bedout Island.

In the unlikely event of a large diesel spill, there is the potential for seabirds to be exposed to surface, entrained and dissolved hydrocarbons. This could result in lethal or sub-lethal effects. Although breeding oceanic seabird species can travel long distances to forage in offshore waters, most breeding seabirds tend to forage in nearshore waters near their breeding colony, resulting in intensive feeding by higher seabird densities in these areas during the breeding season and making these areas particularly sensitive in the event of a spill. Surface entrained or dissolved hydrocarbons are unlikely to impact nesting or egg-laying individuals in colonies, however, it is possible that breeding individuals could come into contact with surface or entrained hydrocarbons while foraging (dive and skim feeding).

Seabirds are vulnerable to contacting surface slicks during feeding or resting on the sea surface, particularly as they do not generally exhibit avoidance behaviour to floating hydrocarbons. Physical contact of seabirds with surface slicks is by several exposure pathways, primarily, immersion, ingestion and inhalation. Such contact with hydrocarbons may result in plumage fouling and hypothermia (loss of thermoregulation), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia and irritation of eyes, skin, nasal cavities and mouths (AMSA 2012; IPIECA 2004) and result in mortality due to oiling of feathers or the ingestion of hydrocarbons. Longer term exposure effects that may potentially impact seabird populations include a loss of reproductive success (loss of breeding adults) and malformation of eggs or chicks (AMSA 2012).

Therefore, a diesel spill may result in impacts on individuals within the White-tailed tropicbird breeding/foraging BIA and potentially disruption to a significant portion of the habitat, however this is not expected to result in a threat to the overall population viability of seabirds, due to the relatively small EMBA and the rapid dispersion of marine diesel.

8.2.2.2.8 Marine Protected Areas

8.2.2.2.8.1 Argo-Rowley Terrace Marine Park

There is a small overlap between the zone of surface hydrocarbons at the low exposure threshold (1 g/m^2) and the Multiple Use Zone (MUZ) of the Argo-Rowley Terrace Marine Park. Additionally, the entrained hydrocarbons EMBA overlaps the MUZ and the Special Purpose Zone (Trawl) of this AMP (Figure 4.15).

The designated natural values of this AMP include a range of species (including species listed as threatened, migratory, marine or cetacean under the EPBC Act), foraging and breeding BIAs for seabirds and a migratory BIA for the Pygmy Blue Whale. Potential impacts to these values from a 280 m^3 marine diesel spill within the Operational Area are assessed in the subsections above.

Potential impacts to commercial fisheries occurring within the MUZ of this AMP are assessed below.

8.2.2.2.8.2 Mermaid Reef Marine Park

There is no overlap between the zone of surface hydrocarbons at the low exposure threshold (1 g/m^2) and the Mermaid Reef Marine Park. There is a very small overlap between the entrained hydrocarbons EMBA and this AMP (winter season only). Maximum instantaneous entrained hydrocarbon concentrations within the Mermaid Reef Marine Park are predicted to range from 30 ppb (summer) to 100 ppb (winter). The area within the marine park predicted to be exposed to entrained hydrocarbons in the 0–10 m upper layer of the water column is restricted to a small patch approximately 2.5 km east of the reef edge. Hence, no seabed habitats or communities of the submerged reef itself are likely to be exposed to entrained hydrocarbons resulting from a marine diesel release within the Operational Area.

8.2.2.2.8.3 Rowley Shoals Marine Park

There is no overlap between the zone of surface hydrocarbons at the low exposure threshold (1 g/m^2) and the waters or islands within the Rowley Shoals Marine Park (State waters). Hence, there will be no shoreline contact or hydrocarbon accumulation within the marine park. As no surface sheens or slicks are likely to occur within the waters of the Rowley Shoals Marine Park, it is highly unlikely that there will be any impacts to socio-economic values of the marine park (i.e. tourism and recreation activities, including fishing and diving/snorkelling charters).

There is overlap between the entrained hydrocarbons EMBA and the Rowley Shoals Marine Park, including exposure to small areas of both Imperieuse and Clerke reefs. Maximum instantaneous entrained hydrocarbon concentrations at Imperieuse and Clerke reefs are predicted to range from 18 ppb (winter) to 158 ppb (summer). Thus, some benthic habitats and communities in the upper layer of the water column (0–10 m) could be exposed to instantaneous concentrations of entrained hydrocarbons 100 ppb, which could result in some sub-lethal effects (e.g. bioaccumulation of hydrocarbons).

8.2.2.2.9 Commercial Fisheries

A 280 m^3 marine diesel spill in the Operational Area is considered unlikely to cause significant direct impacts on the target species fished by the North West Slope Trawl Fishery (NWSTF), the Pilbara Trawl and Trap fisheries (PTMF, PFTIMF), and the Northern Demersal Scalefish Managed Fishery (NDSMF). The target species for these fisheries (demersal finfish and crustaceans) inhabit water depths in the range of 60–200 m and any in-water hydrocarbons are likely to be confined to the upper layers of the water column (0–10 m).

The Mackerel Managed Fishery (MMF) targets pelagic fish species. As described above, adult pelagic fish species are highly mobile and have the ability to move away from the spill affected area or avoid surface waters. The relatively small spill affected area and temporary nature of the predicted marine diesel spill would infer that it is unlikely the hydrocarbon concentrations in the upper layers of the water column would lead to potential exposure of a significant population of pelagic fish to contamination. Given these pelagic species are distributed over a wide geographical area, the impacts at the population or species level are considered very minor in the unlikely event of a marine diesel spill.

However, there is potential that a fishing exclusion zone would be applied in the area of the spill, which would put a temporary ban on fishing activities and therefore potentially lead to subsequent economic impacts on commercial fishing operators if they were planning on undertaking fishing within the area of the spill.

8.2.2.3 First Nations Cultural Features and Heritage Values

Marine habitat and fauna within the EMBA that are of cultural importance to First Nations peoples are described in Section 4.4.8. These include octopus, spiny bream fish, sting rays identified by the Wanparta Aboriginal Corporation as being important totem species to Ngarla people (Section 4.4.8.6). The assessment of hydrocarbon spill impacts to marine fauna described above detail the potential impacts of an accidental hydrocarbon spill on relevant environmental values described in the existing environment. The potential impacts of an oil spill on the environmental values that are also sea country values and totemic species have therefore been assessed above and will be managed to ALARP by the management measures detailed for each of those receptors. Given that no serious (i.e. population level) or irreversible impacts are predicted to occur to fish, elasmobranchs and benthic invertebrates, no serious or irreversible impacts are also predicted to occur to this First Nations value. For intangible cultural heritage values that are not able to be physically assessed for impacts of an accidental oil spill, any disruption to these values is likely to temporary and for the duration of the survey.

8.2.2.4 Summary

Based on the assessment presented above and the implementation of the identified controls (Section 0), it is expected that the consequence associated with an accidental hydrocarbon release to the marine environment and cultural features and heritage values due to a vessel collision will be Moderate (2). The likelihood of impacts occurring is considered to be Rare (A), resulting in a Low risk to sensitive receptors within and adjacent to the Operational Area.

8.2.3 Decision Context

The decision context for accidental hydrocarbon release to the marine environment due to a vessel collision has been assessed as ‘Type A’, given the impacts/risks are well understood, uncertainty is minimal and little or no relevant person interest.

8.2.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation and communication to inform other users. • Use of radar and 24/7 watch.	Yes	These are a legislative requirement for vessels operating in Commonwealth waters and will be implemented by all vessels. Adherence to these requirements will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	4.1
Issue of marine navigation warnings and Notice to Mariners of survey presence and towed array	Yes	The Australian Hydrographic Office (AHO) will be contacted four weeks prior to the commencement of the survey for the publication of related Notices to Mariners. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	2.1
Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings	Yes	The AMSA JRCC will be contacted 24–48 hrs before operations commence for issuing of AUSCOAST warnings. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	2.2
Good Industry Practice			
Notification will be provided to fisheries relevant persons, prior to commencement of the survey, indicating location and expected timing. Notification will also be provided to fisheries relevant persons upon completion of the survey.	Yes	Notification will be provided to fisheries relevant persons, four weeks prior to commencement of the survey, indicating location and expected timing. Notification will also be provided to fisheries relevant persons within two weeks of completion of the survey. This will ensure other users that may potentially be present in the Operational Area are aware of the survey. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	2.3
A communications protocol will be in place between the survey and support vessels and other users (e.g. known commercial fishing vessels within the Operational Area), to actively manage concurrent activities.	Yes	The survey vessel operator will provide effective 'look-aheads' to commercial fisheries fleet managers and vessel skippers to inform them of the current positions of the survey and support vessels, and of proposed operations for the next 48–72-hour period. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	4.3
At least one additional vessel (support or chase vessel) will accompany the survey vessel when in operation and when safe to do so (e.g. outside of inclement weather periods).	Yes	The support and/or chase vessel will conduct advanced scouting to ensure that other activities in the area are provided with advance notice to move away from the path of the survey vessel. Use of two vessels will mean that one vessel can remain with the survey vessel at all times, allowing the other vessel to return to port when necessary. Implementation will reduce the likelihood of vessel collision between the survey and/or support vessels and third-party vessels.	4.4
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the acquisition or the inherent controls have been identified.	N/A	N/A	N/A
Additional Controls Considered			
No additional controls have been identified.	N/A	N/A	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the impacts and risks of accidental hydrocarbon release to the marine environment due to a vessel collision. As the impact/risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Moderate (2)	Rare (A)	Low

8.2.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing the impacts and risks of accidental hydrocarbon release to the marine environment due to a vessel collision, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** No advice or guidelines have been identified that specifically address potential impacts to protected species resulting from accidental hydrocarbon release. **Conservation values and objectives of the North-west Marine Parks Management Plan** No significant impacts are predicted to occur to the natural, cultural and socio-economic values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to the impacts and risks of accidental hydrocarbon release to the marine environment due to a vessel collision.
Legislation and Other	Legislation and Conventions	All requirements under the Navigation Act and associated Marine Orders for navigation, collision, and support vessels are identified as control measures.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practice is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from an accidental hydrocarbon release to the marine environment due to a vessel collision meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, accidental hydrocarbon release to the marine environment due to a vessel collision is unlikely to result in potential impact greater than localised and short-term effects to marine fauna, water quality, marine protected areas and commercial fisheries. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 8.2.4 are considered industry best practice and meet requirements of the Australian Marine Orders, and expectations of AMSA and the AHO. The potential impacts and risks are considered to be of an acceptable level if the adopted controls are implemented. Therefore, CGG considers the adopted controls appropriate to manage the impacts accidental hydrocarbon release to the marine environment due to a vessel collision to be of an acceptable level.

8.2.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID		
EPO 9	No release of hydrocarbons to the marine environment due to a vessel collision associated with the activity.	PS 4.1	PS 2.2	PS 4.3
		PS 2.1	PS 2.3	PS 4.4

Number	Performance Standards	Measurement Criteria
PS (refer to PS 4.1)	Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the *Navigation Act 2012* and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: Appropriate lighting, navigation and communication to inform other users. Use of radar and 24/7 watch.	No incidents of survey or support vessels failing to comply with appropriate navigation, lighting and communication requirements under the *Navigation Act 2012* or its associated Marine Orders.
PS (refer to PS 2.1)	The AHO is advised four weeks prior to survey commencement to allow for the issue of a Notice to Mariners.	Records verify that Notice to Mariners issued by AHO prior to survey commencement.
PS (refer to PS 2.2)	AMSA JRCC is notified of survey activities 24-48 hours before operations commence, to allow for issue of AUSCOAST warnings, at survey commencement and at completion.	Available records verify AMSA JRCC notifications have been made, and that AUSCOAST warnings have been issued.
PS (refer to PS 2.3)	Notification is provided to fisheries relevant persons, four weeks prior to commencement of the survey, indicating location and expected timing. Notification will also be provided to fisheries relevant persons within two weeks of completion of the survey.	Consultation and notification records verify relevant persons have been informed of survey activities throughout the survey period.
PS (refer to PS 4.3)	A communications protocol is in place between the survey and support vessels and other users (e.g. known commercial fishing vessels within the Operational Area), to actively manage concurrent activities.	Records demonstrate that 48-72-hour 'look-aheads' have been provided to relevant persons that have requested to receive them.

Number	Performance Standards	Measurement Criteria
PS (refer to PS 4.4)	At least one chase vessel is employed to assist the seismic vessel to mitigate interference associated with third party vessel operations.	Records demonstrate that one vessel (support or chase vessel) has remained with the survey vessel throughout the entire duration of the survey.

8.3 Hydrocarbon Spill – Bunkering

8.3.1 Details of Impacts and Risks

8.3.1.1 Source of Impact/Risk

Accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea, with the potential hazards of temporary and localised reduction in water quality and temporary toxicity effects to marine biota.

Bunkering of marine diesel between the support vessel and the survey vessel may occur within the Operational Area or surrounding waters for the Sauropod 3D MSS. Bunkering of the survey vessel is expected to be required approximately every 5–6 weeks during the survey.

Two credible scenarios for the loss of containment of marine diesel during bunkering operations were identified:

- Partial or total failure of a bulk transfer hose or fittings during bunkering, due to operational stress or other integrity issues could spill marine diesel to the deck and/or into the marine environment. This would be in the order of less than 200 L, based on the likely volume of a bulk transfer hose (assuming a failure of the dry break coupling and complete loss of hose volume)
- Partial or total failure of a bulk transfer hose or fittings during bunkering, combined with a failure in procedure to shutoff fuel pumps, for a period of up to five minutes, resulting in approximately 1.2 to 25 m^3 marine diesel loss to the deck and/ or into the marine environment.

8.3.1.2 Receptors

- Marine fauna (cetaceans, marine reptiles, seabirds, fishes/elasmobranchs, planktonic communities).
- Water quality.
- Cultural features and heritage values.

8.3.2 Impact/Risk Evaluation

Based on the modelling conducted for the 280 m^3 marine diesel spill within the Operational Area the exposure to surface hydrocarbons above the moderate 10 g/m^2 threshold is limited to the immediate vicinity of the release site, with little potential to extend beyond distances of 1 km or less. Therefore, it is considered that exposure to thresholds concentrations from a 25 m^3 surface spill from bunkering operations would be well within the surface hydrocarbon extent or 'footprint' for the vessel collision scenario in the Operational Area (refer to Figure 8-2), detailed in Section 8.1.3. Given this, specific modelling for a 25 m^3 marine diesel release was not undertaken for the Sauropod 3D MSS.

Based on the modelling results presented in Section 8.1.3, it is considered that there is no potential for contact with any marine protected areas, shallow waters or shorelines above low threshold concentrations (surface hydrocarbons 1 g/m^2; entrained hydrocarbons 10 ppb; or dissolved hydrocarbons 6 ppb) from a 25 m^3 or 200 L spill of marine diesel within the Operational Area during the survey.

The potential biological and ecological impacts to marine fauna and water quality associated with a much larger hydrocarbon spill are presented in Section 8.2. The biological consequences of such small volume releases of marine diesel on identified open water sensitive receptors relate to the potential for minor impacts to cetaceans, marine reptiles, seabirds, fishes/ elasmobranchs and planktonic communities (surface and water column biota) that are within the spill affected area. The potential impacts are considered to be very localised and short-term.

No impacts to commercial fisheries are expected to occur.

Based on the assessment presented above and the implementation of the identified controls (Section 8.3.4), it is expected that the consequence associated with an accidental hydrocarbon release to the marine environment, and therefore to cultural features and heritage values, due to bunkering of the survey vessel at sea will be Negligible (0). The likelihood of impacts occurring is considered to be Rare (A), resulting in a Low residual risk to sensitive receptors within the Operational Area.

8.3.3 Decision Context

The decision context for accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea has been assessed as ‘Type A’, given the impacts/risks are well understood, uncertainty is minimal and little or no relevant person interest.

8.3.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Adherence with requirements of Marine Order 91: Marine pollution prevention – oil.	Yes	By ensuring a SOPEP is in place for the vessel, the likelihood of a spill entering the marine environment is reduced.	10.1
Good Industry Practice			
Bunkering equipment controls: • All bulk transfer hoses tested for integrity before use • Dry-break couplings and flotation installed on refuelling hoses • Adequate number of appropriately stocked, located and maintained spill kits aboard both survey and support vessels.	Yes	By ensuring the appropriate equipment is in place, tested and maintained appropriately, the likelihood of a spill occurring is reduced. By ensuring spill kits are in place, the likelihood of a spill entering the marine environment is reduced. Good industry practice, environmental benefit outweighs additional cost.	10.2
Survey vessel contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • A completed Permit to Work (PTW) and / or Job Safety Analysis (JSA) implemented for bunkering operations • Visual monitoring of gauges, hoses, fittings and sea surface during bunkering operations • Hose checks prior to commencement • Bunkering commences only in daylight hours. If transfer is to continue into night-time, JSA risk assessment must consider lighting and ability to determine if a spill has occurred • Bunkering not to occur in marginal weather conditions.	Yes	By ensuring the appropriate bunkering procedures are implemented, the likelihood of a spill occurring is reduced, and the likelihood of a spill entering the marine environment is also reduced. Good industry practice, environmental benefit outweighs additional cost.	10.3
Bunkering operations will be undertaken within the Operational Area (unless as required in an emergency situation).	Yes	The Operational Area does not overlap with any AMPs, therefore bunkering within the Operational Area is consistent with the management prescriptions of the AMPs. Good industry practice, environmental benefit outweighs additional cost.	10.4
Alternatives/Substitutes Considered			
Survey vessel bunkering only occurs in port.	No	The survey vessel would have to recover the towed array, leave the Operational Area and return to port for bunkering. This would increase the survey duration, and the overall cost. Eliminates the hydrocarbon spill risk from the Operational Area but transfers it to coastal waters. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
Additional Controls Considered			
No additional controls have been identified.	N/A	N/A	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the impacts and risks of accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea. As the impact/risk has been classified as ‘Type A’ and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

8.3.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy Company Standards/Systems	The risk management strategy for managing the impacts and risks of accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea, is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP. Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** N/A: No advice or guidelines have been identified that specifically address potential impacts to protected species resulting from accidental hydrocarbon release **Conservation values and objectives of the North-west Marine Parks Management Plan** No significant impacts are predicted to occur to the natural, cultural and socio-economic values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to the impacts and risks of accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea.
Legislation and Other	Legislation and Conventions	All requirements under the Navigation Act and associated Marine Orders for prevention of pollution from oil are identified as control measures.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practice is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from an accidental hydrocarbon release to the marine environment during bunkering of the survey vessel at sea meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, accidental hydrocarbon release to the marine environment during bunkering is unlikely to result in potential impact greater than very localised and short-term effects to marine fauna and water quality. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 8.3.4 are considered industry best practice and meet requirements of the Australian Marine Orders. The potential impacts and risks are considered to be of an acceptable level if the adopted controls are implemented. Therefore, CGG considers the adopted controls appropriate to manage the impacts accidental hydrocarbon release to the marine environment due to bunkering of the survey vessel at sea to be of an acceptable level.

8.3.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	
EPO 10	No unplanned loss of hydrocarbons to the marine environment from bunkering of the survey vessel at sea during the activity	PS 10.1	PS 10.3
		PS 10.2	PS 10.4

Number	Performance Standards	Measurement Criteria
PS 10.1	A SOPEP is available onboard the survey and support vessels (as appropriate to vessel class), as required by Marine Order 91 (Marine pollution prevention – oil).	Marine Assurance inspection records demonstrate a SOPEP is available onboard the survey and support vessels in compliance with Marine Order 91.
PS 10.2	Bunkering equipment controls are implemented: • All bulk transfer hoses tested for integrity before use • Dry-break couplings and flotation installed on refuelling hoses • Adequate number of appropriately stocked, located and maintained spill kits aboard both survey and support vessels.	Records confirm the vessel bunkering equipment is subject to systematic integrity checks, has dry-break couplings and flotation installed on refuelling hoses, and there are an adequate number of appropriately stocked, located and maintained spill kits aboard both survey and support vessels.
PS 10.3	At sea bunkering procedures are followed, including: • A completed PTW and / or JSA implemented for bunkering operations • Visual monitoring of gauges, hoses, fittings and sea surface during bunkering operations • Hose checks prior to commencement • Bunkering commences only in daylight hours. If transfer is to continue into night-time, JSA risk assessment must consider lighting and ability to determine if a spill has occurred • Bunkering not to occur in marginal weather conditions.	Records demonstrate bunkering / refuelling undertaken in accordance with contractor bunkering procedures.
PS 10.4	Bunkering operations are undertaken within the Operational Area (unless as required in an emergency situation).	Records demonstrate that no bunkering operations have been undertaken outside of the Operational Area.

8.4 Chemical Spill: Single Point Failure

8.4.1 Details of Impacts and Risks

8.4.1.1 Source of Impact/Risk

Accidental spills of up to 1 m^3 of hydraulic fluids or chemicals may result in a localised and short-term reduction in water quality with the potential to result in toxic effects on marine fauna.

8.4.1.2 Receptors

- Marine fauna (cetaceans, marine reptiles, seabirds, fishes/elasmobranchs, planktonic communities).
- Water quality.
- Cultural features and heritage values.

8.4.2 Impact/Risk Evaluation

The accidental release of up to 1 m^3 of hydraulic fluids or chemicals to the marine environment may result in a localised reduction in water quality. Hydraulic fluids spilt or washed overboard have the potential to result in toxicity effects to marine fauna and fish in the immediate vicinity of the spill release location, through direct contact or accidental ingestion. Given the open water dispersive location of the Operational Area, the extent and duration of potential exposures and impacts to marine fauna and fish is expected to be highly localised and short term and limited to the vicinity of point of discharge.

Based on the assessment presented above and the implementation of the identified controls (Section 8.4.4), it is expected that the consequence associated of a single point failure resulting in a reduction in water quality and toxicity to marine fauna and fish, and therefore cultural features and heritage values, will be Negligible (0). The likelihood of impacts occurring is considered to be Rare (A), resulting in a Low residual risk to sensitive receptors within the Operational Area

Further information about the selected control measures, the ALARP evaluation, and the evaluation of Acceptability are provided below.

8.4.3 Decision Context

The decision context for a release of hydraulic fluids or chemicals to the marine environment from a single point failure has been assessed as ‘Type A’, given the impacts/risks are well understood, uncertainty is minimal and little or no relevant person interest.

8.4.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Adherence with requirements of Marine Order 91: Marine pollution prevention – oil.	Yes	By ensuring a SOPEP is in place for the vessel, the likelihood of a spill entering the marine environment is reduced.	10.1
Good Industry Practice			
Hydraulic fluids and chemicals will be selected in accordance with the CGG Chemical Control Procedure and will be selected to have the lowest environmental toxicity possible whilst meeting operational performance requirements.	Yes	Chemical use is controlled through the implementation of the CGG Chemical Control Procedure ensuring the use of chemicals with the lowest environmental toxicity possible meeting technical specifications. Good industry practice.	11.1
Storage, handling and use of hazardous substances (including hydraulic fluids and chemicals) shall be in accordance with the product's Safety Data Sheet (SDS).	Yes	Storage and handling in accordance with SDS, reduces the potential for deck spills. Good industry practice.	11.2
Spill kits and scupper plugs are available on-board the seismic vessel and crew are trained in their use.	Yes	Should a spill occur on deck, spill kits and scupper plugs can prevent the spill from entering the marine environment. Good industry practice.	11.3
Spills will be reported through the CGG Incident Reporting Procedure and waste materials managed in accordance with the vessel Waste/Garbage Management Plan.	Yes	All spills during the Sauropod 3D MSS will be reported through the CGG Incident Reporting Procedure. Waste materials will be managed in accordance with the vessel Waste/Garbage Management Plan. Good industry practice.	11.4
Alternatives/Substitutes Considered			
No hydraulic fluids or chemicals to be used during the seismic survey activity.	No	During the survey, the use of hydraulic oils cannot be eliminated as they are required for the safe operation of equipment. Chemical use is controlled through implementation of the CGG Chemical Control Procedure ensuring the use of chemicals with the lowest environmental toxicity possible meeting technical specifications.	N/A
Additional Controls Considered			
No additional control measures have been identified	N/A	N/A	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the impacts and risks of accidental chemical release to the marine environment from a single point failure. As the impact/risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Negligible (0)	Rare (A)	Low

8.4.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing the impacts and risks of accidental chemical release to the marine environment from a single point failure is compliant with CGG's HSE Policy objectives of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Notification and Reporting (Section 9.12).
External	Values and Sensitivities of the Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** N/A: No advice or guidelines have been identified that specifically address potential impacts to protected species resulting from accidental chemical release. **Conservation values and objectives of the North-west Marine Parks Management Plan** No significant impacts are predicted to occur to the natural, cultural and socio-economic values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs.

Context	Factor	Demonstration
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to the impacts and risks of accidental chemical release to the marine environment due to bunkering of the survey vessel at sea.
Legislation and Other	Legislation and Conventions	All requirements under the Navigation Act and associated Marine Orders for prevention of pollution are identified as control measures.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practice is demonstrated.
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from an accidental chemical release to the marine environment from a single point failure meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, accidental chemical release to the marine environment is unlikely to result in potential impact greater than very localised and short-term effects to marine fauna and water quality. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 8.4.4 are considered industry best practice and meet requirements of the Australian Marine Orders. The potential impacts and risks are considered to be of an acceptable level if the adopted controls are implemented. Therefore, CGG considers the adopted controls appropriate to manage the impacts accidental chemical release to the marine environment from a single point failure to be of an acceptable level.

8.4.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	
EPO 11	No unplanned loss of hydraulic fluids or chemicals to the marine environment from a single point failure during the activity	PS 10.1	PS 10.3
		PS 10.2	PS 10.4

Number	Performance Standards	Measurement Criteria
PS (refer to PS 10.1)	A SOPEP is available onboard the survey and support vessels (as appropriate to vessel class), as required by Marine Order 91 (Marine pollution prevention – oil).	Marine Assurance inspection records demonstrate a SOPEP is available onboard the survey and support vessels in compliance with Marine Order 91.
PS 11.1	Hydraulic fluids and chemicals are selected in accordance with the CGG Chemical Control Procedure and will be selected to have the lowest environmental toxicity possible whilst meeting operational performance requirements.	Records of pre-survey environmental checklist and compliance audit during the survey (Section 9.3.1) confirm that only chemicals approved via the CGG Chemical Control Procedure are carried on the vessel.
PS 11.2	Storage, handling and use of hazardous substances (including hydraulic fluids and chemicals) are in accordance with the product's Safety Data Sheet (SDS).	Records demonstrate survey inductions included the requirement to follow SDS when storing, handling and using hazardous substances (including hydraulic fluids and chemicals). Record of audit during the survey confirms that SDS for hydraulic fluids are available on-board and storage, handling and/or use is in accordance with the SDS.
PS 11.3	Spill kits and scupper plugs are available on-board the seismic vessel and crew are trained in their use.	Record of pre-survey environmental checklist (Section 9.3.1) confirms spill kits and scupper plugs are available on-board. Training and competency records confirm that relevant crew have been trained on the use of spill kits and scupper plugs.
PS 11.4	Spills are reported through the CGG Incident Reporting Procedure and waste materials managed in accordance with the vessel Waste/Garbage Management Plan.	If a spill has occurred during the survey, CGG Incident Reporting records demonstrate that immediate action was taken to clean up the spill and waste was managed in accordance with the vessel Waste/Garbage Management Plan.

8.5 Physical Presence: Entanglement / Collision with Marine Fauna

8.5.1 Details of Impacts and Risks

8.5.1.1 Source of Impact/Risk

The physical presence of the survey and support vessels and towed equipment within the Operational Area provides a risk of potential entanglement/collision with marine fauna. The survey and support vessels operating in the Operational Area, and the towed seismic equipment, may represent a potential entanglement / collision risk to cetaceans and other protected marine fauna, such as whale sharks and marine turtles.

Vessel movements can result in collisions between the vessel (hull, propellers and streamer array) and marine fauna, potentially resulting in serious injury that may affect life functions (e.g. movement and reproduction) or cause mortality. The factors that contribute to the frequency and severity of impacts due to collisions vary greatly due to the vessel type, vessel operation (specific activity, speed), physical environment (e.g. water depth) and the type of fauna potentially present and their behaviours.

The survey will be undertaken by a seismic survey vessel towing an underwater seismic source (at a depth of 5-10 m) and a series of hydrophone streamers (up to 12 at a depth of approximately 15 m). When acquiring data the vessel will travel along pre-determined lines within the Acquisition Area at approximately 4.5 knots. The survey vessel will be accompanied by two support vessels.

This section deals with the risk of entanglement or collision with marine fauna from the physical presence of vessels and in-water equipment (streamers and seismic source) in the Operational Area. Risks associated with the disruption/interference with other marine users are addressed in Section 7.4, and potential underwater acoustic impacts on marine fauna are addressed in Sections 7.1 to 7.2.

8.5.1.2 Receptors

- EPBC listed marine fauna, including threatened and migratory cetaceans, marine turtles and whale sharks.
- Cultural features and heritage values.

8.5.2 Impact/Risk Evaluation

The risk of a vessel collision or entanglement is limited to the footprint of the vessels, which is temporary in nature at any one position, as the vessels transits within the Operational Area for a maximum of 60 days.

As the survey vessel transits at low speeds (4–5 knots), with MFO observers on-board, the likelihood of a vessel-strike and associated injury to megafauna, including those of cultural importance, is considered very unlikely. Support vessels generally travel at higher speeds within the Operational Area and are considered to have a slightly higher potential for collision and damage with megafauna, relative to the survey vessel.

While the seismic source is in operation it is unlikely that marine fauna would become entangled in the array or collide with the seismic equipment, as the sound generated during operations would act as a deterrent. Anecdotally, there have been no reported cases of marine fauna becoming entangled in seismic equipment in Australian waters.

8.5.2.1 Cetaceans

Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels, and dolphins commonly ‘bow ride’ with offshore vessels. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when close to a vessel while others are known to be curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving ships (Richardson *et al.* 1995).

Collisions between vessels and cetaceans occur more frequently where high vessel traffic and cetacean habitat coincide (Whale and Dolphin Conservation Society (WDCS) 2006). There have been occasional recorded instances of cetacean deaths in Australian waters (WDCS 2006), though the data indicates this is more likely to be associated with container ships and fast ferries. The Whale and Dolphin Conservation Society (WDCS 2006) also indicates that some cetacean species, such as Humpback whales, can detect and change course to avoid a vessel.

Laist *et al.* (2001) identified larger vessels (container vessels and fast ferries), moving faster than ten knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling at speeds greater than 14 knots.

Individual cetaceans engaged in behaviours such as feeding, mating or nursing may also be more vulnerable to vessel collisions when distracted by these activities (DoEE 2017).

Several species of cetaceans are known to occur in the NWMR and have wide distributions that are associated with feeding and migration patterns linked to reproductive cycles. The Pygmy Blue Whale migration BIA is located 72 km from the Operational Area. Occasional individuals may therefore pass through the Operational Area and surrounds during the annual migration. Acquisition of the survey may overlap the commencement of the northbound migration (April), but avoids the southbound migration period for Pygmy Blue Whales in the region (September to November). However, overall cetacean numbers within the Operational Area are expected to be very low during the proposed timing of the Sauropod 3D MSS (January to May). Given the low number of cetaceans expected in the Operational Area, presence of two MFOs on-board the seismic survey vessel, and the low operating speeds of vessels, the risk of entanglement or collision is considered low.

8.5.2.2 Marine Turtles

Marine turtles are at potential risk from vessel strike and entanglement with the in-water seismic equipment. Peel *et al.* (2016) reviewed vessel strike data (2000–2015) for marine turtle species in Australian waters and identified that all turtle species present in Australian waters had had an interaction with vessels. Green and loggerhead turtles exhibited the highest incident of interaction. The effect of vessel speed and turtle flee response can be significant. A study by Hazel *et al.* (2007) recorded 60% of green turtles fleeing from vessels travelling at 4 km/h, while only 4% fled from vessels travelling at 19 km/h. When fleeing, 75% of turtles moved away from the vessel's track, 8% swam along the vessel track and 18% crossed in front of the vessel. The study concluded that most turtles would be unlikely to avoid vessels travelling at speeds greater than 4 km/h (DoEE 2017).

The NWMR is considered to be significant for supporting large feeding and nesting turtle populations. Six threatened and migratory marine turtle species have the potential to occur in the Operational Area, however, the Operational Area does not overlap with any BIAs for marine turtle species. The closest foraging BIA for the flatback turtle is 55 km from the Operational Area. In addition, the closest 'habitat critical to the survival of a species' BIA for the flatback turtle is located approximately 55 km from the Operational Area. The marine turtle numbers within the Operational Area are expected to be low during the proposed Sauropod 3D MSS. Given the low number of marine turtles expected in the Operational Area and the low operating speeds of vessels, the risk of entanglement or collision is considered low.

8.5.2.3 Whale Sharks

Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where there is limited option to dive). Whale sharks may traverse offshore North West Shelf waters in the Operational Area during their migrations to and from Ningaloo Reef. The Operational Area does overlap with a foraging BIA for whale sharks which extends northwards from Ningaloo Reef along the 200 m isobath. The foraging BIA is used from August to November and does not overlap with the proposed acquisition period. Whale sharks are a highly migratory species, which are known to migrate between Christmas Island and Ningaloo Reef. Migration is expected to occur between January and March. It is expected that whale shark presence in the Operational Area would not comprise significant numbers, given the main aggregations are recorded in coastal waters, (MPRA 2005; Sleeman *et al.* 2010) and their presence would be transitory and of a short duration. Given the low number of whale sharks expected in the Operational Area and the low operating speeds of vessels, the risk of entanglement or collision is considered low.

8.5.2.4 First Nations Cultural Features and Heritage Values

Fauna within and adjacent to the Operational Area that are of cultural importance to First Nations peoples are described in Section 4.4.8. The assessment of physical presence impacts to marine organisms are described above and details the potential impacts of physical presence on the relevant environmental values described in the existing environment. The potential impacts of physical presence on the environmental values that are also sea country values and totemic species have therefore been assessed above and will be managed to ALARP and Acceptable levels by the management measures. For intangible cultural heritage values that are not able to be physically assessed for impacts of physical presence, any disruption to these values is likely to be temporary and for the duration of the survey.

8.5.2.5 Summary

Based on the assessment presented above and the implementation of the identified controls (Section 8.5.4), it is expected that in the event of entanglement or collision with marine fauna, the consequence would be Major (4), as collision/entanglement of marine fauna could result in serious injury or death. The likelihood of interaction is considered Rare

(A), given the low presence of transiting individuals, avoidance behaviour of marine fauna and the low operating speed of vessels. The residual risk of entanglement/collision with marine fauna has been assessed as Low.

8.5.3 Decision Context

The decision context for the risk of potential entanglement or collision with marine fauna, has been assessed as ‘Type A’, given the risks are well understood and uncertainty is minimal, with little or no relevant person interest.

8.5.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
Vessels will comply, when safe to do so, with the relevant requirements of EPBC Regulations 2000 - Part 8 Division 8.1, including: • Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale • Not exceeding a speed of six knots within the caution zone of a cetacean (300 m).	Yes	The requirements of the EPBC Regulations set out clear measures to reduce speed and avoid approaching cetaceans, which reduces the risk of collision or entanglement. MSS. For safety reasons, the distance requirements are not applied for vessels with limited manoeuvrability. It is a legislative requirement for vessels to comply with the EPBC Act and EPBC Regulations.	3.1
Good Industry Practice			
Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 Part B.1 – Additional Management Measures: Marine Mammal Observers.	Yes	Two trained and experienced marine fauna observers (MFOs) will be aboard the survey vessel. The two MFOs (in addition to briefed crew members) will alternate shifts during daylight hours (during operation of the seismic source) in order to manage fatigue and provide some redundancy in the event one MFO is temporarily unavailable. At least one MFO will be performing marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. The MFOs will have adequate training and will have 12 months experience in Australian waters. Good industry practice, environmental benefit outweighs additional cost.	1.2
Any vessel strike incident to marine mammals shall be reported as soon as possible via the National Vessel Strike Database at https://data.marinemammals.gov.au/report/shipstrike, within 72hr of collision.	Yes	Reporting ship strikes with cetaceans is requested by the DCCEEW's Australian Antarctic Division and allows the Australian Government and International Whaling Commission (IWC) to collate scientific data on vessel strike locations, frequencies and timings so that further research and mitigation can be considered. Good industry practice, environmental benefit outweighs additional cost.	12.1
Turtle guards installed on tail buoys or tail buoys are of a design that does not represent an entrapment risk to turtles.	Yes	A tail buoy will be fitted to the end of each streamer. Tail buoys are brightly coloured and contain a radar reflector and strobe light to be visible to other marine users. If the tail buoys are not of a design that does not represent an entrapment risk to turtles, they will be fitted with guards to prevent accidental entrapment of turtles. Good industry practice, environmental benefit outweighs additional cost.	12.2
All vessel crews have completed an environmental induction covering the requirements for cetacean vessel interactions consistent with EPBC Regulations 2000 – Part 8 Division 8.1.	Yes	Environmental inductions will be included as part of the crew induction package, including cetacean vessel interactions, consistent with EPBC Regulations 2000 – Part 8 Division 8.1. Good industry practice, environmental benefit outweighs additional cost.	12.3
Alternatives/Substitutes Considered			
Use ocean bottom nodes (OBN – receivers) instead of towed hydrophone streamers	No	To further reduce the potential for entanglement, an alternative to the use of towed streamers is the use of ocean bottom receivers. However, this was considered impractical for the following reasons: • Environmentally, OBNs placed on the seabed may reduce the risk of marine fauna becoming entangled in towed streamers. However, this alternative would not alter the risks associated with potential vessel interactions. Also, OBNs can result in unnecessary seabed disturbance particularly in areas of shallow benthic habitat. • OBNs cannot be placed securely on steep sloping seabed, making acquisition in some areas of the Operational Area difficult or impossible to implement. • OBNs would result in a significant increase in vessel activity to manage deployments and recoveries throughout the Operational Area, which would increase the potential for vessel collision and may disrupt other marine users. • Operationally, this alternative would not meet survey requirements for coverage and would also add significantly to the cost and timeframe for the survey, making it impractical. • Given that there have been no reported cases of marine fauna becoming entangled in seismic equipment, the risk is already very low and so little additional benefit would be gained.	N/A
Additional Controls Considered			
Marine fauna entangled within the in-water equipment will be returned to sea (where possible and safe to do so).	Yes	If safe and practicable to do so, marine fauna found to be entangled in towed equipment shall be recovered to reduce the risk of mortality. The environmental benefit outweighs the additional cost.	12.4
Retrieve towed equipment when not in use.	No	Consideration was given to the option of retrieving towed equipment when not in use. However, given the other controls in place to reduce the risk of interaction with marine fauna, this additional control was determined as providing limited benefit and as being	N/A

Control Measure	Control Adopted	Justification	Performance Standard Ref.
		disproportionate due to the significantly increased time, cost and complexity associated with implementing it, as well as increased health and safety risks from repeatedly retrieving and deploying equipment from the survey vessel.	
Survey acquisition timed to avoid turtle internesting periods	No	Not justified. Acquisition of the survey may overlap the nesting and breeding season for a number of turtle species in the region, however the Operational Area is located approximately 55 km from the closest BIA boundary. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
Survey acquisition timed to avoid the migration periods for Humpback whales	Yes	The survey will be acquired in the period January to May, which will avoid the northbound and southbound migration season for Humpback whales in the region (June to October). The environmental benefit outweighs the additional cost.	1.7
Survey acquisition timed to avoid the migration periods for Pygmy Blue Whales	No	Not justified. Acquisition of the survey may overlap the commencement of the northbound migration (April), but avoids the southbound migration period for Pygmy Blue Whales in the region (October to December). The Pygmy Blue Whale migration BIA is located 72 km from the Operational Area. Only occasional, transient individuals are therefore expected in the area during the proposed acquisition period. The costs are grossly disproportionate to any potential environmental benefit gained.	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
In addition to the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for cetaceans, vessels, when safe to do so, will also: • Take action to avoid approaching or drifting closer than 50 m to a turtle • Not exceeding a speed of six knots within 300 m of a turtle.	Yes	In addition to implementing avoidance measures for cetaceans, CGG has considered extending the prescribed avoidance measures to turtles. For safety reasons, the distance requirements are not applied to vessels with limited manoeuvrability. The environmental benefit outweighs the additional cost.	3.4
Vessels, when safe to do so, will also adopt consistent with the DPaW Whale Shark Management Programme (2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark • Not exceeding eight knots within 250 m of a whale shark.	Yes	In addition to implementing the EPBC Regulations 2000 avoidance measures for cetaceans, CGG has extended avoidance measures to whale sharks. For safety reasons, the distance requirements are not applied for vessels with limited manoeuvrability. The environmental benefit outweighs the additional cost.	3.5
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the risks of entanglement or collision with marine fauna. As the risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Major (4)	Rare (A)	Medium

8.5.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing the physical presence of vessels and towed equipment, reflects CGG's HSE Policy goals of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** Proposed control measures and the low residual risk of vessel collision or entanglement are consistent with the various Conservation Advice, Conservation Management Plans, Recovery Plans and other Guidelines for whales, sharks and turtles: • Conservation Management Plan for the Blue Whale • Conservation advice for Sei and Fin whales • Recovery Plan for Marine Turtles in Australia

Context	Factor	Demonstration
		• Whale shark – wildlife management program no. 57 (DPaW 2013) • National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DoEE 2017)
		Conservation values and objectives of the North-west Marine Parks Management Plan No impacts are expected to the natural and cultural heritage values of the Argo-Rowley Terrace, Mermaid Reef or Eighty Mile Beach AMPs.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to the risk of entanglement/collision with marine fauna from the physical presence of vessels and in-water equipment.
Legislation and Other	Legislation	The controls adopted will comply with the *Navigation Act 2012*, *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the *Environment Protection and Biodiversity Conservation Act 1999*.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practices (where applicable).
Ecological Sustainability Development (ESD)	ESD Application	If an incident resulting in entanglement/collision with marine fauna was to occur, it would be expected to be limited to an isolated individual. Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from entanglement/collision with marine fauna meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, physical presence of vessels and in-water equipment is very unlikely to result in potential impact to marine fauna. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the risk have been investigated above. The adopted controls described in Section 8.5.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

8.5.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID		
EPO 12	No injury or death to marine fauna as a result of vessel collision or entanglement with in-water equipment during the Sauropod 3D MSS.	PS 3.1	PS 12.2	PS 1.7
		PS 1.2	PS 12.3	PS 3.4
		PS 12.1	PS 12.4	PS 3.5

Number	Performance Standards	Measurement Criteria
PS (refer to PS 3.1)	Seismic vessels and support vessels (taking into account the limited manoeuvrability of the former) comply with relevant requirements of EPBC Regulations 2000 - Part 8 Division 8.1, including: • Taking action to avoid approaching or drifting closer than 50 m to a dolphin or 100 m to a whale • Not exceeding a speed of six knots within the caution zone of a whale (300 m).	MFO Master Data Sheet verifies interaction between the MSS vessel and marine mammals comply with these requirements. Support vessel observations sheet verified interactions between the vessel and marine mammals comply with these requirements.
PS (refer to PS 1.2)	Operation of the seismic source within the Operational Area for the Sauropod 3D MSS is compliant with EPBC Act Policy Statement 2.1 Part B.1 – Additional Management Measures: Marine Mammal Observers. Two trained and experienced MFOs are aboard the seismic survey vessel. The two MFOs (in addition to briefed crew members) alternate shifts during daylight hours in order to manage fatigue and provide some redundancy in the event one MFO is unavailable. At least one MFO will be performing marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. The MFOs have adequate training and will have 12 months experience in Australian waters.	Records demonstrate that two MFOs were aboard the survey vessel for the duration of the survey and that at least one MFO performed marine mammal observations during daylight hours, during seismic operations and pre-start up observation periods. MFO sighting records and final report. CVs and training records for the MFOs.
PS 12.1	Any vessel strike incident to marine mammals is reported as soon as possible via the National Vessel Strike Database at https://data.marinemammals.gov.au/report/shi, within 72 hr of collision.	Records verify incident has been reported via the National Vessel Strike Database.
PS 12.2	Turtle guards are installed on tail buoys or tail buoys are of a design that does not represent an entrapment risk to turtles.	Inspection records verify turtle guards are installed on header buoys and tail buoys (or buoys have been designed to not represent an entanglement risk to turtles).
PS 12.3	All vessel crews have completed an environmental induction covering the requirements for cetacean vessel interactions consistent with EPBC Regulations 2000 – Part 8 Division 8.1.	Induction records verify that all crews have completed an environmental induction.
PS 12.4	Marine fauna entangled within the in-water equipment are returned to sea (where possible and safe to do so).	MFO records verify that any marine fauna entangled within the in-water equipment are returned to sea (where possible and safe to do so).
PS (refer to PS 1.7)	Survey acquisition is timed to avoid the migration periods for Humpback whales (June to October).	Records confirm that the survey has been acquired outside the June to October Humpback whale migration season.
PS (refer to PS 3.4)	In addition to the requirements of the EPBC Regulations 2000 - Part 8 Division 8.1 for cetaceans, vessels (where safe to do so) also: • Take action to avoid approaching or drifting closer than 50 m to a turtle • Not exceeding a speed of six knots within 300 m of a turtle.	MFO Master Data Sheet verifies interaction between the MSS vessel and marine mammals comply with these requirements. Support vessel observations sheet verified interactions between the vessel and marine mammals comply with these requirements.
PS (refer to PS 3.5)	Vessels, when safe to do so, also adopt will measures consistent with the Whale shark – wildlife management program no. 57 (DPaW 2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark • Not exceeding eight knots within 250 m of a whale shark.	MFO Master Data Sheet verifies interaction between the MSS vessel and marine mammals comply with these requirements. Support vessel observations sheet verified interactions between the vessel and marine mammals comply with these requirements.

8.6 Physical Presence: Loss of Equipment

8.6.1 Details of Impacts and Risks

8.6.1.1 Source of Impact/Risk

The risk of physical loss of equipment (e.g. seismic streamers and/or source) in the Operational Area could result in localised seabed disturbance and disruptions to other marine users, as a result of a breakage in cables or a failure in lifting equipment. The survey will be undertaken by a purpose-built seismic survey vessel towing an underwater seismic source (at a depth of 5–10 m) and a series of hydrophone streamers (up to 12). These streamers will be towed at a depth of approximately 15 m below the surface. Loss of this equipment has the potential to cause localised seabed disturbance, localised damage to benthic habitats, and disruptions to other marine users. Loss of equipment during petroleum activities is uncommon; however, it has been recorded within the industry.

Impacts associated with the unplanned loss of solid wastes (hazardous or non-hazardous) are assessed in Section 8.7.

8.6.1.2 Receptors

- Marine users: Commercial fishing and commercial shipping.
- Benthic habitats and communities.
- Cultural features and heritage values.

8.6.2 Impact/Risk Evaluation

8.6.2.1 Marine Users (e.g., Commercial Fishing and Shipping)

In the unlikely event that equipment is lost, other marine users of the Operational Area may be required to make minor diversions to avoid the equipment, until it can be retrieved (if possible). The potential for such interactions will be limited to a short period of time while the equipment is retrieved (if possible). Should disruption occur, it is only expected to affect individual users and cause temporary disruption through avoidance of a highly localised area. Given the nature and size of the equipment to be used during the survey, lost equipment is not expected to result in a navigational hazard to the sort of vessels typically in the area. Therefore, anticipated impacts are expected to be low.

8.6.2.2 Benthic Habitat and Communities, potentially of cultural importance

Loss of equipment has the potential to cause localised seabed disturbance and localised damage to benthic habitat that may be of cultural importance, arising from the streamers and associated equipment potentially sinking and being dragged along the seabed. However, the tow depth of streamers (15 m), and the application of depth control in-built into the design and planning of the activity means that the likelihood of direct impact on benthic communities during normal operations is highly unlikely.

The ancient coastline at 125 m depth contour KEF overlaps with a small portion of the Operational Area. Parts of the ancient coastline are represented as rocky escarpment, which are considered to provide significant habitat in an area predominantly made up of soft sediment (Section 4.3.2). As discussed in Section 4.4.8 this ancient coastline may also once have been inhabited by First Nations peoples and hence may include locations of potential cultural significance.

The Operational Area is expected to consist primarily of soft, fine unconsolidated sediments, which are typical of the broader NWMR (Section 4.2.4). As such physical impacts to the seabed from lost equipment are expected to be short-term and highly localised. Due to the presence of mostly soft sediments and lack of hard substrate, the seabed is likely to be inhabited by a low abundance and patchy distributions of filter feeders and other epifauna, characteristic of the wider NWMR (Brewer *et al.* 2007). Impacts to benthic habitats such as shelf and slope habitats, pinnacle and terrace seabed features and the ancient coastline KEF are not expected.

8.6.2.3 Summary

Based on the assessment presented above and the implementation of the identified controls (Section 8.6.4), it is expected that localised seabed disturbance, impact to benthic habitats of cultural importance and localised disturbance to marine users will be Minor (1). The likelihood of this consequence occurring is Rare (A) and the residual risk is considered to be Low.

8.6.3 Decision Context

The decision context for loss of equipment has been assessed as ‘Type A’, given the impacts/risks are well understood and uncertainty is minimal with little or no relevant person interest.

8.6.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements and Good Industry Practice			
No relevant legislation has been identified.	N/A	N/A	N/A
Good Industry Practice			
Solid streamers will be used for the survey.	Yes	Solid streamers are used as a standard to prevent any possibility of discharges that could otherwise occur if fluid-filled streamers were used and became damaged. Good industry practice, environmental benefit outweighs additional cost.	13.1
The seismic vessel will operate under approved procedures for streamer deployment/retrieval and these procedures are adhered to at all times.	Yes	The procedure ensures all personnel involved in the deployment/retrieval of in-water equipment, are doing so in a safe and consistent manner. The environmental benefit outweighs the additional cost.	13.2
Streamer equipment is routinely maintained and inspected for wear and tear to ensure the equipment is fit-for-purpose.	Yes	In-water equipment is routinely checked to confirm the integrity of the equipment, and to ensure the equipment is fit-for-purpose. The environmental benefit outweighs the additional cost.	13.3
Streamers will be fitted with the following equipment: • Streamer recovery devices (self-inflating SRDs) • Surface marker buoys • Secondary retaining devices • Tail buoys	Yes	Streamers are fitted with equipment to allow for the ease in deployment and retrieval of in-water equipment. The environmental benefit outweighs the additional cost.	13.4
Support vessels will search for and retrieve lost in-water equipment (where possible and safe to do so).	Yes	Two support vessels will accompany the survey vessel. Support vessels are able to assist in the search and recovery of lost equipment. The environmental benefit outweighs the additional cost.	13.5
Marine relevant persons will be notified (VHF Channel 16) in the event of a loss of in-water equipment.	Yes	Notification to other marine users (i.e. commercial fishing and shipping) to alert them of the navigational hazard (if applicable). This is considered good industry practice.	13.6
Loss of equipment will be reported to AMSA, as soon as possible.	Yes	Notification to AMSA to alert them of the navigational hazard. This is considered good industry practice.	13.7
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the above controls have been identified.	N/A	N/A	N/A
Additional Controls Considered			
No additional controls have been identified.	N/A	N/A	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable improvements have been identified	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the risk of a loss of equipment. The residual risk has been assessed as Low. As the risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Minor (1)	Rare (A)	Low

8.6.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing loss of equipment to the marine environment, reflects CGG's HSE Policy goals of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6)

Context	Factor	Demonstration
		• Environmental Performance Monitoring and Reporting (Section 9.3).
External	Natural Environment	**EPBC Policy Statement 1.1. – Significant Guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** Marine debris causing entanglement and ingestion was recognised in 2003 as a key threatening process for marine vertebrates under the EPBC Act. Pollution generally is also identified as a threat in several conservation advices / recovery plans for EPBC-listed species potentially occurring within the Operational Area. CGG has reduced and, where possible, eliminated any adverse impacts of marine debris from the activities of the seismic survey on turtles, cetaceans, sharks and birds, noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life (Commonwealth of Australia 2018). **Conservation values and objectives of the North-west Marine Parks Management Plan** Although the Operational Area is not located within any AMPs, management of loss of equipment is consistent with the management prescriptions of North and North-west Management Plans for AMPS. No impacts are predicted to occur to the cultural and socio-economic values of the AMPs.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to the loss of equipment during the Sauropod 3D MSS.
Legislation and Other	Legislation	The controls adopted for the loss of equipment to the marine environment will comply with the *Navigation Act 2012*, *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the *Environment Protection and Biodiversity Conservation Act 1999*.
Industry Standards	Industry Standards and Best Practices	Compliance with industry standards and best practices (where applicable).
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from loss of equipment to the marine environment meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, loss of equipment is very unlikely to result in to result in potential impact greater than localised seabed disturbance, and short-term disruption to marine users. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the risk have been investigated above. The adopted controls described in Section 8.6.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

8.6.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID		
EPO 13	No loss of equipment to the marine environment during the survey.	PS 13.1	PS 13.4	PS 13.6
		PS 13.2	PS 13.5	PS 13.7
		PS 13.3		

Number	Performance Standards	Measurement Criteria
PS 13.1	Solid streamers are used for the survey.	Inspection records verify solid streamers are used.
PS 13.2	The survey vessel operates under approved procedures for streamer deployment/retrieval and these procedures are adhered to at all times.	Approved procedures are available and used on-board all vessels.
PS 13.3	Streamer equipment are routinely maintained and inspected for wear and tear to ensure the equipment is fit-for-purpose.	Inspection records verify streamers are fit-for-purpose.
PS 13.4	Streamers are fitted with the following equipment: • SRDs • Surface marker buoys • Secondary retaining devices • Tail buoys.	Equipment deployed meets minimum specification requirements.
PS 13.5	Support vessels search for and retrieve lost in-water equipment (where possible and safe to do so).	Dropped objects recorded in incident report and vessel log.
PS 13.6	Marine relevant persons are notified (VHF Channel 16) in the event of a loss of in-water equipment.	Vessel log records notification on loss of equipment.
PS 13.7	Loss of equipment is reported to AMSA, as soon as practical.	Incident report/notification to AMSA.

8.7 Discharge: Loss of Hazardous or Non-Hazardous Solid Waste

8.7.1 Details of Impacts and Risks

Entanglement with, or ingestion by marine fauna may occur as a result of the unplanned loss of solid wastes (hazardous and non-hazardous waste) from the seismic and support vessels. Loss of solid waste also has the potential to cause a temporary/localised reduction in water quality and minor/temporary toxicity effects to marine biota.

Solid wastes may include non-biodegradable, non-hazardous wastes such as plastics, waste metal, glass and timber, and/or non-biodegradable hazardous wastes such as batteries and oil filters. Some solid waste generated onboard may be blown or knocked/dropped overboard.

Loss of solid wastes excludes scenarios involving detachment of operational equipment (i.e. streamers and the survey array), which is assessed in Section 8.6. Impacts associated with the discharge of putrescible wastes is assessed in Section 7.5.

8.7.1.1 Source of Impact/Risk

- Water quality
- Ancient coastline at the 125 m depth contour KEF.
- Marine biota.
- Marine fauna.
- Cultural features and heritage values.

8.7.2 Impact/Risk Evaluation

The seismic and support vessels will generate a variety of solid wastes including non-hazardous wastes (e.g. paper, plastics, waste metal and glass) and/or hazardous wastes (e.g. batteries and oil filters). Hence, there is the potential for solid wastes to be discharged to the marine environment.

Discharge of solid wastes have the potential to:

- Temporarily create a localised change in water/sediment quality resulting in localised, minor and temporary ecological impacts
- Cause injury, ingestion or entanglement by marine fauna.

8.7.2.1 Water/Sediment Quality

Impacts to water quality resulting from the unplanned loss of solid wastes are expected to be minor, temporary and highly localised. The resulting change in water quality in the water column will be highly localised and short term. Impacts to sediment quality are also expected to be minor, temporary and highly localised. Therefore, significant impacts to marine biota are not expected.

8.7.2.2 Marine Fauna

The risk associated with the loss of solid wastes to marine fauna, including those of cultural importance, involves direct interaction between the waste and organism, which may result in fauna mortality or injury through ingestion or entanglement.

Interaction may occur with marine fauna, including culturally important and EPBC listed species such as cetaceans, marine turtles and whale sharks in the:

- Pelagic zone (floating wastes / temporarily floating wastes); and/or
- Benthic zone (wastes that descend the water column to the seabed).

Solid wastes will not be discharged to sea but rather will be stored on-board the seismic vessel and support vessels prior to transfer to a supply vessel for onshore recycling or disposal. Where practical, solid waste will be minimised, and non-hazardous waste will be either reused or recycled.

Windblown waste is likely to be a rare event as wastes will be stored in closed/covered containers. In the event of waste blown overboard, attempts would be made to recover it. There is the potential for windblown wastes to not be recovered

from the marine environment, which may impact fauna via ingestion or entanglement. Ingestion or entanglement by marine fauna has the potential to result in serious injury or mortality.

Lost heavy solid wastes descending the water column will settle on the seabed, potentially causing minor disturbance to sediment and sessile benthic organisms. Benthic habitats within the Operational Area are considered to generally comprise of relatively little seabed structure or sessile epibenthos (Section 4.3.2). Any impact associated with this risk would be highly localised and proportional to the size/type of the solid waste.

Consequently, the potential impacts to marine fauna as a result of windblown waste or waste knocked/dropped overboard are unlikely and would be limited to individual occurrences.

8.7.2.3 Summary

Considering the required controls, the consequence resulting from the risk of occasional short term and localised disturbance to marine fauna and benthic habitat of cultural importance from the unplanned discharge of hazardous and non-hazardous solid waste is Minor (1). The likelihood of this consequence occurring is Rare (A) and the risk is considered to be Low.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

8.7.3 Decision Context

The decision context for loss of solid wastes has been assessed as ‘Type A’, given the impacts/risks are well understood, uncertainty is minimal and little or no relevant person interest.

8.7.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements			
In accordance with MARPOL Annex V and Marine Order 95: • Vessels 100 GRT (or certified for 15 persons on-board) will have a Waste Management Plan • Vessels ≥400 gross tonnes (or certified for 15 persons on-board) will have a waste management logbook	Yes	Vessels engaged for the survey that are of 100 GRT or certified to carry more than 15 people will have a Waste Management Plan and vessels ≥400 gross tonnes or certified to carry more than 15 persons, will hold a Waste Management Logbook. It is a legislative requirement for vessels to comply with MARPOL and AMSA Marine Orders.	14.1
Marine Order 94 – packaged harmful substances, which requires: • Vessels carrying harmful substances in packaged form must comply with regulations 2 to 5 of MARPOL Annex III, with respect to stowage requirements A substance may only be washed overboard if: • The physical, chemical and biological properties of the substance have been considered • Washing overboard is considered the most appropriate manner of disposal • The vessel master has authorised the washing overboard.	Yes	Vessels used for the survey will comply with regulations 2 to 5 of MARPOL Annex III and the vessel Master will comply with Marine Order 94. It is a legislative requirement for vessels to comply with AMSA Marine Orders.	14.2
Good Industry Practice			
Bins available for the segregation of waste as per the vessel Waste Management Plan, and bins for potentially wind-blown waste are covered (e.g. using lids or netting).	Yes	Bins will be used to segregate wastes on vessels in accordance with the vessel Waste Management Plan and covered bins will be used to prevent windblown waste. The control is considered good practice, is well defined and established standard practice by the offshore petroleum sector. While adoption of the control does not reduce the likelihood or consequence of the risk, implementation is considered to provide overall benefit to the risk.	14.3
Recycling or reuse of non-hazardous solid waste where possible.	Yes	Non-hazardous solid waste generated on-board the vessel will either be recycled where practical or reused. Good industry practice, environmental benefit outweighs additional cost.	14.4
Alternatives/Substitutes Considered			
No practicable alternative or substitutes to the above the controls have been identified	N/A	N/A	N/A
Additional Controls Considered			
No practicable alternative or substitutes to the above the controls have been identified	N/A	N/A	N/A
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No practicable alternative or substitutes to the above the controls have been identified	N/A	N/A	N/A
ALARP Statement			
The residual risk associated with the unplanned loss of solid waste has been determined to be Low. CGG considers the adopted control measures appropriate to manage the risks of a loss of solid waste. As the risk has been classified as 'Type A' and no reasonable additional or alternative controls were identified that would further reduce the impacts and risks, without jeopardising the objectives of the survey, the risk is considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Minor (1)	Rare (A)	Low

8.7.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing the loss of soil waste, reflects CGG's HSE Policy goals of proactively identifying hazards, eliminating impacts where possible and where this is not possible managing the risk to ALARP.
	Company Standards/Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Natural Environment	**EPBC Policy Statement 1.1. – Significant guidelines**

Context	Factor	Demonstration
		The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines:** Marine debris causing entanglement and ingestion was recognised in 2003 as a key threatening process for marine vertebrates under the EPBC Act. Pollution generally is also identified as a threat in several conservation advice / recovery plans for EPBC-listed species potentially occurring within the Operational Area. CGG has reduced and, where possible, eliminated any adverse impacts of marine debris from the activities of the seismic survey on turtles, cetaceans, sharks and birds, noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life (Commonwealth of Australia 2018). **Conservation values and objectives of the North-west Marine Parks Management Plan** Although the Operational Area is not located within any AMPs, management of discharges in accordance with the requirements of MARPOL meets the management prescriptions outlined in the North and North-west Management Plans for AMPs. Unplanned loss of solid waste will not occur in AMPs.
	Relevant Persons Expectations	No specific concerns have been raised by relevant persons relating to loss of solid waste.
Legislation and Other	Legislation	The proposed controls meet or exceed the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and associated AMSA Marine Orders made under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* for the management of discharges at sea.
Industry Standards	Industry Standards and Best Practices	The impact/risk will comply with industry standards and good practice by using bins to segregate wastes on vessels in accordance with the vessel Waste Management Plan. Covered bins with tight lids will be used to prevent windblown waste.
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from loss of hazardous or non-hazardous solid waste meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, loss of solid waste is unlikely to result in potential impact greater than localised and short-term local concern to water quality and marine biota. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls described in Section 8.7.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

8.7.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID	
EPO 14	No releases of solid hazardous or non-hazardous waste to the marine environment during the survey.	PS 14.1	PS 14.3
		PS 14.2	PS 14.4

Number	Performance Standards	Measurement Criteria
PS 14.1	Seismic vessel and support vessels are compliant with Marine Order 95 – pollution prevention – Garbage: • Vessels 100 GRT (or certified for 15 persons on-board) will have a Waste Management Plan • Vessels ≥400 gross tonnes (or certified for 15 persons on-board) will have a waste management logbook	Records demonstrate any non-compliance with Marine Orders is documented.
PS 14.2	Seismic vessel and support vessels are compliant with Marine Orders 94 – packaged harmful substances which provides information about preventing harmful substances carried by regulated Australian vessels, from entering the marine environment, which requires: • Vessels carrying harmful substances in packaged form must comply with regulations 2 to 5 of MARPOL Annex III, with respect to stowage requirements • A vessel Master may only wash a substance overboard if: • The physical, chemical and biological properties of the substance have been considered • Washing overboard is considered the most appropriate manner of disposal • The vessel Master has authorised the washing overboard.	Records demonstrate any non-compliance with Marine Orders is documented.
PS 14.3	Hazardous and non-hazardous waste will be managed in accordance with the vessel Waste Management Plan, which requires: • Dedicated waste segregation bins. • Records of all waste to be disposed, treated or recycled onshore. • Waste streams shall be handled and managed according to their hazard and recyclability class.	Pre-Mobilisation Inspection Report confirms that a vessel Waste Management Plan is on the vessel Documented evidence that the vessel Waste Management Plan is included in induction content Records demonstrate compliance against implemented vessel Waste Management Plan.
PS 14.4	Non-hazardous solid waste is recycled or reused where possible.	Records demonstrate compliance against implemented vessel Waste Management Plan.

8.8 Introduction of Invasive Marine Species: Ballast Water and Biofouling

8.8.1 Details of Impacts and Risks

8.8.1.1 Source of Impact/Risk

Potential introduction of invasive marine species (IMS) via unmanaged vessel biofouling or the discharge of ballast water from vessels within the Operational Area.

IMS are non-indigenous marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish invasive populations. The survey and support vessels operating in the Operational Area have the potential to introduce IMS via the following mechanisms:

- Discharge of ballast water containing IMS
- Translocation of IMS through biofouling of the vessel hull, internal sea water systems (e.g. sea chests, bilges) or immersible equipment (e.g. towed seismic source and streamers).

The survey and support vessels will operate out of an Australian port (likely Port Hedland). Should a survey or support vessel arrive in Australia from overseas, it will enter Australian territory via an Australian port prior to mobilising to the Operational Area.

8.8.1.2 Receptors

- Marine ecological communities
- Ancient coastline at the 125 m depth contour KEF.
- Cultural features and heritage values.

8.8.2 Impact/Risk Evaluation

IMS are widely recognised as potentially significant threats to marine ecosystems worldwide. Shallow coastal marine environments in particular, are thought to be amongst the ecosystems most susceptible to the establishment of IMS, which largely reflects the accidental transport of IMS by international shipping to marinas and ports (Commonwealth of Australia 2009; Wells *et al.* 2009). The availability of suitable habitat, such as hard substrate or artificial structures are also conducive to the settlement and establishment of IMS (Glasby *et al.* 2007; Dafforn *et al.* 2009a, 2009b; Wells *et al.* 2009).

Not all organisms that are translocated to an area outside of their natural range will survive to establish as IMS, with the majority of introduced species failing to establish (Williamson and Fitter 1996; Paulay *et al.* 2002). The successful survival and subsequent establishment of an IMS is dependent on a number of factors, including:

- Presence and potential for uptake of organisms at a point of origin prior to translocation, such as a port, harbour or within coastal waters
- Activities undertaken by the vessel (both at origin and destination) that favour successful establishment of the IMS, such as low speed or stationary vessel activities in shallow water locations
- Environmental conditions during transit and at destination compared with the point of origin, such as water temperature, salinity and light availability
- Availability of suitable habitat on which to settle, grow, reproduce and establish a population.

Once introduced, IMS may be irreversible and can have significant impacts on the marine ecosystem. Invasive organisms may have few or no predators or natural competition, resulting in IMS potentially outcompeting native species for food or habitat, preying on native species, and/or changing the nature of the environment. This may result in an alteration to the structure (species biodiversity and abundance) and the functioning of ecological communities. Introduction of IMS also has the potential to introduce pathogens to the marine environment, which can be detrimental to native organisms.

During the Sauropod 3D MSS, vessels will be moving for the majority of the time and will not be stationary for prolonged periods and so are less conducive to the translocation of IMS than stationary vessels. The water depths in the Operational Area range from approximately 95 m to 172 m. The bathymetry within the Operational Area is predominately characterised by relatively flat seabed without shallow bathymetric features. In addition, the substrate is predominantly calcareous gravel, sand and silt, which support relatively little seabed structure or sessile epibenthos. Areas of hard substrate and topographic relief supporting filter feeder communities may occur in association with the ancient coastline at the 125 m depth contour

KEF. Therefore, given the nature of the survey activities, the relatively deep-water location and limited availability of suitable habitat provides relatively unfavourable environmental conditions for most IMS to become established and spread. However, in the unlikely event that IMS were introduced to the Operational Area by the survey and support vessels and were successful in establishing on substrates associated with the ancient coastline at the 125 m depth contour KEF, this could result in long-term-impacts to the these regionally significant ecological communities. Changes to ecological communities may also impact socio-economic receptors such as commercial fisheries, by affecting target fish stocks or through food chain related impacts.

Given the unfavourable water depths, environmental conditions (i.e. low light penetration at the seabed), and the limited availability of suitable habitat in the Operational Area, establishment of IMS is not expected to occur. However, any localised introduction of IMS in the Operational Area, including the ancient coastline at the 125 m depth contour KEF, may result in long-term changes to ecological communities in the form of decreased ecological diversity or ecosystem health, and potential for indirect effects to commercial fisheries. If unmanaged, the potential consequence of localised but medium-term impacts is assessed as Moderate (2).

Given the environmental conditions in the Operational Area, the mobile nature of the survey and support vessels and the implementation of the identified controls (Section 8.8.4), the consequence is considered to be Moderate (2) and the likelihood of IMS being introduced and subsequently becoming established is reduced to Rare (A), resulting in a Low level of residual risk.

Fauna within and adjacent to the Operational Area that are of cultural importance to First Nations peoples are described in Section 4.4.8. The assessment of IMS impacts to marine organisms and environmental values described above details the potential impacts of IMS on the relevant environmental values described in the existing environment. The potential impacts of IMS on the environmental values that are also sea country values and totemic species have therefore been assessed above and will be managed to ALARP and Acceptable levels by the management measures. For intangible cultural heritage values that are not able to be physically assessed for impacts of IMS, any disruption to these values is likely to be temporary and for the duration of the survey.

Further information about the selected control measures, the ALARP evaluation, and the demonstration of Acceptability are provided below.

8.8.3 Decision Context

The decision context for the potential introduction of IMS has been assessed as ‘Type A’, given the impacts/risks are well understood, good practice is well defined, the conditions in the Operational Area are of limited environmental sensitivity with respect to IMS, and there is little or no relevant person interest.

8.8.4 Identification of Control Measures and Demonstration of ALARP

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Legislative Requirements and Good Industry Practice			
Seismic vessel and support vessels will have Department of Agriculture, Fisheries and Forestry biosecurity clearance prior to mobilising to the Operational Area.	Yes	Vessels are required to submit a pre-arrival report prior to entering Australian territorial waters and obtain Department of Agriculture, Fisheries and Forestry (DAFF) biosecurity clearance. Clearance confirms that the vessel meets the requirements of the *Biosecurity Act 2015* and Biosecurity Regulations 2016 for entry into Australian waters, including review of a ballast water report by a biosecurity officer. Mobilisation of the vessels to the Operational Area will only occur after clearance is confirmed. Clearance confirms that the vessel does not present a high risk to the marine environment in Australian waters and therefore reduces the likelihood of IMS being translocated to the Operational Area. The Ballast Water Report provided during reporting identifies if the vessel has or intends to discharge internationally sourced ballast water, and management will be conducted as determined by DWAR.	15.1
Vessels will also have an anti-fouling system that is compliant with the prescriptions of the International Convention on the Control of Harmful Anti-fouling systems on ships 2001, the requirements of the *Protection of the Sea (Harmful Antifouling Systems) Act 2006* and Marine Order 98 (Marine pollution - anti-fouling systems) 2013.	Yes	Vessels will have an anti-fouling system that is compliant with the International Convention on the Control of Harmful Anti-fouling systems on ships 2001, the requirements of the *Protection of the Sea (Harmful Antifouling Systems) Act 2006* and Marine Order 98 (Marine pollution - anti-fouling systems) 2013. An anti-fouling coating provides a level of protection to reduce the establishment of marine organisms on hulls and in niches, and therefore reduces the likelihood of IMS being introduced through biofouling.	15.2
Compliant with the Australian Ballast Water Management Requirements, vessels will manage ballast water exchange/discharge using one of the following approved methods of management including: • An approved ballast water management system • Ballast water exchange conducted in an acceptable area * • Use of low-risk ballast water (e.g. fresh potable water, water taken up on the high seas, water taken up and discharged within the same place) • Retention of high-risk ballast water on-board the vessel • Discharge to an approved ballast water reception facility. *Acceptable area is as defined in the Biosecurity (Ballast Water and Sediment) Determination 2017.	Yes	Once in the Operational Area, vessels are not anticipated to exchange/discharge ballast water. Any requirement to do so will comply with the Australian Ballast Water Management Requirements, which are consistent with international good practice and the Ballast Water Management Convention. Management of ballast water reduces the likelihood of IMS being introduced to the Operational Area by preventing the exchange of high-risk ballast water.	15.3
Vessels will have an approved Ballast Water Management Plan (BWMP) and valid Ballast Water Management Certificate (BWMC) unless an exemption applies or is obtained from DWAR.	Yes	In accordance with the Australian Ballast Water Management Requirements, vessels will have a BWMP that details the approved ballast water management method. A BWMC verifies the vessel has been surveyed to a standard compliant with the Ballast Water Convention. Management of ballast water reduces the likelihood of IMS being introduced to the Operational Area by preventing the exchange of high-risk ballast water.	15.4
Vessels will maintain complete and accurate records of ballast water exchange that complies with Section B, Regulation B.2. of the Annex to the Ballast Water Convention.	Yes	Records identify when ballast water is taken on-board; circulated or treated for ballast water management purposes; and discharged to the sea or a reception facility; and accidental or other exceptional discharges of ballast water. Ballast water records will be used to confirm that ballast water management is undertaken in accordance with the Australian Ballast Water Management Requirements, as detailed above.	15.5
Biofouling risk assessment	Yes	A biofouling risk assessment will be completed for each vessel mobilised from overseas or from other regions in Australia prior to mobilising to the Operational Area. CGG will use the Biofouling Risk Assessment Tool 'Vessel Check' developed by the WA DPIRD (or equivalent). The assessment will focus on hulls, niche areas, sea water systems and immersible equipment, and consider previous biofouling inspections, cleaning or treatment of biofouling, the vessels voyage history, and relevant biofouling management measures. Mitigation will be implemented that is commensurate to the level of risk, as appropriate to ensure the vessel and equipment poses a low risk of introducing IMS. For vessels determined to have a LOW biofouling risk, the vessel is deemed suitable for use in the Sauropod 3D MSS without corrective actions. For vessels determined to have a MEDIUM or HIGH risk, the vessel contractor will need to engage a qualified independent third-party marine pest inspector to determine the corrective actions to reduce the vessel IMS risk to low. The vessel contractor must demonstrate to CGG that all corrective actions have been implemented and reassessment of the vessel prior to mobilisation determines the risk to be low. This control and implementation of any associated corrective actions will reduce the likelihood of IMS translocation and establishment from biofouling.	15.6

Control Measure	Control Adopted	Justification	Performance Standard Ref.
Alternatives/Substitutes Considered			
No discharge of ballast water from vessels.	No	Although, ballast water exchange is not expected to occur during routine survey activities, the possibility of discharge or exchange cannot be ruled out completely. Ballast water exchange and uptake may be required in unexpected circumstances where the safety of persons on-board the vessel is a necessity. Ballast water will already be managed in accordance with the Australian Ballast Water Management Requirements and the likelihood of introducing IMS via ballast water is highly unlikely. The control is not practicable to implement and is grossly disproportionate to the limited environmental benefit that would be gained in addition to existing controls.	N/A
Additional Controls Considered			
Hull cleaning and/or new antifouling coat application to vessel hull and niche areas on every occasion prior to entry into the NWMR.	No	Given the existing control measure to undertake a biofouling risk assessment, this control measure may not be commensurate to the level of risk. Should the risk assessment determine a vessel to have a medium or high IMS risk from biofouling, further inspections or cleaning may be implemented. However, the cost of undertaking inspections and hull cleaning could range from tens to hundreds of thousands of dollars. This is not practicable to implement in all cases and is disproportionate to the level of risk if the existing risk profile for a vessel is already low.	N/A
All towed seismic equipment (source and streamers) have been removed from the water, inspected and cleaned (where required) prior to deployment in the NWMR.	Yes	Transfer of immersible equipment will result in equipment being stored out of water, which reduces the potential for marine fouling to survive transport. Equipment will also be inspected and cleaned prior to deployment in Australian waters, which reduces the risk of introducing IMS and also increases performance of the equipment.	15.7
Improvements Considered to Effectiveness of Controls (Functionality, Availability, Reliability, Survivability, Independence and Compatibility)			
No further improvements have been identified that can practicably reduce the level of risk.	N/A	N/A	N/A
ALARP Statement			
CGG considers the adopted control measures appropriate to manage the impacts and risks of IMS. As the impact/risk has been classified as 'Type A', all legislative and good practice controls, as well as additional controls have been identified that further reduce the impacts and risks, without jeopardising the objectives of the survey, the impacts and risks are considered to be ALARP.			

Risk Ranking	Consequence	Likelihood	Risk Ranking
Residual Risk	Moderate (2)	Rare (A)	Low

8.8.5 Demonstration of Acceptable Levels

Context	Factor	Demonstration
Internal	CGG Policy	The risk management strategy for managing the potential to introduce IMS, reflects CGG's HSE Policy goals of proactively identifying hazards, eliminating impacts where possible and, where this is not possible, managing the risk to ALARP.
	Company Standards/ Systems	Section 9 details the relevant management system processes adopted to implement and manage impacts/risks to ALARP: • Contractor and Supplier Management (Section 9.6) • Environmental Performance Monitoring and Reporting (Section 9.3).
External	Natural Environment	**Natural environmental setting of the Sauropod 3D MSS** The water depths and environmental conditions within the Sauropod 3D MSS Operational Area present limited potential for the introduction and establishment of IMS and the residual risk is low. **EPBC Policy Statement 1.1. – Significant guidelines** The residual risk has been assessed as low and will not have a significant impact upon protected matters in accordance with EPBC Policy Statement 1.1. – Significant guidelines. **Conservation Advice, Recovery Plans, and Other Guidelines** IMS is identified as a key threat in several conservation management plans, with actions focusing on the prevention of their introduction. The proposed control measures are consistent with these actions. **Conservation values and objectives of the North-west Marine Parks Management Plan** No IMS impacts are predicted to occur to the natural values within the AMPs.
	Relevant Persons Expectations	The Department of Agriculture, Fisheries and Forestry responded during relevant person consultation and outlined the need to comply with the requirements of the *Biosecurity Act 2015*, Biosecurity Regulations 2016, and Australian Ballast Water Management Requirements. The Department also provided information on biofouling management (including biofouling guidelines 2011) The control measures adopted meet the requirements of the *Biosecurity Act 2015*, Biosecurity Regulations 2016, and the Australian Ballast Water Management Requirements and are consistent with the National Biofouling Management Guidelines.
Legislation and Other	Legislation	The controls adopted will comply with the *Biosecurity Act 2015*, Biosecurity Regulations 2016, and the Australian Ballast Water Management Requirements.

Context	Factor	Demonstration
Industry Standards	Industry Standards and Best Practices	The controls adopted with regards to anti-fouling coatings, biofouling risk assessment and corrective actions are consistent with the National Biofouling Management Guidelines.
Ecological Sustainability Development (ESD)	ESD Application	Compliance with the principles of ESD is demonstrated.

Acceptability Statement
As identified in Section 6.7.1, impacts and risks classified as 'Decision Type A' are considered acceptable if the level of residual risk is determined to be low or medium and the criteria outlined in Table 6-7 are met. The evaluation of potential risk and impacts from introduction of invasive marine species meets these requirements as outlined above. The impact assessment has determined that, given the adopted controls, the Sauropod 3D MSS is highly unlikely to result in the introduction of IMS. Activities do not have a significant impact on MNES including those with an Indigenous connection with, or traditional use in nearshore areas as defined in Section 4.4.8. Further opportunities to reduce the risk have been investigated above. The adopted controls described in Section 8.8.4, are considered industry best practice and meet legislative requirements. CGG considers the adopted control measure to be appropriate to manage the activity to an acceptable level.

8.8.6 Environmental Performance Outcomes, Standards and Measurement Criteria

Number	Environmental Performance Outcomes	Relevant Performance Standard ID		
EPO 15	Prevent the introduction and establishment of IMS in the marine environment as a result of the Sauropod 3D MSS	PS 15.1	PS 15.4	PS 15.6
		PS 15.2	PS 15.5	PS 15.7
		PS 15.3		

Number	Performance Standards	Measurement Criteria
PS 15.1	CGG verify that vessel contractors comply with pre-arrival reporting obligations defined in the *Biosecurity Act 2015* and that biosecurity clearance / low risk status is obtained from DAFF prior to mobilisation to the Operational Area.	Pre-mobilisation vessel audit confirms vessels have received documentation of DAFF release from biosecurity control or low risk status.
PS 15.2	All vessels have an anti-fouling system that complies with the requirements of Annex 1 of the International Convention on the Control of Harmful Anti-fouling systems on ships 2001, the requirements of the *Protection of the Sea (Harmful Antifouling Systems) Act 2006* and Marine Order 98 (Marine pollution - anti-fouling systems) 2013.	Pre-mobilisation vessel audit confirms vessels have current anti-fouling certification that complies with the stated convention, Act and Marine Order.
PS 15.3	Vessels operating within Australian seas manage ballast water discharge in accordance with the Australian Ballast Water Management Requirements using one of the following approved methods of management including: • An approved ballast water management system • Ballast water exchange conducted in an acceptable area* • Use of low-risk ballast water • Retention of high-risk ballast water on-board the vessel • Discharge to an approved ballast water reception facility. *Acceptable area is as defined in the Biosecurity (Ballast Water and Sediment) Determination 2017.	Pre-mobilisation vessel audit confirms vessels have a BWMC and BWMP that provides for ballast water management in accordance with the Australian Ballast Water Management Requirements. Ballast water records confirm that ballast water management was undertaken in accordance with the Australian Ballast Water Management Requirements.
PS 15.4	Vessels have an approved BWMP and valid BWMC, unless an exemption applies or is obtained from DWAR.	Vessels have an approved BWMP and valid BWMC on-board.
PS 15.5	Vessels maintain complete and accurate records of ballast water exchange that complies with Section B, Regulation B.2. of the Annex to the Ballast Water Convention.	Records demonstrate the ballast water exchange records are maintained.
PS 15.6	A biofouling risk assessment, in accordance with WA DPIRD 'Vessel Check' (or equivalent) is completed for all MSS vessels mobilising from overseas or from other bioregions of Australia, prior to arrival within the NWMR. Where required, mitigation measures commensurate to the risk are implemented to ensure the vessel risk profile is reduced to 'Low' in accordance with WA DPIRD 'Vessel Check' (or equivalent).	Vessel-specific biofouling risk assessment (WA DPIRD 'Vessel Check' or equivalent) confirming the vessel presents a low risk and records of mitigation measures implemented (if required).
PS 15.7	The seismic source and towed streamers have been removed from the water, inspected and cleaned (where required) prior to deployment in the NWMR.	Pre-mobilisation vessel audit confirms seismic source and towed streamers have been removed from the water, inspected and cleaned (where required).

9 Implementation Strategy

CGG's implementation strategy for this EP has been developed to comply with the requirements of Regulation 22(1) of the OPGGS(E) and describes the specific measures and arrangements that will be implemented for the duration of the activity to ensure that:

- All environmental impacts and risks of the activity will be continually identified and reduced to a level that is ALARP
- Control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and acceptable levels
- Environmental performance outcomes and standards set out in the EP are met
- Arrangements are in place to respond to, and monitor impacts of, oil pollution emergencies
- Relevant person consultation is maintained throughout the activity as appropriate.

The implementation strategy outlines a systematic approach that describes:

- The management systems by which the control measures identified in the risk assessment will be implemented
- The implementation of control measures will be monitored to ensure environmental risks continue to be managed to ALARP
- The ongoing relevant person consultation process prior to and during the activity
- Monitoring, auditing and reporting of environmental performance for activities carried out under the EP
- Arrangements in place to respond to, and monitor impacts of, oil pollution emergencies.

The implementation strategy for this EP has considered lessons learnt from the implementation of previous campaigns and inspection recommendations.

9.1 Environmental Management System

The Sauropod 3D MSS will be conducted under the framework of the CGG Environment and HSE Policies (Appendix A:), CGG Environmental Management Procedure, CGG Health, Safety, Environment and Social Responsibility Operating Management System (HSE-OMS) and the survey vessel's HSE MS.

The program will also operate under a project-specific HSE plan that CGG and the vessel operator will develop for the Sauropod 3D MSS. The Project HSE Plan is a tailored document that ensures CGG's environmental management standards and intended performance outcomes are achieved at operational level throughout the activity, while identifying and enabling the selected seismic contractors' own procedures (if a contractor is used) to be utilised where appropriate; for example, for specific vessel operational controls. At all times, however, the seismic contractor will be required as a minimum to comply with all relevant requirements of CGG's HSE policies and standards. As described in CGG Environment Management Procedure, the Project HSE Plan will incorporate regulatory and client environmental requirements including procedures for the following:

- Emergency response
- Waste management
- Hazardous materials and handling
- Fuel/oil spills.

The seismic contractor's vessel HSE documentation will be reviewed for compliance with the relevant requirements described in this EP prior to the commencement of the activity. In the event of a gap between the existing plans and procedures and the requirements of this EP, a bridging document will be developed to ensure all control measures are adequately covered in the implementation of the EP and the hierarchy of control established.

9.2 Management of change

For the Sauropod 3D MSS, the following activities will trigger a Management of Change (MoC) process:

- A new scope (e.g. timing, location or changes to operational details such as vessel type, equipment, processes or procedures), which has the potential to impact on the environment not assessed for environmental impact previously or authorised in existing management plans and procedures (responsibility of the CGG Project Manager)
- Change to the existing activity, scope, equipment, process or procedures which have the potential to impact on the environment or interface with an environmental receptor (responsibility of the CGG Project Manager)
- Changes in the external environment managed and monitored by the CGG Project Manager (or delegate)
- Provision of new information that differs to that included in this EP, such as:
  - Potential changes in scientific knowledge regarding impacts and risks from seismic activities
  - New environmental sensitivities within or adjacent to the survey area
- Issue of new regulatory requirements (e.g. AMP Management Plans)
- Identification of KEFs, threatened or migratory species or critical habitats/BIAs not identified in the EP
- Identification of new relevant person objections or claims that are assessed to have merit
- Non-conformances (audits, inspections, etc.) which identify control measures may no longer manage environmental impact/risk to ALARP or acceptable criteria. Non-conformances are monitored by the CGG offshore representative
- Incidents which identify new or increased impacts and risks arising from activities not previously identified in the accepted EP. Incidents are monitored by the CGG offshore representative.

Any change to the Sauropod 3D MSS shall be directed to the CGG offshore representative and the CGG Project Manager for initial assessment. The change shall be assessed for environmental impact/risk in accordance with the CGG risk methodology and any implications determined for the environment and associated regulatory document revisions.

A risk assessment will accompany any MoC with identified environmental impacts/risks in accordance with the CGG Risk Management and Management of Change Process (refer Section 6 and Section 9.2).

For changes (e.g. additional controls implemented) identified in the risk assessment process, if relevant person interests, activities or functions are affected by the change, relevant persons will be advised, and feedback invited on the proposed change.

Additional controls identified as part of the MoC shall be effective in reducing the environmental impact and risk to a level which is ALARP and acceptable; and meet the nominated EPOs and EPSs set out in the accepted EP for the activity. Note: Existing EPOs and EPSs cannot be altered from those set out in the accepted EP. If EPOs/EPSs cannot be met, a recordable or reportable incident will be registered for the activity.

9.3 Environmental Performance Monitoring, Inspection, Audit and Reporting

9.3.1 Pre-survey inspection and audit

Prior to the survey, CGG will undertake:

- A vessel audit/inspection to confirm that the vessel management systems are consistent with the environmental management controls detailed in this EP. This will ensure that procedures and equipment for managing routine discharges and emissions are in place to enable conformance with the EP. The audit will be documented, and any corrective actions closed out and tracked through the CGG management system.
- A review of the risk of IMS, potentially including an inspection to confirm that the vessel does not pose an unacceptable risk of IMS.
- An audit of the on-board spill response capability of the seismic vessel against its SOPEP and relevant controls in this EP, to verify spill preparedness
- A review to ensure that the EP Assurance procedure has been communicated to relevant personnel.

9.3.2 Monitoring, auditing and management of non-conformance

CGG will maintain a quantitative record of emissions and discharges as required under Regulation 22(6) of the OPGGS(E). This record will include all emissions and discharges to the air and water and can be monitored and audited against the environmental performance standards. A summary of these results will be reported in the Sauropod 3D MSS Environmental Performance Report to be submitted to NOPSEMA three months after the completion of the Sauropod 3D MSS.

CGG will monitor the performance of the control measures during the activity in line with the Project HSE Plan and CGG Environment Management document. Environmental performance during the survey will be reviewed to ensure that:

- EPOs and EPSs are being met, reviewed and where necessary amended (to continue to reduce the environmental impacts and risks of the activity to ALARP).
- Potential non-conformances and opportunities for continuous improvement are identified and corrective actions implemented.
- All environmental monitoring requirements have been met before completing the activity.

The following arrangements will be established to review the environmental performance of the activity:

- Inspections of the vessels will be carried out before and during the survey to ensure that procedures and equipment for managing routine discharges and emissions are in place to enable conformance with the EP.
- The performance of key equipment as described in this EP (i.e. oil-in-water separator) will be checked to ensure ongoing reduction of risks and impacts to ALARP, and any potential issues (i.e. observations of poor operating condition/performance or non-conformances) are continually monitored and raised as soon as practicable
- Records of inspections against EP requirements are documented in the ECR.

CGG will develop and maintain an electronic Environmental Conformance Register for the activity, which details the environmental commitments, performance outcomes and criteria outlined in this EP. The Conformance Register is an audit tool to be used before and during the activity to demonstrate conformance of the activity with the environmental performance commitments made by CGG.

A summary of the EP commitments for the activity will be distributed aboard the survey vessel, and implementation of the environmental performance standards will be monitored by the CGG Client Site Representative.

Conformance will be monitored on a regular basis by the Client Site Representative, or delegate, via mechanisms including fortnightly audits during the activity. Conformance auditing or inspection during the Sauropod 3D MSS will be based on the Conformance Register and will target the following:

- Conformance with regulatory requirements detailed in this EP
- Management strategies and procedures to ensure EPOs and EPSs are being implemented, monitored, measured and evaluated
- Emissions and discharges are being monitored, measured and documented.

Non-conformances and opportunities for improvement will be identified and corrective actions will be tracked to completion utilising the seismic vessel's on-board action tracking system. Corrective actions will specify the remedial action required to fix the breach and prevent its reoccurrence and is delegated to the person deemed most appropriate to fulfil the action. Where more immediacy is required, non-compliances will be communicated to relevant personnel immediately and responded to as soon as possible. CGG will carry forward any areas of non-conformance identified during the Sauropod 3D MSS for consideration in future seismic campaigns to assist with continuous improvement in environmental management controls and performance outcomes.

All breaches of EPOs and EPSs in this EP are considered non-compliances and a recordable incident (refer to Section 9.12). Non-compliances may be identified during an audit, inspection, general observation or as a consequence of an incident.

9.3.3 Review

An end of survey HSE Review will be jointly conducted by CGG and the seismic contractor during the Post-survey Meeting.

This activity will enable the review of management and mitigation strategies implemented during the survey and, including reviews of performance, incident investigations, audits and field activity to identify actions for future seismic surveys, which can be implemented on a continuous improvement basis. The end of survey HSE Review will include a 'Lessons Learnt' section to facilitate incorporation of any recommended improvement actions in future seismic activities.

9.3.4 Record Management

In accordance with the Commonwealth OPGGS (E) Regulations - Regulation 52, CGG will store and maintain documents or records relevant to the EP implementation for a period of five years in a way that makes retrieval reasonably practicable.

9.4 Organisation Structure

Key roles and responsibilities for CGG and contractor (if used) personnel in relation to implementation, management and review of this EP are described in Table 9-1. It is ultimately CGG's responsibility to ensure all employees and contractors (if used) comply with the requirements of the CGG corporate HSE Policy and that the personnel are suitably trained and competent in their respective roles. Roles and responsibilities for environmental management during the activity are a combination of generic/standard professional duties, such as complying with shipboard garbage procedures, complemented by project-specific requirements arising from this EP, such as regulator-specific reporting arrangements. CGG will ensure that all employees and contractors associated with the Sauropod 3D MSS are inducted into the requirements of the corporate Environment Policy (Appendix A), particularly regarding the responsibilities associated with each role. CGG will further ensure that all personnel are suitably trained and competent in their respective roles.

A clear chain of command for the shore-based and vessel-based roles relating to the Sauropod 3D MSS is provided in Figure 9-1.

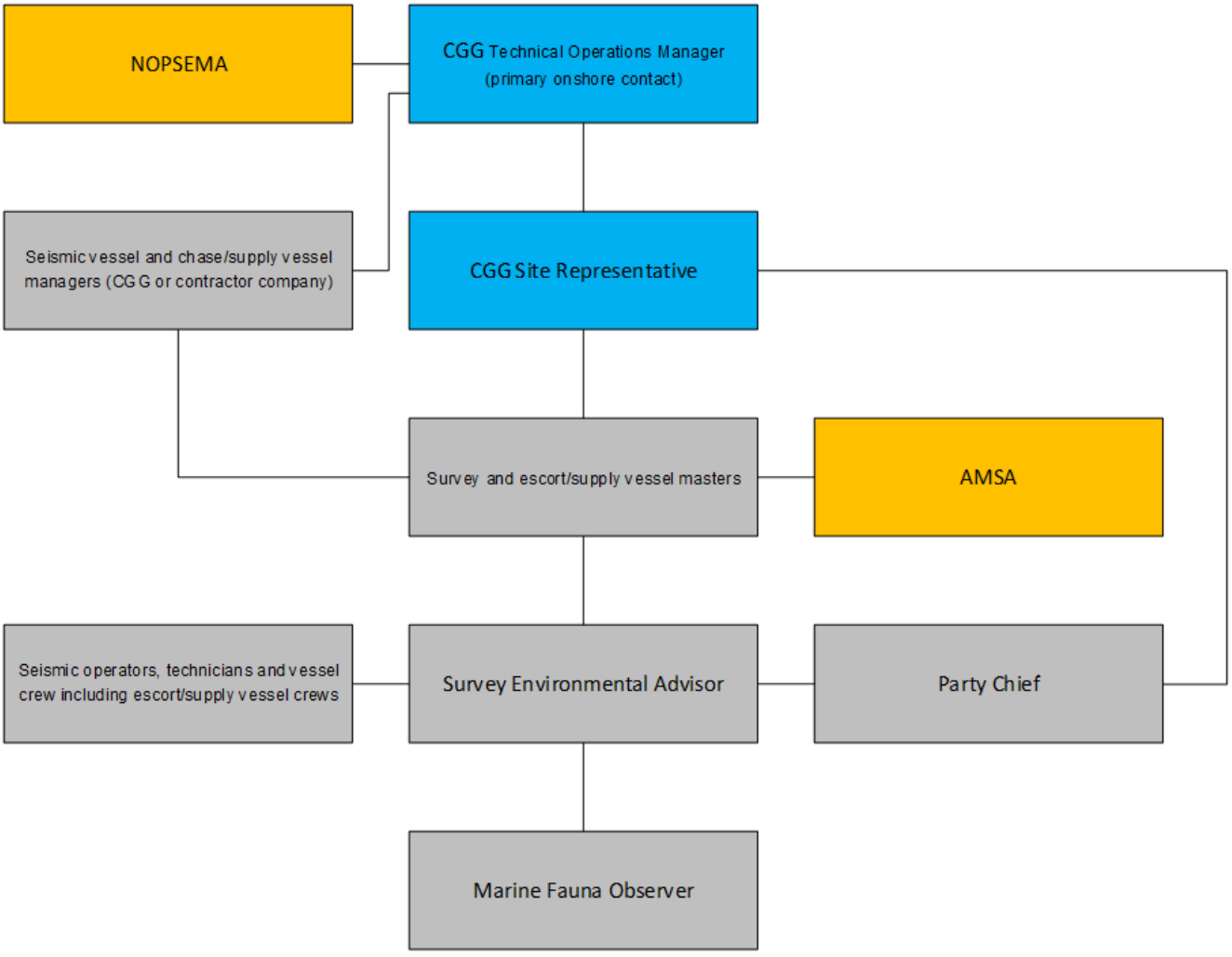


Figure 9-1 - Sauropod 3D MSS Organisation Structure

Roles and responsibilities as they relate specifically to Oil Spill Response are detailed in the Sauropod 3D MSS Oil Pollution Emergency Plan (OPEP) (Appendix H).

During contract award and on evaluation of the contractor's management system, specific on-board positions will be identified who are responsible for specific control measure implementation.

Table 9-1 – Roles and responsibilities

Role	Responsibility
CGG Technical Operations Manager (primary onshore contact)	• Ensure the activity is undertaken as per the performance outcomes of the EP. • Provide sufficient resources to implement management measures to achieve the performance outcomes of the EP. • Manage change requests for the activity and notifying the Survey Environmental Adviser (SEA) of any scope changes in a timely manner. • Liaise with regulatory authorities as required. • With the support of the SEA, ensure that ongoing monitoring for potential changes that may have a bearing on the EP are undertaken • Review the EP as necessary and manage change requests • Ensure environmental incident reporting meets regulatory requirements. • Monitor and close out corrective actions raised from environmental inspections/audits or incidents. • Commit resources to facilitate an emergency response strategy in the event of an incident. • Manage the CGG emergency response strategy in the event of an incident. • Review results of conformance audits conducted during the program and make recommendations where required. • Ensure that all reportable incidents are reported to NOPSEMA within 3 days of the incident occurring. • Ensure that all recordable incidents are reported to NOPSEMA as soon as practicable after the end of the calendar month, and not later than 15 days after the end of the calendar month. • Notify NOPSEMA of any spills in Commonwealth waters. • Ensure that a full briefing to all project personnel is provided, including details of the environmental sensitivities of the Acquisition Area and environmental management procedures and performance outcomes detailed in this EP. • Preparation of the Post-survey Environmental Review Report (PERR) and submission to NOPSEMA.
Seismic vessel and chase/supply vessel managers (CGG or contractor company)	• Vessel Quality, Health, Safety and Environmental (QHSE) performance (qualitative and quantitative) including but not limited to – Leadership by personal example and visible commitment to instil excellent QHSE behaviour and culture aboard – Establishing and reviewing the annual QHSE plan for the vessel – Ensuring the vessel's conformance with all company standards, policies and procedures – Ensuring major incidents (Lost Time Injury and/or Hi-Potential or above) are thoroughly investigated, root cause analyses performed, corrective actions completed, logged and closed out – Participation in key audits – Ownership of the vessel's HSE statistics, leading and lagging indicators and overall HSE performance – Ensuring that all relevant QHSE documentation is in place for the vessel, according to the company's QHSE Management System requirements.
Survey and escort/supply vessel masters	• Ensure the safe execution of all operations of the survey/supply/escort vessel • Overall responsibility for HSE management aboard the survey/supply/escort vessel • Ensure vessel operations are being conducted in accordance with the legislative requirements and this EP, including waste management, refuelling and emergency/oil spill response • Ensure vessel audits, inspections, emergency drills, training, HSE and inductions are undertaken • Ensure maintenance of equipment and records meet statutory requirements • Implement the vessel's SOPEP and OPEP procedures in the event of an oil spill, including first response to an incident using the resources immediately available to the vessel • Immediately notify the Client Site Representative of any incidents/activities arising from vessel operations that are likely to have a negative impact on the performance outcomes detailed in this EP • Support the Client Site Representative in ensuring that all relevant HSE documents are understood and adhered to • Report hydrocarbon or other chemical spillage to the Party Chief • Establish and maintain radio contact with other vessels in the Sauropod 3D MSS operational area and adjacent waters • Notify AMSA, the CGG Technical Operations Manager and the support vessels to report to seismic survey Vessel Manager in the event of a notifiable oil spill.

Role	Responsibility
Party chief	• Ensure safe execution of all operations carried out by the seismic crew aboard the survey vessel. • Ensure that the following documents are in place and aboard – CGG Sauropod HSE Plan – Emergency Response Procedures – HSE Management Procedures – Hazard Management Procedures – SOPEP and OPEP – this EP. • Ensure the seismic operations are conducted in accordance with – the CGG Environment Policy – Bridging Document between CGG, this EP and the seismic vessel contractor, if required – CGG plans, procedures and work instructions – relevant environmental legislative requirements or regulatory conditions – this EP. • Ensure the control measures adopted within this EP relating to operation of the seismic source are implemented to minimise potential environmental impacts resulting from seismic acquisition (e.g. pre-watch, soft-start procedures, stop-work procedures) • Ensure equipment used on site is inspected before use and as required during survey. • With assistance from others, inspect and maintain equipment, including environmental equipment. • Maintain all statutory test and inspection documentation for the marine equipment. • Provide a daily log of activities and environmental incidents to the Client Site Representative. • Ensure compliance with all aspects of HSE reporting and for investigations of all incidents and near misses. • Immediately notify the Client Site Representative of any incidents/activities arising from seismic operations that are likely to have a negative impact on the performance outcomes detailed in this EP.
CGG/client site representative (primary offshore contact)	• Ensure that the following documents are understood and adhered to – project HSE Plan and CGG HSE Plan – Emergency Response Procedures including survey vessel SOPEP – HSE Management Procedures – Hazard Management Procedures – Environmental Management Procedures – this EP • Facilitate clear communications between the Perth office, the CGG Technical Operations Manager, Vessel Manager and the survey vessel personnel • Ensuring all personnel have received a program environmental induction and the induction includes environmental sensitivities, control measures, specific roles and responsibilities of all vessel crew members • Ensuring day-to-day activities are monitored for conformance against this EP and the outcomes are reported to the Technical Operations Manager • Immediately alerting the Technical Operations Manager of any changes in operations which could impact negatively on environmental performance or for changes in operation which alter the environmental risk profile of the activity • Ensuring vessel inspections are undertaken in accordance with the requirements of this EP, CGG's procedures and the seismic vessel's procedures • Ensuring survey operations are carried out in accordance with the control measures and environmental performance standards adopted within this EP • Monitoring and reporting on the conformance of all EP commitments through observations and assessments of performance against the measurement criteria • Assisting with review, investigation and reporting all environmental incidents are reported to the Technical Operations Manager, appropriate levels of incident investigation are undertaken and corrective actions from incidents are tracked to completion on behalf of CGG • Ensuring incidents are fully investigated and corrective actions monitored to close-out • Facilitating clear communications between the Perth office, the Technical Operations Manager, Vessel Manager and the survey vessel crew • Ensuring data and records are collected for the Post-survey Environmental Performance Report (PEPR)

Role	Responsibility
	• Assisting the Technical Operations Manager in the preparation of the PEPR • Collating information for monthly recordable incident report and providing information to the Technical Operations Manager • Liaising with the Technical Operations Manager in the event of a change in the activity and updates the EP in accordance with the requirements of the OPGGS(E) Regulations • Performing MFO duties when the dedicated MFO is unable to, such as during short break periods • Immediately notify the Client Site Representative of any incidents/activities arising from seismic operations that are likely to have a negative impact on the performance outcomes detailed in this EP
Survey environmental advisor (SEA)	• Prepare environmental induction and vessel inspection information. • Provide a briefing to project personnel and survey vessel crew members of the environmental sensitivities of the Acquisition Area, environmental management strategies, EPO, and EPS detailed in the EP as part of the environmental induction process. • Ensure all relevant personnel have received and understood the spatial and temporal exclusions provided in the EP in relation to charts. • Assist with review, investigation and reporting of environmental incidents. • Ensure environmental inspections/audits are undertaken as per the requirements of the EP. • Maintain and advise Operations Manager of the status of the Corrective Action Register • Monitor and provide evidence of conformance to the environmental commitments as outlined in this EP and ensure the Conformance Register is updated. • Assist in preparation of external regulatory reports required for the survey, in line with environmental approval requirements and the CGG HSE incident reporting procedures. • Prepare a report of the overall environmental performance upon completion of the survey, including the results of audits and any incidents, and forward to the Project Manager. • Collate data for and assist in the preparation of the PERR.
Marine fauna observers (MFO)	• Ensure conformance with the relevant environmental performance requirements under this EP, including inspections and adequate fauna watch and implementation of EPBC Policy Statement 2.1 Part A and Part B management measures adopted for the survey. • Record any non-conformances with EPBC Act Policy Statement 2.1 management measures adopted for the survey. • Maintain and distribute records of marine mammal sightings and other species of concern and submitting daily and final survey sighting reports to the Client Site Representative and CGG Technical Operations Manager. • Submit notification of any incidents involving vessel collision and/or equipment entanglement with marine fauna, in accordance with the EPBC Regulations. • Provide environmental inductions for survey personnel (where relevant), including details of the environmental sensitivities of the Operational Area, control measures and performance outcomes and standards detailed within this EP. • Preparation of the MFO Report.
Seismic operators, technicians and vessel crew including escort/supply vessel crews	• Conduct activities in a professional and safe manner with attention to good housekeeping procedures and work practices. • Immediately report any incidents to the Survey Vessel Master and Party Chief. • Encourage improvement in environmental performance wherever possible. • Immediately report any environmental incidents or spillages (hydrocarbons or other chemicals) to the Survey Vessel Master and Party Chief.

9.5 Training and competencies

All personnel involved with the Sauropod 3D MSS will be given a project-specific environmental induction prior to commencing work. This induction will cover environmental responsibilities relevant to the duties and responsibilities of the roles described in Section 9.4 including:

- Environmental sensitivities and conservation values in the Acquisition Area and surrounding waters
- Environmental risks and potential impacts associated with the activity
- Waste management and chemical management procedures (including the vessel GMP)
- Emergency response and spill management procedures outlined in the OPEP and vessel SOPEP
- Procedures for marine fauna interactions (including MFO duties and obligations)
- Roles and environmental responsibilities of key personnel on board the survey vessel
- The importance of following procedures and using company processes (JSAs etc.) to identify environmental risks and mitigation measures
- Environmental performance outcomes, standards and measurement criteria to be complied with under the EP
- Procedures for reporting environmental hazards, incidents, near misses and opportunities for improvement
- Opportunities for employee communication and participation
- Relevant plans and procedures (CGG and seismic/supply/escort vessel contractor owned), including where they can be obtained on board the vessel.

A record of the induction will be retained by CGG's Technical Operations Manager with the endorsement of personnel who attended. All personnel are required to sign an attendance sheet to confirm their participation in and understanding of the induction. If a contractor is used, they will conduct their own company and vessel-specific inductions independently and in addition to the project-specific HSE induction.

9.5.1 Competency and Ongoing Awareness

CGG or the seismic vessel contractor (if used) will provide marine crew who are trained and competent to undertake their respective activities on board the vessel. All marine personnel will be qualified in accordance with the International Convention on Standards of Training Certification and Watch Keeping for Seafarers (STCW95).

Only appropriately experienced MFOs (as determined by a review of their CVs) will be utilised for the Sauropod 3D MSS. Evidence of experience includes, but is not limited to:

- Completion of an approved MFO/marine mammal observer (MMO) training course (including distance estimation training)
- The lead MFO will have served a minimum of five seismic survey campaigns in Australia or New Zealand and had the responsibility to
- Apply the EPBC Act PS 2.1 Part A and parts of Part B
- Establish robust communications protocol between MFO and the seismic operator, navigators or gun crew
- Train or supervise junior MFOs
- Write the compliance and sightings report at the completion of survey
- Time as a marine fauna conservation guide, participation in paid or voluntary cetacean research surveys
- Work at sea where marine mammal identification experience was achieved – with seismic MFO experience preferred
- Visual distance estimation experience/ability including "calibration" through the help of the marine bridge crew to provide distances to objects measured via the radar
- All marine fauna detection personnel will be familiarized with relevant EP commitments, knowledge of the measures contained in EPBC Act PS 2.1 and their responsibilities for implementing them.

The MMOs will provide an information session to control room operators and other essential personnel at the start of the survey regarding their fauna observation duties and the communication protocols required with the control room operators to ensure shutdowns and power downs occur efficiently.

The following activities will serve to reinforce and maintain ongoing environmental awareness of vessel personnel for the Sauropod 3D MSS. Records will be produced for each of these meetings:

- Project kick-off meeting: Held at the start of the activity and reviews the contractual and HSE specifications for the activity, the scope of work, vessel-specific HSE plans, environmental outcomes, performance standards and measurement criteria within this EP.
- Daily progress meetings (on board): Review all survey operations and incidents of the previous day, actions are recorded within the daily progress report.
- Toolbox meetings: Attended by all personnel involved in a specific operation (i.e. operations involving major hazards and/or involving more than one person). This meeting reviews the activity and reinforces the adoption of control measures within this EP to prevent adverse environmental and safety impacts. Recorded within the daily progress report.

All personnel will be encouraged to communicate any concerns, suggest improvements to the control measures implemented for any particular task or operation during the activity and comment on any proposed changes to equipment, systems, or methods of operation of equipment, where these may have HSE implications. Opportunities for personnel (including management, relevant contractors and MMOs) to participate in improving the management of environmental risks during the activity include:

- At the time of the induction
- During daily toolbox and pre-start meetings at the commencement of each shift and prior to commencing a new task (e.g. recovery of streamer)
- Identification of hazards based on incident and near miss reporting
- Providing suggestions for improvements to the Client Site Representative at any time.

CGG crew and contractors (including all vessel personnel) will be provided information on employee communication and participation during the project environmental induction prior to commencing the activity.

9.6 Contractor and Supplier Management

Seismic contractors considered for the Sauropod 3D MSS will be assessed against, and meet the following criteria:

- Compliance with all statutory requirements
- Have an acceptable HSEQ performance record in undertaking seismic activities
- Provide evidence of resources and competency in the services to be provided
- Services, procedures and vessel hardware comply with the requirements of this EP
- Any equipment to be used in the provision of survey services meets regulatory requirements, is fit-for-purpose and has all equipment, testing and verification certificates.
- Specific requirements, which need to be assessed at tender evaluation stage includes:
- The acoustic source is confirmed to be 2,820 in^3 or less.
- Specific requirements that need to be assessed prior to vessel mobilisation to the Operational Area include:
- All vessels transiting from outside of the NWMR must be assessed for biofouling risk and have the relevant biosecurity clearance from DWAR (refer Section 8.8).

EP implementation activities with the selected seismic contractor have been described throughout Section 9.

9.7 Emergency Response

CGG's emergency preparedness and response arrangements will be included within the Project HSE Plan. In addition, the seismic vessel will be expected to have a vessel-specific Emergency Response Plan (ERP) and SOPEP. These documents will be reviewed by CGG to ensure they meet the requirements for emergency and oil spill response specified within this EP.

As the Sauropod 3D MSS is vessel-based, it is considered appropriate that operational response to an emergency would be handled by CGG using their existing emergency response procedures and the vessel-specific ERP and SOPEP. The ERP, SOPEP and OPEP will be tested prior to the commencement of the survey.

CGG reviews specific activities, equipment and workplaces to identify possible emergency situations that may arise. CGG would ensure that any subcontracted vessel operator has established systems to ensure emergency plans are developed, implemented and maintained and that these plans address those incidents that are reasonably foreseeable. Information that is considered when identifying potential emergency situations include the following:

- Results of hazard identification and impact/risk assessments
- Legal requirements
- Previous incident (including accident) and emergency experience
- Emergency situations known to have occurred in similar organisations
- Information related to accident and/or incident investigations posted on the websites of regulators or emergency response agencies.
- The Project HSE Plan contains instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification and contact information to ensure that:
- All potential emergencies are identified
- Emergency response plans are documented, accessible and clearly communicated
- Roles and responsibilities are clearly defined
- Adequate equipment, facilities and trained personnel are available to respond to emergency situations to mitigate adverse consequences
- Inspection and testing of critical emergency equipment is performed
- Emergency drills and exercises are conducted to assess emergency response capacity and capabilities
- Lessons learned are communicated to the appropriate people
- Adequate treatment and medical management are available for injured employees.

9.7.1 Emergency response initiation

In the event of an emergency, in the first instance the Survey Vessel Master will assume overall on-site command and act as the Emergency Response Coordinator (ERC). In the event of a Level 2 release or above, AMSA will take over control of the response in their role as Control Agency and provide direction to the ERC. All persons on board the vessels will be required to act under the ERC's directions. The Survey Vessel Master will maintain communications with the Vessel Manager and CGG Technical Operations Manager and/or other emergency services in the event of an emergency.

When an emergency occurs, the initial alert will usually be made from the emergency location itself, such as from the Vessel Master or Client Site Representative, to the Crisis Management Team (CMT) or equivalent department of the vessel operator, as well as to relevant Commonwealth and State Agencies (such as AMSA). The CMT will be mobilised upon initial contact and emergency response will be initiated. This will be carried out by working directly with the established emergency services operating in the area. The survey and support vessel(s) will have equipment on board for responding to emergencies including, but not limited to, medical equipment, fire-fighting equipment and oil spill response equipment.

Upon receiving notification of an emergency, the vessel marine crew will respond in accordance with CGG's Crisis Management Procedure, which details the responsibilities for each of the CMT roles. The ERC will maintain the direct link between the vessel and the CMT. The vessel Emergency Response Plan (ERP) would also be implemented.

In the event of an emergency, the Survey Vessel Master will notify the onshore duty manager (and CGG Technical Operations Manager), who will activate the CMT. CGG will, if necessary, be ready to provide technical and tactical resources to the emergency response. The CGG Technical Operations Manager will liaise with the CMT, provide support to the response as required and provide regular reports until the response is terminated.

Notifications to relevant Commonwealth and State Agencies will be made as defined in Section 9.12.

9.7.2 Adverse weather procedures

It is the duty of the Vessel Master to act as the focal point for all actions and communications with regards to any emergency, including response to adverse weather or sea state, to safeguard his vessel, all personnel on board and environment.

During adverse weather the Survey Vessel Master is responsible for:

- Ensuring the safety of all personnel on board
- Monitoring all available weather forecasts and predictions
- Initiating the vessel safety management system, vessel HSE procedures and/or vessel ERP
- Keeping the Party Chief and Client Site Representative fully informed of the prevailing situation and intended action to be taken
- Assessing and maintaining security, watertight integrity and stability of vessel
- Proceeding to identified shelter location(s) as appropriate.
- Other appropriate responsibilities shall be taken into consideration as dictated by the situation.

In addition to in-vessel VHF Marine Radio Weather Services, daily weather forecasting from a designated weather forecast will be provided (if available) to monitor weather within the Operational Area over the duration of the survey.

Should poor/bad weather be imminent/encountered, the Vessel Master shall implement weather monitoring to assess conditions on site. The amount of monitoring and subsequent action would be dependent on the severity of the bad weather front and resulting actions will comply with the survey contractors procedure for Severe Weather Monitoring.

The CGG Technical Operations Manager shall ensure adequate weather forecasting is available at an increased frequency as the severity escalates.

9.8 Maintaining Environmental and Legislative Knowledge

9.8.1 Prior to Survey

If the survey commences six months after the approval of the EP, then at least eight weeks prior to the survey, the CGG Technical Project Manager shall undertake pre-survey planning that will review and consider the following as a minimum:

- Relevant person notification requirements as per Section 9.12
- New issues or concerns raised by relevant persons
- Changes to relevant legislation or regulatory guidelines
- Existing information in relation to any component of the receiving environment described in Section 4 (including BIAs, AMPs)
- Search the NOPSEMA website and consult with geophysical companies and/or titleholders to determine the presence of other seismic operations overlapping the proposed Sauropod 3D MSS
- Changes to commercial fishery licence areas, fishery status, current fishing effort and licence holders overlapping the Sauropod 3D MSS area based on:
    - Status reports and available data sources such as FRDC, IMAS for fisheries and aquatic resources
    - Information provided directly by fishers, WA DPIRD, and AFMA through the relevant person consultation process
    - Fishing locations
    - Spawning information relevant to key indicator species
    - Newly available scientific literature
- New acoustic source technology and justification for or against its implementation
- Confirmation of emergency (oil spill) contacts.

If new information regarding the receiving environment relevant to the Sauropod 3D MSS area is present, then an internal risk assessment will be conducted as described in Section 9.2.

9.9 EP Revision and Resubmission

Any new information, changes or updates considered via the MoC process (refer Section 9.2) will also be considered against Regulations 38 and 39 of the OPGGS (E) Regulations, to determine if resubmission of the EP to NOPSEMA is required.

Relevant sub-regulations and triggers for EP resubmission under Regulations 38 and 39 include the following:

- 38 New Activity, defined as a change to the extent that the regulatory levy category applied to the Sauropod 3D MSS would change.
- 39 Significant modification of the Sauropod 3D MSS activity or to how the activity is being managed and conducted. Modification to the activity or management system that CGG consider to be significant include but are not limited to:
  - The total acoustic source volume and dB output is increased beyond that defined in this EP; or
  - The vessel fuel type changes from that described in this EP; or
  - The CGG Environmental Management System (Section 9.1) is altered to the degree that the overall Sauropod 3D MSS activity or a potential impact or risk of the activity can no longer be managed to ALARP or acceptable levels or in accordance with relevant EPOs and EPSs.
- 39 New stage of the activity, defined as either:
  - A change to the spatial limits of the activity (an increase in the geographical extent of the Sauropod 3D MSS Operational Area); or
  - A change to the temporal limits of the activity (an extension to the acquisition timeframe or EP timeframe specified in this EP).
- 39 New or increased environmental impact or risk. Only significant new or significant increased impacts or risks (following identification of additional control measures) require resubmission of the EP to NOPSEMA.
- 39 Change in Titleholder. A change in Titleholder requires a resubmission of the EP.
  - A resubmission of the EP may also be required if requested by NOPSEMA (Regulation 40).

Minor revisions to the Sauropod 3D MSS EP that do not require resubmission to NOPSEMA will be made when:

- Minor administrative changes are identified that do not impact on the environment (e.g. document references, contact details, etc.
- A review of the activity/change and the environmental impacts and risks of the activity/change does not trigger a requirement for revision under the OPGGS (E) Regulations (Regulations 38, 39 and 40).

Where amendments are made to the accepted EP/OPEP via the CGG MoC process, revisions made will be justified, tracked and a comprehensive record of the revision kept for each change. This includes all risk assessments associated with MoC activities.

9.10 OPEP

The Sauropod 3D MSS OPEP, considering the nature and scale of the activity and the potential spill risks involved (refer Section 8), consists of the following:

- Survey / support vessel(s) SOPEP (for vessels ≥400 gross tonnes involved in the survey or equivalent for lesser tonnage vessels) that manage the environmental impacts of a spill and vessel-based operational monitoring (agreement OPRC 90)
- CGG Sauropod 3D MSS OPEP, which supports the individual vessel-based SOPEPs, details the interaction between contractor-related spill response plans and CGG response arrangements.

  These response arrangements are consistent with, and supported by, the:
- National Plan for Maritime Environmental Emergencies (NATPLAN): Australian Maritime Safety Authority (AMSA) – has jurisdiction and is the Control Agency for vessel spills which affect Commonwealth waters
- State Hazard Plan for Maritime Environmental Emergencies (State Hazard Plan): The WA Department of Transport (DoT) is the Control Agency for marine oil spills in WA state waters.

The seismic and support vessels (if ≥400 gross tonnes) IMO-accepted SOPEPs, prepared in accordance with IMO guidelines for the development of shipboard oil pollution emergency plans (resolution MEPC.54 (32) as amended by

resolution MEPC.86 (44)), include oil spill response arrangements and provisions for testing the SOPEP (oil pollution emergency drills), as required under Regulations 14(8AA), 14(8A) and 14(8B) to 14(8E) of the OPGGER. Typical oil spill response actions for shipboard oil spills are contained in the Sauropod 3D MSS OPEP.

CGG will ensure that support vessels ≥400 gross tonnes (that are not obligated legislatively to have a SOPEP), do have vessel-specific spill response plans (to an equivalent standard) that cover spill response arrangements. The SOPEP is designed to ensure a rapid and appropriate response to any oil spill and provide practical information required to undertake a rapid, effective response, and reporting procedures in the event of a spill.

Initial actions undertaken by a vessel in the event of a spill to limit environmental impacts, are detailed in the Sauropod 3D MSS OPEP.

9.10.1 Drills and Training (OPEP/SOPEP)

The OPEP will be tested:

- Prior to the survey commencing
- Following any significant amendment of the arrangements
- If and when a new seismic vessel is engaged for the activity
- Not later than 12 months after the most recent test.

These arrangements for testing the OPEP are commensurate with the nature and scale of the worst-case oil spill scenario and the short duration of the survey.

Vessel-based SOPEP tests are undertaken by vessels routinely as per MARPOL Annex I (Regulation 15) requirements, and drill outcomes reviewed as part of the ongoing monitoring and improvement of emergency response control measures.

A desktop drill of the Sauropod 3D MSS OPEP, including the vessel SOPEP, will be conducted to assess the effectiveness of the arrangements, taking into account the nature and scale of the risk of a hydrocarbon prior to survey commencement. Specifically, the drill will test the following:

- Roles and responsibilities of those involved in oil spill response are clear and understood
- Communication sequence from the vessel master to vessel-contractor onshore management and the Control Agency, including notification of the AMSA JRCC is adequate, current and includes all relevant details
- Communication between the CGG offshore representative and CGG Technical Project Manager and subsequent notification authorities is adequate and timely
- Ensures Type 1 operational monitoring such as spill surveillance and tracking is appropriate, understood and practised
- Equipment and procedures intended for source control on-board the vessels are available for use as outlined in the vessel SOPEP.

The outcomes of the Sauropod 3D MSS OPEP drill will be documented, reviewed and improvements identified (as needed). Should any inadequacies, altered contractual arrangements or improvements to arrangements be identified via testing, these corrective actions will be registered as a non-conformance (refer to Section 9.12) and the EP/OPEP will be amended for these items via a Management of Change process (refer Section 9.2). This is the responsibility of the CGG Project Manager. The CGG Technical Project Manager is responsible for assessing any changes to the OPEP against the criteria in OPGGS (E) Regulations - Regulations 38 and 39 and where necessary, the EP/OPEP submitted to NOPSEMA as a formal revision.

9.10.2 Maintaining Currency

CGG will monitor AMSA and DoT's published plans and should the plans change, CGG will assess the implications of any changes to the OPEP arrangements as described in this EP.

Any change to the activity itself, or the potential impacts and risks associated with it, will result in a review of the EP (including the OPEP) to ensure the measures in place remain suitable and there is no significant increase in impact or risk.

9.10.3 OSMP

The Sauropod 3D MSS OSMP (Appendix I:), considers the nature and scale of the activity and the potential monitoring requirements of the spill risks involved (refer Section 8). The OSMP has the objectives to:

- Identify high priority protection areas within the EMBA in real time
- Specify monitoring methodologies

- Detail the process CGG will follow to determine the monitoring studies that will be implemented in order to:
  - Provide situational awareness and assist in planning and execution of spill response to minimise environmental harm
  - Provide for short-term and long-term environmental damage and recovery assessments.

9.11 Communication and Consultation

9.11.1 Internal Communications

The seismic contractor will be responsible for keeping its workforce informed about environmental issues. The party chief acts as a focal point for personnel to raise environmental issues, and consults/involves all personnel in the following:

- Issues associated with the implementation of the EP
- Any proposed changes to equipment, systems, or methods of operation of plant, where these may have environmental implications
- Any proposals associated with continuous improvement of environmental protection, including the setting of environmental objectives and training schemes.
- Regular HSE meetings will be held on the seismic vessel. The issues discussed and actions taken will be recorded. The minutes of each meeting, including action items from the meetings, will be made available to all personnel.

Other forms of internal communication include toolbox meetings, which occur before every critical or unfamiliar job. This meeting includes all personnel involved in the task and will include aspects such as spill prevention requirements, etc.

9.12 Notifications and Reporting

Under Regulation 24(c) and 47 of the OPGGS(E), CGG is required to notify NOPSEMA of any recordable (An incident arising from the activity that breaches an EPO or EPS in the EP that applies to the activity that is not a reportable incident) and reportable (An incident arising from the activity that has caused, or has the potential to cause, moderate to significant environmental damage) incident within a specified timeframe. Environmental incidents will be reported to the relevant government agency by the Client Site Representative. The requirements for reporting and recording incidents are outlined in Table 9-2.

Following any recordable or reportable incident, CGG will undertake an incident investigation and this information will be communicated to all relevant personnel. All recordable and reportable incidents will be documented in the PERR by the CGG Technical Operations Manager, and including details of the event, immediate action taken to control the situation, and corrective actions to prevent re-occurrence. The CGG Technical Operations Manager and Client Site Representative will follow up actions taken to ensure that the corrective actions have been taken to close it out. When planning future activities, CGG will review the reportable and recordable incidents that have occurred previously to incorporate any lessons learned as part of CGG's continual improvement process.

Table 9-2 - Notification requirements

Requirement	Timing	Contact
Recordable Incidents		
As a minimum, the written monthly recordable incident report must include a description of: • All recordable incidents which occurred during the calendar month • All material facts and circumstances concerning the incidents that the operator knows or is able to reasonably find out. • Any actions taken to avoid or mitigate any adverse environmental impacts of the incident Corrective actions that have been taken, or may be taken, to prevent a repeat of similar incidents occurring.	As soon as possible but before the fifteenth day of the following calendar month.	NOPSEMA - submissions@nopsema.gov.au
Reportable Incidents		
Verbal Notifications		
Vessel-sourced spill in Commonwealth waters.	Within one hour	JRCC Australia: Phone: +61 2 6230 6811 or 1800 641 792 Facsimile: +61 02 6230 6868
Reportable incidents include, but are not limited to, those that have been identified through the risk assessment process as having an inherent impact consequence of 'significant', 'major' or 'critical', or at a minimum, the following incidents: • A level 2 spill incident • Vessel strike / entrapment or entanglement with a cetacean or marine turtle • IMS Introduction. The notification must contain: • All material facts and circumstances concerning the incident • Any action taken to avoid or mitigate the adverse environmental impact of the incident • The corrective action that has been taken or is proposed to be taken to stop, control or remedy the reportable incident. This must be followed by a written record of notification ASAP after notification. This written notification must also be supplied to the NOPTA and DMIRS for Commonwealth water incidents.	Within two hours	Verbal: NOPSEMA – Phone 1300 674 472 DMIRS - 0419 960 621 Written Notification: NOPSEMA - submissions@nopsema.gov.au NOPTA – reporting@nopta.gov.au DMIRS - petroleum.environment@dmirs.wa.gov.au
If an oil pollution incident occurs within or approaches an AMP, or where an oil spill response action must be taken within an AMP, the Director of National Parks (DNP) must be contacted immediately. Information which must be provided within that notification includes: • Titleholder details • Time and location of the incident (including AMP likely to be affected) • Proposed response arrangements as per OPEP • Confirmation of providing access to the relevant monitoring and evaluation reports when available, • Contact details of the emergency coordinator.	As soon as possible and prior to response action being taken, as far as reasonably practicable	Verbal: Director of Marine Parks – 0419 293 465 (24hr Marine Compliance Duty Officer) Written Notification: marine.compliance@environment.gov.au
Notify DCCEEW of any death or injury of a listed threatened species; all cetacean species; listed migratory species or listed marine species.	Within seven days	Phone: +61 2 6274 111 Email: EPBC.Permits @environment.gov.au
Written Incident Reports		
Verbal notification of a reportable incident to NOPSEMA (Commonwealth waters) must be followed by a written report. As a minimum, the written incident report will include: • The incident and all material facts and circumstances concerning the incident • Actions taken to avoid or mitigate any adverse environmental impacts • The corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident • The action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	Within three days of notification of incident (NOPSEMA) Within seven days after submission to NOPSEMA (NOPTA).	NOPSEMA - submissions@nopsema.gov.au NOPTA – reporting@nopta.gov.au
Vessel strike with cetacean is reported to the DCCEEW.	Within 72 hours of incident	Upload information to: https://data.marinemammals.gov.au/report/shipstrike

9.12.1 External Routine Notification and Reporting Requirements

Review of statutory and relevant person requirements with respect to routine external notification and reporting is provided in Table 9-3. These actions are the responsibility of the CGG Project Manager (or delegate).

Table 9-3 – External Routine Notification and Reporting Requirements

Requirement	Timing	Contact
Routine Performance Reporting		
OPGGS (E) Regulation 51: Submit an EP Performance/Compliance Report to NOPSEMA. This reports compliance against each of the EPOs and EPSs as outlined in this EP.	Within three months of survey completion.	NOPSEMA - submissions@nopsema.gov.au
Provide cetacean observation data to the DCCEEW. This report will include: • The location, date and start-up time of the survey • Name, qualifications and experience of MFOs involved in the survey • The location, times and reasons when observations were hampered by poor visibility or high winds • The location and time of any start-up delays, shut-downs or stop-work procedures instigated as a result of whale sightings • The location, time and distance of any cetacean sightings • The date and time of completion of the survey.	Within two months of activity completion.	Upload information to: https://data.marinemammals.gov.au/csa
EP Accepted and Activity Update		
Notification to all relevant persons advising of EP acceptance and provide an update on survey commencement.	Within ten days of the date the EP has been accepted.	All relevant relevant persons listed in the Consultation Log.
Notification of the establishment of the claims process, the survey timing and the Adjustment Area	No less than 28 days before activity commencement.	Relevant commercial fishing licence holders and respective peak commercial fishing industry bodies.
Provision of OPEP to DoT and AMSA following EP acceptance and prior to survey commencement.	Prior to survey commencement.	Contact details listed in Consultation Log.
Survey Commencement		
Notify AHO for Notice to Mariners.	At least four weeks prior to commencement.	AHO - datacentre@hydro.gov.au
Notify fisheries relevant persons of survey commencement. The notification shall include: • Survey location including a map and digital files of the Adjustment Area and starting zone • Time frame (anticipated start date and likely duration) • Vessel details (vessel names, call signs, IMO vessel numbers, radio and satellite phone communication details) • Website details for 48 hr look-aheads • Telephone and email contact details for claims, objections, queries or concerns.	At least four weeks prior to commencement.	Fisheries relevant persons listed in Consultation Log.
Notify DMIRS of survey commencement.	At least ten days prior to commencement.	DMIRS - petroleum.environment@dmirs.wa.gov.au
Notify NOPSEMA of survey commencement.	At least ten days prior to commencement.	NOPSEMA - submissions@nopsema.gov.au
Notify AMSA for promulgation of radio-navigation warnings. This notification will include: when operations start and end, name, callsign and Maritime Mobile Service Identity (MMSI), satellite communications details (including INMARSAT-C and satellite telephone numbers), area of operation, requested clearance from other vessels and any other information that may contribute to safety at sea.	At least 24-48 hours prior to survey commencement.	JRCC - rccaus@amsa.gov.au Ph: 1800 641 792 or +61 2 6230 6811
Survey Cessation		
Notify AMSA to cease Auscoast Warnings	Upon vessel demobilisation.	JRCC - rccaus@amsa.gov.au Ph: 1800 641 792 or +61 2 6230 6811
Notify NOPSEMA with survey completion date	Within ten days of survey completion.	NOPSEMA - submissions@nopsema.gov.au
Notify DMIRS with survey completion date	Within ten days of survey completion.	DMIRS - petroleum.environment@dmirs.wa.gov.au.
Notify fisheries relevant persons of survey cessation	Within ten days of survey completion.	Fisheries relevant persons listed in the Consultation Log.
End of EP		
Notification of EP completion to NOPSEMA.	End of EP operation.	NOPSEMA - submissions@nopsema.gov.au

10 References

[ABARES] Torres Strait Finfish Fishery. 2021. https://www.agriculture.gov.au/abares/research-topics/fisheries/fishery-status/torres-strait-finfish-fishery Accessed on 05 July 2021

[AGDD] Australian Government Department of Defence, 2021. Unexploded ordnance. Accessed from https://www.defence.gov.au/UXO/Where/Default.asp. Accessed on 10 June 2021.

[AMMC] Australian Marine Mammal Centre, 2019. Australian Marine Mammal Centre. Available at http://www.marinemammals.gov.au/. Accessed on 16 May 2019.

[AMSA] Australian Maritime Safety Authority, 2013. Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities.

[BoM] Bureau of Meteorology, 2021a. Climate Statistics of Australian Locations, Bureau of Meteorology, Canberra, ACT. Available at http://www.bom.gov.au/climate/averages/tables/cw_004019.shtml. Accessed 25 May 2021.

[BoM] Bureau of Meteorology, 2021b. Daily Maximum Temperature – Rowley Shoals, Bureau of Meteorology, Canberra, ACT. Available at http://www.bom.gov.au/jsp/ncc/cdio/wData/wdata?p_nccObsCode=122andp_display_type=dailyDataFileandp_stn_num=200713andp_startYear=. Accessed 25 May 2021.

[BoM] Bureau of Meteorology, 2021c. Monthly Rainfall – Wallal Downs. Bureau of Meteorology, Canberra, ACT. Available at http://www.bom.gov.au/jsp/ncc/cdio/wData/wdata?p_nccObsCode=139andp_display_type=dataFileandp_stn_num=004068. Accessed 25 May 2021.

[BoM] Bureau of Meteorology, 2021d. Tropical Cyclones Affecting Port Hedland. Bureau of Meteorology, Canberra, ACT. Available at http://www.bom.gov.au/cyclone/history/wa/pthed.shtml. Accessed 25 May 2021.

[CGG] Environment Plan - Sauropod 3D Marine Seismic Survey (WA-527-P), Revision 2.3.1. Published 2 April 2024. Available at: https://docs.nopsema.gov.au/A1072378

[CALM] Department of Conservation and Land Management, 2005., Indicative Management Plan for the proposed Dampier Archipelago marine park and Cape Preston marine management area, Department of Conservation and Land Management, Perth, Australia, pp. 145.[CSIRO] Commonwealth Scientific and Industrial Research Organisation 2015. Marine Benthic Substrate Data – CAMRIS – Marsed, CSIRO Data Collection, 10.4225/08/551485612CDEE.

[DAF] Queensland Department of Agriculture and Fisheries 2021. East Coast Spanish Mackerel Working Group communique https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable/fishery-working-groups/spanish-mackerel-fishery-working-group/communiques/17-18-may-2021

[DAWE] Department of Agriculture, Water and Environment. 2020. Australian Ballast Water Management Requirements: Version 8. Available from: https://www.agriculture.gov.au/sites/default/files/documents/australian-ballast-water-management-requirements.pdf. Accessed on 12 July 2022.

[DAWE] Department of Agriculture, Water and Environment, 2021a. *Sousa sahulensis* — Australian Humpback Dolphin. Available at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=50. Accessed on 10 June 2021

[DAWE] Department of Agriculture, Water and Environment, 2021b. *Sterna dougallii* — Roseate Tern. Accessed from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?showprofile=Y&taxon_id=817. Accessed on 10 June 2021.

[DAWE] Department of Agriculture, Water and Environment, 2016. Indo-pacific Humpback Dolphin BIA. Accessed from https://maps.atlas.parksaustralia.gov.au/index.html?intro=false&z=4&ll=137.15359,-35.52756&l0=cmr_cmr%3AAU_DOEE_bia_2016_BlueandPygmyBlueWhale,ea_ea-be%3AWorld_Bright-Earth-e-Atlas-basemap,g_SATELLITE,g_ROADMAP&v0=,,f,f&_ga=2.44602086.359892719.1565584136-1576342056.1565584136. Accessed on 10 June 2021

[DAWE] Department of Agriculture, Water and Environment, 2016. *Charadrius leschenaultii* — Greater Sand Plover, Large Sand Plover. Accessed from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=877#:~:text=In%20Australia%2C%20the%20Greater%20Sand,2006). Accessed on 5 July 2022.

[DAWE] Department of Agriculture, Water and Environment, n.d. Underwater Cultural Heritage Act 2018. Accessed from https://www.environment.gov.au/heritage/underwater-heritage/underwater-cultural-heritage-act. Accessed on 10 June 2021.

[DAWR] Department of Agriculture, Water and Resources, 2018. Guidelines for the Implementation of the Commonwealth Fisheries Harvest Strategy Policy. Department of Agriculture and Water Resources, Canberra, November.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2021. Australasian Underwater Cultural Heritage Database. Available at: http://www.environment.gov.au/shipwreck/public/maps/shipwreck-map-search-load.do

[DCCEEW] Department of Climate Change, Energy, the Environment and Water n.d., Australian Heritage Council's final assessment of national heritage values of the West Kimberley (PDF 1.69 MB), West Kimberley Place Report, accessed 16/06/2023.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2023. Application for Wildlife Trade Operation reassessment – Western Australian Pilbara Trap Managed Fishery. https://www.dcceew.gov.au/sites/default/files/documents/wa-pilbara-trap-managed-fishery-reassessment-approval-2023.pdf

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2023. Conservation Advice for Calidris ferruginea (curlew sandpiper). Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice-18122023.pdf. In effect under the EPBC Act from 18-Dec-2023. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, n.d. Conservation Advices. Available from: https://www.dcceew.gov.au/environment/biodiversity/threatened/conservation-advices. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, n.d. Recovery Plans. Available from: https://www.dcceew.gov.au/environment/biodiversity/threatened/recovery-plans. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, n.d. Australia's National Heritage List. Available from: https://www.dcceew.gov.au/parks-heritage/heritage/places/national-heritage-list. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, n.d. Biologically Important Areas for protected marine species (BIAs). Available from: https://www.dcceew.gov.au/environment/marine/bias. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, n.d. Marine Bioregional Plans. Commonwealth of Australia. Canberra. Available from: https://www.dcceew.gov.au/environment/marine/marine-bioregional-plans. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2024. *Conservation Advice for* Calidris canutus *(red knot)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/855-conservation-advice-05012024.pdf. In effect under the EPBC Act from 05-Jan-2024. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2023. *Conservation Advice for* Charadrius leschenaultii *(greater sand plover)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/877-conservation-advice-18122023.pdf. In effect under the EPBC Act from 18-Dec-2023. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2025. *Conservation Advice for* Sousa sahulensis *(Australian humpback dolphin)* . Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/87942-conservation-advice-05032025.pdf. In effect under the EPBC Act from 05-Mar-2025. Accessed 24 June 2025.

[DCCEEW] Department of Climate Change, Energy, the Environment and Water, 2025. *Conservation Advice for* Orcaella heinsohni *(Australian snubfin dolphin)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/81322-conservation-advice-05032025.pdf. In effect under the EPBC Act from 05-Mar-2025. Accessed 24 June 2025.

[DEC] Department of Environment and Conservation, 2007. Rowley Shoals marine Park Management Plan 2007-2017, Management Plan No 56. Prepared by the Department of Environment and Conservation on behalf of the Marine Parks and Reserves Authority (MPRA), Perth, Western Australia.

[DEH] Department of Environment and Heritage, 2005. Whale Shark (*Rhincodon typus*) Recovery Plan Issues Paper. Commonwealth Department of Environment and Heritage. 26 pp.

[DEWHA] Department of the Environment, Water, Heritage and the Arts, 2008a. The North-west Marine Bioregional Plan: Bioregional Profile. A description of the Ecosystems, Conservation Values and Uses of the North-west Marine Region. Australian Government, Canberra.

[DEWHA] Department of the Environment, Water, Heritage and the Arts, 2008b. Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1768-conservation-advice.pdf. In effect under the EPBC Act from 08-Jan-2009.

[DEWHA] Department of the Environment, Water, Heritage, and the Arts 2008c. EPBC Act Policy Statement 2.1 - Interaction Between Offshore Seismic Exploration and Whales. In: Australian Government. Department of the Environment, Water, Heritage and the Arts. 14 pp.

[DFO] Department of Fisheries and Oceans. 2004. Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals. Canadian Science Advisory Secretariat (CSAS), Habitat Status Report 2004/002, 15 pp.

[DNP] Director of National Parks, 2018. North-west Marine Parks Network Management Plan 2018, Director of National Parks, Canberra.

[DoE] Department of the Environment and Energy, 2015e. Biologically Important Areas of Regionally Significant Marine Species. COPYRIGHT Commonwealth of Australia, Australian Government. Available from http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B2ed86f5a-4598-4ae9-924f-ac821c701003%7D

[DoE] Department of the Environment, 2014. Approved Conservation Advice for *Pristis pristis* (largetooth sawfish). Canberra, ACT: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/60756-conservation-advice.pdf. In effect under the EPBC Act from 11-Apr-2014.[DoE] Department of the Environment, 2015a. Conservation Management Plan for the Blue Whale – A Recovery Plan under the Environment Protect and Biodiversity Conservation Act 1999. Canberra: Department of the Environment. Available at http://www.environment.gov.au/biodiversity/threatened/publications/recovery/blue-whale-conservation-management-plan. In effect under the EPBC Act from 03-Oct-2015.

[DoE] Department of the Environment, 2014. Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*). Canberra, ACT: Department of the Environment. Available from: http://www.environment.gov.au/resource/recovery-plan-grey-nurse-shark-carcharias-taurus. In effect under the EPBC Act from 14-Aug-2014. Accessed 2 July 2025.

[DoE] Department of the Environment, 2015b. Sawfish and River Sharks Multispecies Recovery Plan. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan. In effect under the EPBC Act from 07-Nov-2015.

[DoEE] Department of Environment and Energy, n.d. The Ramsar Convention on Wetlands. Available at https://www.environment.gov.au/water/wetlands/ramsar Accessed 13 May 2019i

[DoEE] Department of the Environment and Energy, 2017. Recovery Plan for Marine Turtles in Australia. Canberra, ACT: Commonwealth of Australia.

[DoEE] Department of the Environment and Energy, 2018. Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Canberra, ACT: Commonwealth of Australia. In effect under the EPBC Act from 21-Jul-2018.

[DoEE] Department of the Environment and Energy, 2019a. Species Profile and Threats Database. Available at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Accessed on 4 April 2019.

[DoEE] Department of the Environment and Energy, n.d. Biologically important areas of regionally significant marine species. Commonwealth of Australia. Available from: https://www.environment.gov.au/marine/marine-species/bias. Accessed 29/05/2019d

[DoEE] Department of the Environment and Energy, 2017. National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna. Available from: https://www.dcceew.gov.au/sites/default/files/documents/vessel-strike-strategy.pdf.

[DoEE] Department of the Environment and Energy, n.d. Species Profile and Threats Database - Canyons linking the Argo Abyssal Plain and Scott Plateau. Available at https://www.environment.gov.au/sprat-public/action/kef/view/8;jsessionid=7BE137C6FB158E60179C4EA5D6B2D97A Accessed 13/05/2019e

[DoEE] Department of the Environment and Energy, n.d. Species Profile and Threats Database - Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. Available at https://www.environment.gov.au/sprat-public/action/kef/view/11;jsessionid=01AD87551D0DE1B0248C8722BE137004 Accessed 13/05/2019f

[DoEE] Department of the Environment and Energy, n.d. Species Profile and Threats Database – Key Ecological Features. Available from https://www.environment.gov.au/sprat-public/action/kef/search Accessed 20.05.2019g

[DPaW] Department of Parks and Wildlife, 2013. Whale shark – wildlife management program no. 57

[DoF] Department of Fisheries, 2008. Northern Demersal Scalefish Managed Fishery. ESD Report Series No. 6.

[DoF] Department of Fisheries, 2012. State of the Fisheries report. https://www.fish.wa.gov.au/About-Us/Publications/Pages/State-of-the-Fisheries-report.aspx

[DoF] Department of Fisheries, 2013. Spanish mackerel. https://www.fish.wa.gov.au/Species/Spanish-Mackerel/Pages/default.aspx

[DoF] Department of Fisheries, 2016. INTEGRATED FISHERIES MANAGEMENT RESOURCE REPORT PEARL OYSTER (Pinctada maxima) RESOURCE. Fisheries Management paper No. 281. Document number ISSN 0819-432.

[DoFb] Department of Fisheries, 2016. Western Australian Silver-lipped Oyster (Pinctada Maxima) Resources Harvest Strategy 2016 – 2021 Version 1.0 Pearly Oyster Fishery. Fisheries Management Paper No. 276. Document number ISSN 0819-432.

[DoT] Department of Transport, 2020. State Hazard Plan – Maritime Environmental Emergencies (MEE). Available at https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_StateHazardPlanMaritimeEnviroEmergMEE.pdf

[DPaW] Department of Parks and Wildlife, 2014. Eighty Mile Beach Marine Park Management Plan 80 2014 - 2024, Department of Parks and Wildlife, Perth.

[DPaW] Department of Parks and Wildlife, 2016. Yawuru Nagulagun / Roebuck Bay Marine Park Joint Management Plan 2016, Department of Parks and Wildlife, Perth.

[DPIRD] Department of Primary Industries and Regional Development, 2017. North Coast demersal scalefish resource harvest strategy 2017 – 2021. Available from http://www.fish.wa.gov.au/Documents/management_papers/fmp285.pdf

[DPIRD] Department of Primary Industries and regional Development, 2018. Commercial Fishing Guide. Available at https://www.fish.wa.gov.au/Fishing-and-Aquaculture/Commercial-Fishing/Pages/Commercial-Fishing-Guide.aspx Accessed 20 May 2019.

[DPIRD] Department of Primary Industries and Regional Development, 2019. Finfish spawning advice. DPIRD Principal Scientist pers. comm. 23/5/2019.

[DPIRD] Department of Primary Industries and Regional Development, 2020a State of the Fisheries report. https://www.fish.wa.gov.au/About-Us/Publications/Pages/State-of-the-Fisheries-report.aspx

[DPIRD] Department of Primary Industries and Regional Development, 2020b Draft Resource Assessment Report – North Coast Demersal Scalefish Resource. https://www.fish.wa.gov.au/Documents/resource_assessment/resource_assessment_report_013.pdf

[DPIRD] Department of Primary Industries and Regional Development, 2024. Pilbara Demersal Scalefish Resource Recovery Plan 2023 – 2043 (Phase 1). Fisheries Management Paper No. 310. https://library.dpird.wa.gov.au/fr_fmp.

[DPLH] Department of Planning, Lands and Heritage, 2022. Aboriginal Heritage Inquiry System. Available at https://www.dplh.wa.gov.au/information-and-services/aboriginal-heritage/aboriginal-heritage-search Accessed 30 September 2022.

[DPW] Department of Parks and Wildlife 2014, Eighty Mile Beach Marine Park Management Plan 80 2014-2024 Department of Parks and Wildlife, Perth

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2011. Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1115-conservation-advice.pdf. In effect under the EPBC Act from 15-Feb-2011.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2011. Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake). Canberra, ACT: Department of Sustainability,

Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1118-conservation-advice.pdf. In effect under the EPBC Act from 15-Feb-2011.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2012a. Marine bioregional plan for the North Marine Region. Commonwealth of Australia.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2012b. Species group report card – bony fishes. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia Capital Territory.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2012c. Species group report card – Dugong. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia Capital Territory.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2012d. Species group report card – reptiles. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia Capital Territory.

[DSEWPaC] Department of Sustainability, Environment, Water, Population and Communities, 2013. Recovery Plan for the White Shark (*Carcharodon carcharias*). Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/recovery-plan-white-shark-carcharodon-carcharias. In effect under the EPBC Act from 06-Aug-2013 as *Carcharodon carcharias*.

[ERM] Environmental Resources Management, 2017. Bethany 3D Survey Environment Plan - Seismic Airguns and Fish Mortality Literature Review. Final Report to Santos, Reference No. 0436696. 1 December 2017. 39 pp.

[IAGC] International Association of Geophysical Contractors. 2017. Plankton Study Speculative and Needs Better Data. News Release, June 22, 2017. 2 pp.

[IPIECA] International Petroleum Industry Conservation Association, 2004. A guide to Oiled Wildlife Response Planning, International Petroleum Industry Conservation Association, No. 13.

[ITOPF] International Tanker Owners Pollution Federation, 2011. Effects of Oil Pollution on the Marine Environment. Technical Information Paper. Technical paper No. 13. The International Tank Owners Pollution Federation Limited.

[MPRA] Marine Parks and Reserves Authority, 2005. Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005 – 2015. Marine Parks and Reserves Authority, Perth, Western Australia.

[NMFS] National Marine Fisheries Service. 2014. Marine Mammals: Interim Sound Threshold Guidance (webpage). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

[NMFS] National Marine Fisheries Service. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 189 pp.

[NMFS] National Marine Fisheries Service. 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 pp.

[NMSC] The Australian National Marine Safety Committee, 2010. Marine Incidents during 2009. Preliminary Data Analysis. Available at http://www.nmsc.gov.au

[NNTT] National Native Title Tribunal, 2023a. National Native Title Register Details - WCD2005/003 - Bardi and Jawi Native Title Determination. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2005/003

[NNTT] National Native Title Tribunal, 2023b. National Native Title Register Details - WCD2018/005 – Bindunbur. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2018/005

[NNTT] National Native Title Tribunal, 2023c. National Native Title Register Details - WCD2018/004 - Jabirr Jabirr/Ngumbarl. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2018/004

[NNTT] National Native Title Tribunal, 2023d. National Native Title Register Details - WCD2006/001 - Rubibi Community. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2006/001

[NNTT] National Native Title Tribunal, 2023e. National Native Title Register Details - WCD2002/001 - Karajarri People (Area A). Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2002/001

[NNTT] National Native Title Tribunal, 2023f. National Native Title Register Details - WCD2004/002 - Karajarri People (Area B). Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2004/002

[NNTT] National Native Title Tribunal, 2023g. National Native Title Register Details - WCD2012/001 - Nyangumarta-Karajarri Overlap Proceeding (Yawinya). Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2012/001

[NNTT] National Native Title Tribunal, 2023h. National Native Title Register Details - WCD2009/001 - Nyangumarta People (Part A). Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2009/001

[NNTT] National Native Title Tribunal, 2023i. National Native Title Register Details - WCD2018/015 - Kariyarra. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2018/015

[NNTT] National Native Title Tribunal, 2023c. National Native Title Register Details - WCD2018/004 - Jabirr Jabirr/Ngumbarl. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2018/004

[NNTT] National Native Title Tribunal, 2023c. National Native Title Register Details - WCD2018/004 - Jabirr Jabirr/Ngumbarl. Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=WCD2018/004

[NNTT] National Native Title Tribunal, 2023j. National Native Title Register Details - WCD2007/003 - Ngarla and Ngarla #2 (Determination Area A). Available at: http://www.nntt.gov.au/searchRegApps/NativeTitleClaims/Pages/Determination_details.aspx?NNTT_Fileno=WCD2007/003

[NOAA] National Oceanic and Atmospheric Administration, 2010. Oil and Sea Turtles: biology planning and response, US Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Response and Restoration, 116 pp.

[NOAA] National Oceanic and Atmospheric Administration, 2021a. WOA 2013 V2 Data Access: Statistical mean of temperature on 1° grid for all decades. National Oceanic and Atmospheric Administration, United States Department of Commerce, Maryland.

[NOAA] National Oceanic and Atmospheric Administration, 2021b. WOA 2013 V2 Data Access: Statistical mean of salinity on 1° grid for all decades. National Oceanic and Atmospheric Administration, United States Department of Commerce, Maryland.

[NOPSEMA] National Offshore Petroleum Safety and Environmental Management Authority, 2024. Consultation in the course of preparing an environment plan (N-04750-GL2086). Australian Government, Canberra. Available at: https://www.nopsema.gov.au/sites/default/files/documents/Consultation%20in%20the%20course%20of%20preparing%20an%20Environment%20Plan.pdf

[NSF] National Science Foundation (U.S.), Geological Survey (U.S.), and [NOAA] National Oceanic and Atmospheric Administration (U.S.). 2011. Final Programmatic Environmental Impact Statement/Overseas. Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey. National Science Foundation, Arlington, VA, U.S.A.

[NSW DPI] NSW Department of Primary Industries. 2014. NSW Department of Primary Industries submission on PEP11 seismic survey proposal 2014/15. 15 pp.

[Nyamba Buru Yawuru] Nyamba Buru Yawuru, 2020. 'Welcome'. Available at: https://www.yawuru.org.au/?doing_wp_cron=1691623203.5600659847259521484375

Nyul Nyul PBC Aboriginal Corporation RNTBC, 2024. . Nyul Nyul Healthy Country & Indigenous Protected Area Management Plan 2024-2034. Available at: https://static1.squarespace.com/static/59fecece017db2ab70aa1874/t/6719c34f7e61fa7fc99b1856/1729741680694/KLC_NyulNyul_HealthyCountryPlan.pdf

[PSMA] Department of the Prime Minister and Cabinet Australia, 2019. PSMA Geocoded National Address File (G-NAF) Administrative Boundaries, CadLite, Features of Interest, G-NAF, G-NAF Lite, G-NAF Live, Land Tenure, Postcode Boundaries and Transport and Topography. PSMA Australia Limited, ACT.

[RPS] RPS Group, 2010. Marine Mammals Technical Report – Wheatstone Project Technical Appendix O12. RPS Planning and Environment Pt Ltd, Perth, Western Australia.

[RPS] RPS Group, 2019. 3D Oil WA-527-P. Oil Spill Modelling. Final Report No. MAQ0793J, 29 May 2019. 70 pp.

[Town of Port Hedland] Town of Port Hedland 2023. 'Reconciliation'. Available at: https://www.porthedland.wa.gov.au/our-community/community/reconciliation.aspx

[TSSC] Threatened Species Scientific Committee, 2008. Listing Advice for *Pristis zijsron* (Green Sawfish). Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/68442-listing-advice.pdf. In effect under the EPBC Act from 07-Mar-2008.

[TSSC] Threatened Species Scientific Committee, 2009. Commonwealth Listing Advice on *Pristis clavata* (Dwarf Sawfish). Department of the Environment, Water, Heritage and the Arts. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/68447-listing-advice.pdf. In effect under the EPBC Act from 20-Oct-2009.

[TSSC] Threatened Species Scientific Committee, 2015a. Conservation Advice *Balaenoptera borealis* sei whale. Canberra: Department of the Environment. Available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/34-conservation-advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

[TSSC] Threatened Species Scientific Committee, 2015b. Conservation Advice *Balaenoptera physalus* Fin whale. Canberra: Department of the Environment. Available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/37-conservation-advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

[TSSC] Threatened Species Scientific Committee, 2015c. Conservation Advice *Megaptera novaeangliae* Humpback whale. Canberra: Department of the Environment. Available at http://www.environment.gov.au/biodiversity/threatened/species/pubs/38-conservation-advice-10102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

[TSSC] Threatened Species Scientific Committee, 2015d. Conservation Advice *Rhincodon typus* whale shark. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66680-conservation-advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

[TSSC] Threatened Species Scientific Committee, 2015e. Conservation Advice *Papasula abbott*i Abbott's booby. Canberra: Department of the Environment. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/59297-conservation-advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

[WDCS] Whale and Dolphin Conservation Society, 2006. Vessel collisions and cetaceans: What happens when they don't miss the boat. Whale and Dolphin Conservation Society. United Kingdom.

Ainslie, M.A., 2008. Review of published safety thresholds for human divers exposed to underwater sound. TNO Defence, Security and Safety Report. TNO-DV 2007 A598.Austin, D. and Pollum, R. 20169. The IUCN Red List of Threatened Species 2019. Available at http://www.iucnredlist.org/. Accessed 13 May 2019.

Amoser, S. and Ladich, F. 2003. Diversity in noise-induced temporary hearing loss in otophysine fishes. Journal of the Acoustical Society of America 113: 2170–2179.

André, M., Kaifu, K., Solé, M., van der Schaar, M., Akamatsu, T., Balastegui, A., Sánchez, A.M. and Castell, J.V. 2016. Contribution to the understanding of particle motion perception in marine invertebrates. pp. 47–55, in Popper, N.A., Hawkins, A. (eds.), The effects of noise on aquatic life II. Springer, New York, USA.

Australian Bureau of Statistics (2021) A census of Australia. www. https://www.abs.gov.au/census

Australian Museum. 2019. Ruby Snapper, *Etelis carbunculus* (Cuvier, 1828). Viewed online on 20 March 2019 at https://australianmuseum.net.au/learn/animals/fishes/ruby-snapper-etelis-carbunculus-cuvier-1828/.

Baker, C., Potter, A., Tran, M. and Heap, A.D. 2008. Sedimentology and Geomorphology of the North West Marine Region of Australia, Geoscience Australia Record 2008/07, Geoscience Australia, Canberra, Australian Capital Territory.

Bannister, A., Kemper, C.M., and Warnecke, R.M.1996. The Action Plan for Australian Cetaceans. Australian Nature Conservation Agency, Canberra, Australian Capital Territory.

Bardi-Jawi Niimidjman Aboriginal Corporation RNTBC (2013) Bardi-Jawi IPA Management Plan 2013-2023 . , 52 pp. https://static1.squarespace.com/static/59fecece017db2ab70aa1874/t/5a7bdb8471c10b9941e9f4b9/1518066605569/bardi-jawi-healthy-country-plan.pdf

Begg, G.A., Chen, C.C.-M., O'Neill, M.F. and Rose, D.B. 2006. Stock assessment of the Torres Strait Spanish mackerel fishery. CRC Reef Research Centre Technical Report No. 66. CRC Reef Research Centre, Townsville, Queensland.

Berry, P.F. and Marsh, L.M. 1986. Part I: History of Investigation and Description of the Physical Environment, in Berry, P. (Ed.), Fauna Surveys of the Rowley Shoals, Scott Reef and Seringapatam Reef, North-western Australia. Records of the Western Australian Museum, Supplement No. 25, pp.1-25.

Best, P.B., Butterworth, D.S. and Rickett, L.H. 1984. An Assessment Cruise for the South African Inshore Atock of Bryde's Whales (*Balaenoptera edeni*). Report of the International Whaling Commission, vol. 34, pp. 403-423.

Birdlife International 2019a. streaked shearwater *Calonectris leucomelas*. Available at http://datazone.birdlife.org/species/factsheet/streaked-shearwater-calonectris-leucomelas/text. Accessed 16 May 2019.

Birdlife International 2019b. lesser frigatebird *Fregata ariel*. Available at http://datazone.birdlife.org/species/factsheet/lesser-frigatebird-fregata-ariel/text. Accessed 16 May 2019.

Boeger, W.A., Pie, M.R., Ostrensky, A. and Cardoso, M.F., 2006. The Effect of Exposure to Seismic Prospecting on Coral Reef Fishes. Brazilian Journal of Oceanography 54(4): 235-239.

Booman, C., Dalen, J., Leivestad, H., Levsen, A., van der Meeren, T. and Toklum, K., 1996. Effekter av luftkanonskyting på egg, larver og yngel. Undersøkelser ved Havforskningsinstituttet og Zoologisk laboratorium, UIB. [In Norwegian with English Summary]. 89 pp.

Bouchet P.J., Thiele, D, Marley S.A., Waples, K, Weisenberger F, Balanggarra Rangers, Bardi Jawi Rangers, Dambimangari Rangers, Nyamba Buru Yawuru Rangers, Nyul Nyul Rangers, Uunguu Rangers & Raudino H, 2021. Regional assessment of the Conservation Status of Snubfin dolphins (*Orcaella heinsohni*) in the Kimberley Region, Western Australia. *Frontiers in Marine Science*.

Bradley, J and Yanyuwa families (2010) Singing saltwater country: Journey to the songlines of Carpentaria. Allen and Unwin, Sydney Australia.

Bradshaw, C.J.A., Mollet, H.F. and Meekan, M.G. 2007. Inferring Population Trends for the World's Largest Fish and Mark-Recapture Estimates of Survival, Journal of Animal Ecology, vol. 76, no. 76, pp. 480-489.

Bray, D.J. 2020. *Etelis* carbunculus in Fishes of Australia, accessed 14 May 2020, http://136.154.202.208/home/species/1238

Bray, D.J. and Thompson, V.J. 2017. Fishes of Australia. Available at http://fishesofaustralia.net.au/. Accessed 13 May 2019.

Brewer, D., Lyne, V., Skewes, T. and Rothlisberg, P., 2007. Trophic Systems of the North-West Marine Region, CSIRO Marine and Atmospheric Research, Report to the Department of the Environment, Water, Heritage and the Arts. CSIRO Marine and Atmospheric Research, Cleveland, Australia.

Brooks, L, Palmer, C, Griffiths, A.D. & Pollock, K.H., 2017. Monitoring variation in small coastal dolphin populations: An example from Darwin, Northern Territory, Australia. *Frontiers in Marine Science 4*.

Brown, A.M., Bejder, K., Pollock, K.H. and Allen, S.J. 2014. Abundance of coastal dolphins in Roebuck Bay, Western Australia: Updated results from 2013 and 2014 sampling period. A report to WWF Australia, Murdock University Cetacean Research Unit, Murdoch University, Western Australia.

Bruce, B., Bradford, R., Foster, S., Lee, K., Lansdell, M., Cooper, S. and Przeslawski, R., 2018. Quantifying fish behaviour and commercial catch rates in relation to a marine seismic survey. Marine Environmental Research 140: 18-30.

Burbidge, A., Woinarski, J. and Harrison, P. 2014. The Action Plan for Australian Mammals 2012. CSIRO Publishing, Victoria

Buchanan, Geoff, Altman, John, Arthur, Bill, Oades, Daniel and Bardi Jawi Rangers (2009), Always part of us: the socioeconomics of Indigenous customary use and management of dugong and marine turtles – a view from Bardi and Jawi sea country, Western Australia. Northern Australian Indigenous Land and Sea Management Alliance (NAILSMA) Research Report 001/2009. Darwin, N.T

Burgess, H.G. and Branstetter, S. 2009. *Carcharhinus limbatus* – The IUCN Red List of Threatened Species. Available at https://www.iucnredlist.org/species/3851/10124862. Accessed 11 April 2019.

Butler, I. and Steven, A. H. 2021. Torres Strait Bêche-de-mer and Trochus fisheries. In: Status Reports of the Fisheries and Aquatic Resources of Western Australia 2020/21: The State of the Fisheries eds. Newman, S.J., Wise, B.S., Santoro, K.G. and Gaughan, D.J. Department of Primary Industries and Regional Development, Western Australia.

Butler, I, Patterson, H, Bromhead, D, Galeano, D, Timmiss, T, Woodhams, J and Curtotti, R 2024, Fishery status reports 2024, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, DOI: https://doi.org/10.25814/bfnc-9160. CC BY 4.0.

Cailliet, G.M., Cavanagah, R.D., Kulka, D.W., Stevens, J.D., Soldo, A., Clo, S., Macias, D., Baum, J., Kohin, S., Duarte, A., Holtzhausen, J.A., Acuña, E., Amorim, A., and Domingo, A. 2009. *Isurus oxyrinchus* – IUCN Red List of Threatened Species. Available at https://www.iucnredlist.org/species/39341/2903170#population. Accessed 15 May 2019.

Carroll, A.G., Przeslawski, R., Duncan, A., Gunning, M. and Bruce, B., 2017. A critical review of the potential impacts of marine seismic surveys on fish and invertebrates. Marine Pollution Bulletin 114: 9-24.

Chapman, C. and Hawkins, A. 1969. The importance of sound in fish behaviour in relation to capture by trawls. Fisheries and Aquaculture Report 62 (3): 717–729.

Childerhouse, S. I. M. O. N., Double, M., & Gales, N. I. C. K. (2010). Satellite tracking of southern right whales (Eubalaena australis) at the Auckland Islands, New Zealand. Unpublished report (SC/62/BRG19) presented to the Scientific Committee of the International Whaling Commission, Cambridge, UK.

Chilvers, B.L., Delean, S., Gales, N.J., Holley, D.K., Lawler, I.R., Marsh, H. and Preen, A.R. 2004. Diving behaviour of dugons, Dugong dugon, Journal of Experimental Marine Biology and Ecology, vol. 304, no. 2, pp. 203-224.

Christian, J.R., Mathieu, A., Thompson, D.H., White, D. and Buchanan, R.A., 2003. Effect of seismic energy on snow crab (*Chionoecetes opilio*). Environmental Funds Project No. 144. Fisheries and Oceans Canada, Calgary, Canada.

Clarkson, C., Jacobs, Z., Marwick, B. *et al.* Human occupation of northern Australia by 65,000 years ago. *Nature* **547**, 306–310 (2017). https://doi.org/10.1038/nature22968

Colman, J.G. 1997. A Review of the Biology and Ecology of the Whale Shark. The Fisheries society of British Isles, Journal of Fish Biology, vol. 51, no. 6, pp. 1219-1234.

Commonwealth of Australia, 2009. National Biofouling Management Guidance for the Petroleum and Exploration Industry, http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidance_petroleum.pdf. Viewed 25 April 2019.

Commonwealth of Australia, 2010. Ningaloo Coast World Heritage Nomination. Commonwealth of Australia, Canberra, Australian Capital Territory. 360 pp.

Commonwealth of Australia, 2015. Wildlife Conservation Plan for Migratory Shorebirds. Canberra, ACT: Department of the Environment. Available at: http://www.environment.gov.au/biodiversity/publications/wildlife-conservation-plan-migratory-shorebirds-2016. In effect under the EPBC Act from 15-Jan-2016.

Commonwealth of Australia, 2021. Inquiry report - Making waves: the impact of seismic testing on fisheries and the marine environment. Available at: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/SeismicTesting/Report

Commonwealth of Australia, n.d. Australian Heritage Database - Mermaid Reef - Rowley Shoals, Broome, WA, Australia. Commonwealth of Australia. Available at https://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;search=state%3DWA%3Blist_code%3DCHL%3Blegal_status%3D35%3Bkeyword_PD%3D0%3Bkeyword_SS%3D0%3Bkeyword_PH%3D0;place_id=105255 Accessed 14 May 2019.

Dafforn, K. A., Glasby, T. M., and Johnston, E. L., 2009a. Links between estuarine condition and spatial distributions of marine invaders. Diversity and Distributions 15(5): 807–821.

Dafforn, K. A., Johnston, E. L., Glasby, T. M., 2009b. Shallow moving structures promote marine invader dominance. Biofouling 25:3, 277-287.

Dalen, J. and Knutsen, G. 1987. Scaring effects in fish and harmful effects on eggs, larvae and fry by offshore seismic explorations. pp. 93–102 in Merklinger, H.M (ed.), Progress in underwater acoustics. Plenum Publishing Corporation, New York, USA.

Day, R.D., McCauley, R.D., Fitzgibbon, Q.P., Hartman, K. and Semmens, J.M., 2016a. Exposure to seismic air gun signals causes physiological harm and alters behaviour in the scallop *Pecten fumatus*. Fisheries and Aquaculture Centre, Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS 7001, Australia; and Centre for Marine Science and Technology, Curtin University, Perth, WA 6845, Australia.

Day, R.D., McCauley, R.M., Fitzgibbon, Q.P. and Semmens, J.M. 2016b. Assessing the impact of marine seismic surveys on southeast Australian scallop and lobster fisheries. FRDC Project No 2012/008. University of Tasmania, Hobart, Tasmania.

Day, R.D., McCauley, R.M., Fitzgibbon, Q.P., Hartmann, K. and Semmens, J.M. 2017. Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*. Proceedings of the National Academy of Science of the United States of America, October 2017, 114 (40) E8537-E8546; DOI: 10.1073/pnas.1700564114.

del Hoyo, J., Elliot, A. and Sargatal, J. 1992. Handbook of the Birds of the World, Vol. 1: Ostrich to Ducks. Lynx Edicions, Barcelona, Spain.

del Hoyo, J., Elliot, A. and Sargatal, J. 1996. Handbook of the Birds of the World, Vol. 3: Hoatzin to Auks. Lynx Edicions, Barcelona, Spain.

Director of National Parks, 2018. North-west Marine Parks Network Management Plan 2018. Director of National Parks. Canberra.

Dobbs R, Davies C, Pettit N, Pusey B, Walker M, Close PC & Tingle F 2015, Nyul Nyul freshwater management and monitoring plan, Charles Darwin University, Darwin.

Done, T.J., Williams, D.McB., Speare, P.J,. Davidson, J., DeVantier, L.M., Newman, S.J. and Hutchins, J.B., 1994. Surveys of coral and fish communities at Scott Reef and Rowley Shoals. Australian Institute of Marine Science, Townsville.

Donovan, A., Brewer, D., van der Velde, T., and Skewes, T. 2008. Scientific descriptions of four selected key ecological features (KEFs) in the north-west bioregion: final report. A report to the Department of the Environment, Water Heritage and the Arts. CSIRO Marine and Atmospheric Research, Hobart.

Double, M.C. Jenner, K.C.S., Jenner, M-N., Ball, I., Childerhouse, S., Laverick, S. and Gales, N. 2012. Satellite tracking of northbound Humpback whales (*Megaptera novaeangliae*) off Western Australia. Australian Marine Mammal Centre. Available at: http://www.wamsi.org.au/sites/wamsi.org.au/files/Final%20report%20-%20Satellite%20tracking%20WA%20Humpback%20whales%202011.pdf

Double, M.C., Andrews-Goff, V., Jenner, K.C.S., Jenner, M-N., Laverick, S.M., Branch, T.A. and Gales, N.J. 2014. Migratory Movements of Pygmy Blue Whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as revealed by Satellite Telemetry, PLoS One, vol. 9, no. 4.

Dwyer, R. G., Rathbone, M., Foote, D. L., Bennett, M., Butcher, P. A., Otway, N. M., Louden, B. M., Jaine, F. R., Franklin, C. E., & Kilpatrick, C., 2023. Marine reserve use by a migratory coastal shark, Carcharias taurus. Biological Conservation, 283, 110099.

Ebert, D.A., Fowler, S. and Compagno, L. 2013. Sharks of the World. A Fully Illustrated Guide. Wild Nature Press, Plymouth, United Kingdom.

Edmonds, N.J., Firmin, C.J., Goldsmith, D., Faulkner, R.C. and Wood, D.T., 2016. A review of crustacean sensitivity to high amplitude underwater noise: data needs for effective risk assessment in relation to UK commercial species. Marine Pollution Bulletin 108: 5–11.

Engås, A. and Løkkeborg, S. 2002. Effects of seismic shooting and vessel-generated noise on fish behaviour and catch rates. Bioacoustics 12(2-3): 313–316.

Engås, A., Løkkeborg, S., Ona, E. and Soldal, A.V., 1996. Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). Canadian Journal of Fisheries and Aquatic Sciences 53: 2238–2249.

Environment Australia, 2000. Mermaid Reef Marine National Nature Reserve Plan of Management. Environmental Australia, Canberra.

Environment Australia, 2002. Ningaloo Marine Park (Commonwealth Waters) Management Plan, Environment Australia, Canberra, Australian Capital Territory.

Etkins, D.S., 1997. The Impact of Oil Spills on Marine Mammals, OSIR Report 13 March 1997 Special Report.

Falkner, I., Whiteway, T., Przeslawski, R. and Heap, A.D. 2009. Review of Ten Key Ecological Features (KEFs) in the Northwest Marine Region, Geoscience Australia Record 2009/13. A report to the Department of the Environment, Water, Heritage and the Arts, Geoscience Australia, Canberra, Australian Capital Territory.

Fanta, E., 2004. Efeitos da sísmica com Cabo Flutuante em peixes tropicais de areas recifais. Relatório Tècnico (CTAIBAMA 298857) Universidade Federal do Paraná, Departamento de Biologia Celular, Grupo de Estudos de Impacto Ambienta. August 4, 2004 [Effects of Floating Cable Seismic on Tropical Fish in Reef Areas. Technical Report prepared by the Environmental Impact Study Group (GEIA) of Cellular Biology Department, University of Paraná, Curitiba, Brazil]. 54 pp.

Fewtrell, J. and McCauley, R. 2012. Impact of air gun noise on the behaviour of marine fish and squid. Marine Pollution Bulletin 64 (5): 984-993.

Fields, D. M., Handegard, N. O., Dalen, J., Eichner, C., Malde, K., Karlsen, Ø., Skiftesvik, A. B., Durif, C. M. F., and Browman, H. I. Airgun blasts used in marine seismic surveys have limited effects on mortality, and no sublethal effects on behaviour or gene expression, in the copepod *Calanus finmarchicus*. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsz126.

Finneran, J.J., Henderson, E., Houser, D., Jenkins, K., Kotecki, S. and Mulsow, J., 2017. Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III). Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 pp.

Fletcher, W.J. and Santoro, K. (eds). 2012. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2011/12: The State of the Fisheries. Department of Fisheries, Western Australia.

Ford, J.K.B., Ellis, G.M., Matkin, D.R., Balcomb, K.C., Briggs, D. and Morton, A.B. 2005. Killer whale Attacks on Minke Whales: Prey Capture and Antipredator Tactics, Marine Mammal Science, vol 21, no. 4, pp 603-618.

French, D.P., Schuttenberg, H.Z. and Isaji, T., 1999. Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida power and light. In: Proceedings - AMOP 99 Technical Seminar, June 2-4, 1999, Calgary, Alberta, Canada, pp. 243-270.

French-McCay, D., Rowe, J.J., Whittier, N., Sankaranarayanan, S. and Etkin, D.S. 2004. Estimate of potential impacts and natural resource damages of oil. Journal of Hazardous Materials 107(1), 11–25.

French-McCay, D.P., 2003. Development and application of damage assessment modelling: example assessment for the North Cape oil spill. Marine Pollution Bulletin 47(9), 9–12.

French-McCay, D.P., 2004. Spill impact modelling: development and validation. Environmental Toxicology and Chemistry 23(10), 2441–2456.

Froese, R. and Pauly, D (Ed.) 2019. Fishbase. Available at http://www.fishbase.org/. Accessed 13 May 2019.

Gagnon, M.M. and Rawson, C.A., 2010. Montara Well Release: Report on necropsies from a Timor Sea green sea turtle. Perth, Western Australia, Curtin University, vol. 15.

Gambell, R. (1968). Seasonal Cycles and Reproduction in Sei Whales of the Southern Hemisphere. Discovery Reports. 35:31-134.

Gardner W (1995) Five dreamtime stories in Nyangumarta. Wangka Maya, South Hedland, 31 pp.

Gascoyne Development Commission. 2012. Economic Development Opportunities for the Gascoyne Region associated with the Resource Sector Investment and Expansion. Gascoyne Pilbara Project, January 2012. SGS Economics and Planning, pp. 95.

Gaughan, D.J. and Santoro, K. (eds), 2018. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2016/17: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Gaughan, D.J., Newman, S.J., and Wakefield, C.B. 2018. Western Australian Marine Stewardship Council Report Series No. 11: Summary of the stock structure information used for determining spatial management of the index species for the scalefish resources of northern Western Australia. Department of Primary Industries and Regional Development, Western Australia. 32pp.

Gedamke, J., Gales, N., and Frydman, S., 2011. Assessing risk of baleen whale hearing loss from seismic surveys: the effect of uncertainty and individual variation. Journal of the Acoustical Society of America 129 (1): 496–506.

Gilmour, J., Cheal, A., Smith, L., Underwood, J., Meekan, M., Fitzgibbon, B. and Rees, M., 2007. Data compilation and analysis for Rowley Shoals: Mermaid, Imperieuse and Clerke reefs. A report to the Department of Environment and Water Resources, Australian Institute of Marine Science, Perth.

Gilmour, J., Speed, C.W. and Babcock, R., 2016. Coral reproduction in Western Australia. PeerJ 4:e2010; DOI 10.7717/peerj.2010.

Glasby, T. M., Connell, S. D., Holloway, M. G., Hewitt, C. L., 2007. Nonindigenous biota on artificial structures: could habitat creation facilitate biological invasions. Marine Biology 151: 887–895.

Gomez, C. Lawson, J.W., Wright, A.J., Buren, A.D., Tollit, D. and Lesage, V., 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. Canadian Journal of Zoology 94: 801–819.

Government of Western Australia, 2023. Shipwreck Databases: Shipwrecks of Western Australia. Western Australian Museum. Available at: https://museum.wa.gov.au/maritime-archaeology-db/wrecks/map

Green, B. S., and Gardner, C. 2009. Surviving a sea-change: survival of southern rock lobster (*Jasus edwardsii*) translocated to a site of fast growth. ICES Journal of Marine Science 66: 656–664.

Guinea, M. 2013. Monitoring Program for the Monata Well Release Timor Sea Monitoring Study S6 Sea Snakes / Turtles. Available at http://www.environment.gov.au/system/files/pages/bcefac9b-ebc5-4013-9c88-a356280c202c/files/surveys-sea-snakes-turtles.pdf. Accessed 16 May 2019.

Guinea, M.L. 1995. The sea turtles and sea snakes of Ashmore Reef Reserve. Northern Territory University, Darwin.

Hanf, D., Hodgson, A. J., Kobryn, H., Bejder, L., & Smith, J. N., 2022. Dolphin distribution and habitat suitability in north western Australia: applications and implications of a broad-scale, non-targeted dataset. *Frontiers in Marine Science*, 8, 733841.

Harasti, D., Lee, K.A., Gallen, C., Hughes, J.M. and Stewart, J. 2015. Movements, home range and site fidelity of snapper (*Chrysophrys auratus*) within a temperate marine protected area. PLoS ONE 10(11): e0142454.

Hart, A.M., Murphy, D.M., Fabris, F.F 2022. Western Australian Sea Cucumber Resource. Resource Assessment Report (2022). Fisheries Research Report No. 324: Department of Primary Industries and Regional Development, Western Australia. 113 pp.

Hawkins, A.D. and Popper, A.N. 2016. A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. ICES Journal of Marine Science 74(3): 635-651.

Hawkins, A.D. and Popper, A.N., 2017. A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. ICES Journal of Marine Science doi:10.1093/icesjms/fsw205.

Hawkins, A.D., Roberts, L. and Cheesman, S. 2014. Responses of free-living coastal pelagic fish to impulsive sounds. Journal of the Acoustical Society of America. 135(5): 3101-3116.

Hayes, E.H., Fullagar, R., Field, J.H. et al. 65,000-years of continuous grinding stone use at Madjedbebe, Northern Australia. Sci Rep 12, 11747 (2022). https://doi.org/10.1038/s41598-022-15174-x

Hazel, J., Lawler, I.R. and Hanmann, M. 2009. Diving at the shallow end: Green turtle behaviour in near-shore foraging habitat, vol. 371, no. 1, pp. 84-92.

Heatwole, H. and Cogger, H.G. 1993. Family Hydrophiidae in Glasby, C.G., Ross, G.J.B. and Beesley, P.L. (Ed.) Fauna of Australia Volume 2A – Amphilbia and Reptilia. Australian Government Publishing Service, Canberra, pp. 439.

Hedley, SL. Bannister, JL. and Dunlop, RA. 2011. Abundance estimates of Breeding Stock 'D' Humpback Whales from aerial and land-based surveys off Shark Bay, Western Australia, 2008. Journal of Cetacean Research and Management, Special Issue 3: 209-221.

Heyward, A., Colquhoun, J., Cripps, E., McCorry, D., Stowar, M., Radford, B., Miller, K., Miller, I. and Battershill, C., 2018. No evidence of damage to the soft tissue or skeletal integrity of mesophotic corals exposed to a 3D marine seismic survey. Marine Pollution Bulletin 129: 8-13.

Heyward, A.J., Pinceratto, E. and Smith, L.D. 1997. Big Bank Shoals of the Timor Sea: an environmental resources atlas. Australian Institute of Marine Science and BHIP Petroleum, Victoria, pp. 115.

Holliday, D.V., Pieper, R.E., Clarke, M.E. and Greenlaw, C.F. 1987. The effects of airgun energy releases on the eggs, larvae and adults of the northern anchovy (*Engraulis mordax*). API Publication 4453. Report by Tracor Applied Sciences for American Petroleum Institute, Washington D.C, USA.

Hooper, J.N.A. and Ekins, M., 2004. Collation and validation of museum collection databases related to the distribution of marine sponges in Northern Australia., Unpublished report to the National Oceans Office, Hobart.

Horwood, J.W. 1987. The Sei Whale: Population Biology, Ecology and Management. Croom Helm Ltd, New York.

Houde, E.D. and Zastrow, C.E., 1993. Ecosystem- and taxon-specific dynamic and energetics properties of larval fish assemblages. Bulletin of Marine Science 53 (2): 290-335.

Houser, D.S., Yost, W., Burkard, R., Finneran, J.J., Reichmuth, J.J. and Mulsow, J., 2017. A review of the history, development and application of auditory weighting functions in humans and marine mammals. The Journal of the Acoustical Society of America 141: 1371-1413.

Howey-Jordan LA, Brooks EJ, Abercrombie DL, Jordan LKB, Brooks A, *et al.* (2013) Complex Movements, Philopatry and Expanded Depth Range of a Severely Threatened Pelagic Shark, the Oceanic Whitetip (Carcharhinus longimanus) in the Western North Atlantic. PLoS ONE 8(2): e56588. doi:10.1371/ journal.pone.0056588

Hueter, R.E., Tyminski, J.P., Morris, J.J., Abierno, A.R. and Valdes, J.A. 2016. Horizontal and vertical movements of longfin mako (*Isurus paucus*) tracked with satellite-linked tags in the northwestern Atlantic Ocean. Fishery Bulletin 115(1): 101–116.

Jackson, G., Denham, A., Hesp, A., Hall, N., Fisher, E., & Stephenson, P. 2020. Resource assessment report; Gascoyne demersal scalefish resource. Department of Primary Industries and Regional Development. Available at https://www.fish.wa.gov.au/Documents/resource_assessment/resource_assessment_report_009.pdf

Jakobs, S. & Braccini, M., 2019. Acoustic and conventional tagging support the growth patterns of grey nurse sharks and reveal their large-scale displacements in the west coast of Australia. Mar Biol 166:150.

James, N.P., Bone, Y., Kyser, T.K., Dix, G.R. and Collins, L.B. 2004. The importance of changing oceanography in controlling late Quaternary carbonate sedimentation on a high-energy, tropical, oceanic ramp, North-western Australia, Sedimentology 51: 1179–1205.

Jarman, S.N. and Wilson, S.G., 2004. DNA-based species identification of krill consumed by whale sharks, Journal of Fish Biology 65: 586–591.

Jefferson, T.A. & Rosenbaum, H.C., 2014. Taxonomic revision of the humpback dolphins (*Sousa* spp.), and description of a new species from Australia. *Marine Mammal Science* 30(4): 1494-151

Jenner, K.C.S., Jenner, M-N.M., and McCabe, K.A. 2001. Geographical and Temporal Movements of Humpback Whales in Western Australian Waters, APPEA Journal, vol. 441, no. 1, pp. 749-765.

Karrajari Traditional Lands Association (2014) Karajarri Healthy Country Plan 2013-2023: Palanapayana Tukjana Ngurra. , 56pp., https://www.ktla.org.au/karajarri-healthy-country-plan

Kato, H. 2002. Bryde's Whales *Balaenopetra edeni* and *B. brydei*, in Perrin, W.F., Wrsig, B., and Thewissen, H.G.M. (Ed.), Encyclopaedia or Marine Mammals, Academic Press, pp. 171-177.

Kennish, M.J., 1997. Practical handbook of Estuarine and Marine Pollution. Boca Raton, FL: CRC Press.

Kordjazi, Z., Frusher, S., Buxton, C. D., and Gardner, C. 2015. Estimating survival of rock lobsters from long-term tagging programmes: how survey number and interval influence estimates. ICES Journal of Marine Science 72: 244–251.

Koshleva, V. 1992. The impacts of air guns used in marine seismic explorations on organisms living in the Barents Sea. Fisheries and Offshore Petroleum Exploitation, 2nd International Conference, Bergen, Norway, 6-8 April 1992.

Kostyuchenko, L. 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. Hydrobiological Journal 9: 45–48.

Laist, D. W., Knowlton, A. R., Mead, J. G., Collet, A. S., and Podesta, M. (2001). Collisions between ships and whales. Mar. Mamm. Sci. 17, 35–75. doi: 10.1111/j.1748-7692.2001.tb00980.x

Langstreth, J., Williams, A., Stewart, J., Marton, N., Lewis, P. and Saunders, T. 2018. Spanish Mackerel (2018). Accessed online on 20 March 2019 at https://www.fish.gov.au/report/253-Spanish-Mackerel-2018

Last, P.R. and Stevens J.D. 2009. Sharks and Rays of Australia. CSIRO Publishing, Melbourne, pp. 550

Lewis, P. and Watt, M., 2021. Statewide Large Pelagic Finfish Resource Status Report 2021. In: Status Reports of the Fisheries and Aquatic Resources of Western Australia 2020/21: The State of the Fisheries eds. Newman, S.J.,

Wise, B.S., Santoro, K.G. and Gaughan, D.J. Department of Primary Industries and Regional Development, Western Australia.

Lewis, S. E., Sloss, C. R., Murray-Wallace, C. V., Woodroffe, C. D. and Smithers, S. G. 2013. Postglacial sea-level changes around the Australian margin: a review. Quaternary Science Reviews, 74 115-138.Limpus, C. 2008. A Biological Review of Australian Marine Turtles, Queensland Government.

Liberman, M.C. 2015. Noise-induced hearing loss: permanent vs. temporary threshold shifts and the effects of hair-cell versus neuronal degeneration. pp. 1-7 in Popper, A.N. and Hawkins, A.D. (eds.) The effects of noise on aquatic life II. Springer, New York, USA.

Limpus, C.J (2009). A biological review of Australian marine turtle species. 6. Leatherback turtle, *Dermochelys coriacea* (Vandelli). Queensland: Environmental Protection Agency. Lindsey, T.R. 1986. The Seabirds of Australia. Angus and Robertson, Australia.

Limpus, C.J. 2004. A Biological Review of Australian Marine Turtles. The State of Queensland, Environmental Protection Agency, Australia.

Limpus, C.J. 2007. A Biological Review of Australian Marine Turtles. The State of Queensland, Environmental Protection Agency, Australia.

Limpus, C.J. 2008. A Biological Review of Australian Marine Turtle Species. 1. Loggerhead turtle, *Caretta caretta* (Linneaus). The State of Queensland, Environmental Protection Agency, Australia.

Limpus, C.J. and Miller, J.D. 2008. A Biological Review of the Australian Marine Turtles 2. Green turtle Chelonia mydas (Linnaeus). The State of Queensland, Environmental Protection Agency, Australia.

Lincoln, G., Mathews, D., Oades, D. with the Balanggarra, Bardi Jawi, Dambimangari, Karajarri, Mayala, Nyangumarta, Nyul Nyul, Wunambal Gaambera & Yawuru ISWAG members (2021) The Kimberley Indigenous Turtle & Dugong Initiative 2021-2031. Prepared by Mosaic Environmental for the Kimberley Indigenous Saltwater Advisory Group (ISWAG) Broome 2021

Lukoschek, V., Guinea, M. and Milton, D. 2010. *Aipysurus apraefrontalis* – the IUCN Red Listed of Threatened Species. Available at https://www.iucnredlist.org/species/176770/7301138 . Accessed 14 May 2019.

Lutcavage, M.E., Lutz, P.L., Bossart, G.D. and Hudson, D.M., 1995. Physiologic and clinicopathological effects of crude oil on loggerhead sea turtles, Archives of Environmental Contamination and Toxicology (28): 417–422.

Mackie, M., Buckworth, R.C. and Gaughan, D.J., 2003. Stock assessment of narrow-barred Spanish mackerel (Scomberomorus commerson) in Western Australia. Department of Fisheries.

Mackie M.C., Lewis P.D., Kennedy J., Saville K., Crowe F., Newman, S.J. and Smith, K.A. 2010. Western Australian Mackerel Fishery. Ecologically Sustainable Development Series No. 7. Western Australian Department of Fisheries, Perth, Western Australia.

Mackintosh, N.A. 1965. The stocks of whales. Fishing News (Books) Ltd, London.

Marchant, S. and Higgeins, P.J. (Ed.) 1990. Handbook of Australia, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks. Oxford University Press, Melbourne, Victoria

Marchesan, M. Spotto, M. Verginella, L. and Ferrero, EA. 2006. 'Behavioural Effects of Artificial Light on Fish Species of Commercial Interest', Fisheries Research, vol. 73, pp. 171-185.

Marquenie, J. Donners, M. Poot, H. Steckel, W. de Wit, B. and Nam, A. 2008. Adapting the Spectral Composition of Artificial Lighting to Safeguard the Environment, Petroleum and Chemical Industry Conference Europe – Electrical and Instrumentation Applications, 5th PCIC Europe, pp. 1 - 6.

Marquez, R. 1990. FAO species catalogue; Sea Turtles of the World. An annotated and illustrated catalogue of the sea turtle species known to date. FAO Fisheries Synopsis, vol. 11, no. 125, pp. 81. Rome: Food and Agriculture Organisation of United Nations.

Marriot, R., Jackson, G., Lenaton, R., Telfer, C., Stephenson E., Bruce, C., Adams, D. and Noriss, J. 2014. Biology and Stock Status of Inshore Demersal Scalefish Indicator Species in the Gascoyne Coast Bioregion. Fisheries Research Report No. 228. Department of Fisheries.

Marsh, H., Eros, C., Penrose, H. and Hugues, J. 2002. Dugong – Status Report and Action Plans for countries and territories, UNEP Early Warning and Assessment Report Series 1, pp 162.

Marshall, A., Kashiwagi, T., Bennett, M.B., Deakos, M., Stevens, G., McGregor, G., Clark, T., Ishiara, H. and Sato, K. 2018. *Mobila alfredi* – IUCN Red List of Threatened Species. Available at https://www.iucnredlist.org/species/195459/126665723. Accessed on 15 May 2019.

Marshall, M 2020. Living Heritage: Protecting the Aboriginal Cultural Heritage of the Dampier Peninsula for all. Department of Planning, Lands and Heritage. Available at: https://www.wa.gov.au/system/files/2021-07/Report_Living-Heritage_-Protecting-the-Aboriginal-Cultural-Heritage-of-the-Dampier-Peninsula.PDF.Martin, J., Keag, M., Newman, S. and Wakefield, C. 2014. Goldband Snapper *Pristipomoides multidens*. Accessed online on 27 February 2019 at https://www.fish.gov.au/2014-Reports/Goldband_Snapper.Matishov, G.G., 1992. The reaction of bottom-fish larvae to airgun pulses in the context of the vulnerable Barent Sea ecosystem. Fisheries and Offshore Petroleum Exploitation, 2nd International Conference. Bergen, Norway, 6-8 April 1992.

Mate, B. R., Nieukirk, S. L., & Kraus, S. D. (1997). Satellite-monitored movements of the northern right whale. The Journal of wildlife management, 1393-1405.

McCauley R.D. and Jenner, C. 2010. Migratory patterns and estimated population size of Pygmy Blue Whales (*Balaenoptera musculus brevicauda*) traversing the Western Australian coast based on passive acoustics. Paper SC/62/SH26 presented to the IWC Scientific Committee (unpublished).

McCauley, R.D. 2011. CGG Kimberley Sea Noise Logger Program, Sept 2006 to June-2009: Whales, Fish and Man-made noise. Report produced for CGG Energy Ltd, pp. 86.

McCauley, R.D. and Duncan, A.J. 2011. Sea Noise Logger Deployment, Wheatstone and Onslow, April 2009 to November 2010: Great whales, fish and man-made noise sources. CMST tech. Report R2011-23, Curtin University of Technology, Perth, Western Australia.

McCauley, R.D., Day, R.D., Swadling, K.M., Fitzgibbon, Q.P., Watson, R.A. and Semmens, J.M., 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. Nature Ecology and Evolution 1: 1-8.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. *et al.*, 2000a. Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on Humpback whales, sea turtles, fishes and squid. Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Marine Science and Technology, Western Australia. 198 pp.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. *et al.*, 2000b. Marine seismic surveys: A study of environmental implications. Australian Petroleum Production Exploration Association (APPEA) Journal 40(1): 692-708.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. 2003. Marine seismic surveys: analysis and propagation of air-gun signals; and effects of exposure on Humpback whales, sea turtles, fishes and squid. In: Anon eds.), Environmental implications of offshore oil and gas development in Australia: further research, Australian Petroleum Production Exploration Association, Canberra.

McCauley, R.D., Salgado Kent, C. and Archer, M. 2008. Impacts of seismic survey pass-bys on fish hearing and caged fish behaviour, Scott Reef Lagoon, Western Australia. Prepared for ERM and CGG Energy, CMST Report No. 2008-52, Curtin University, Perth, Australia.

McKinney, D. 2009. A survey of the scleractinian corals at Mermaid, Scott, and Seringapatam Reefs, Western Australia. Records of the Western Australian Museum Supplement No. 77, pp. 105–143.

McPherson, C., MacGillivray, A., and Hager, E. (2018). Validation of airgun array modelled source signatures. The Journal of the Acoustical Society of America 144(3), 1846 doi:10.1121/1.5068132

McPherson, G.R., 1993. Reproductive biology of the narrow barred Spanish Mackerel (*Scomberomorus commerson*) in Queensland waters. Asian Fish. Sci. 6, 169–182.

Meekan, M., Bradshaw, C., Press, M., McLean, C., Richards, A., Quasnichka, S. and Taylor, J. 2006. Population size and structure of whale sharks (*Rhincodon typus*) at Ningaloo Reef Western Australia, Marine Ecology-Progress Series, 319, pp.275-285.

Meekan, M., Speed, C.W., McCauley, R.D., Fisher, R., Birt, M.J., L.M. Currey-Randall,J.M. Semmens,S.J. Newman,K. Cure,M. Stowar,B. Vaughan,& M.J.G. Parsons. 2021. A large-scale experiment finds no evidence that a seismic survey impacts a demersal fish fauna, Proc. Natl. Acad. Sci. U.S.A. 118 (30) e2100869118, https://doi.org/10.1073/pnas.2100869118.

Miller, I.R. and Cripps, E. 2013. Three-dimensional marine seismic survey has no measurable effect on species richness or abundance of a coral reef associated fish community. Marine Pollution Bulletin 7(1-2), 63-70.

Milton, S.L. and Lutz, P.L., 2003. Physiological and genetic responses to environmental stress. In: Lutz, P.L., Musick, J.A. and Wyneken, J. (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, pp. 164–198.

Moein, S.E., Musick, J.A., Keinath, J.A., Barnard, D.E., Lenhardt, M.L. and George, R., 1995. Evaluation of Seismic Sources for Repelling Sea Turtles from Hopper Dredges, in Sea Turtle Research Program: Summary Report. In: Hales, L.Z., (ed.). Report from U.S. Army Engineer Division, South Atlantic, Atlanta GA, and U.S. Naval Submarine Base, Kings Bay GA. Technical Report CERC-95. 90 pp.

Moran, M., Burton, C. and Jenke, J. 2004. Long-term movement patterns of continental shelf and inner gulf snapper (*Pagrus auratus*, Sparidae) from tagging in the Shark Bay region of Western Australia. Marine and Freshwater Research 54 (8): 913–922.

Moran, M., Edmonds, J., Jenke, J., Cassells, G. and Burton, C. 1993. Fisheries biology of emperors (Lethrinidae) in north-west Australian coastal waters. Final Report to the Fisheries Research and Development Corporation (FRDC) Project No. 89/20, Fisheries Department of Western Australia, Western Australia pp. 58.

Morgan, D.L., Whitty, J.M, and Philips, N.M. 2009. Endangered sawfishes and river sharks in Western Australia. Report prepared for CGG Energy Limited. Centre for fish and Fisheries Research, Murdoch University,

Morley, E.L., Jones, G. and Radford, A.N. 2014. The importance of invertebrates when considering the impacts of anthropogenic noise. Proceedings of the Royal Society B 281: 20132683.

Musick, J.A., Stevens, J.D., Baum, J.K., Bradai, M., Clò, S., Fergusson, I., Grubbs, R.D., Soldo, A., Vacchi, M. and Vooren, C.M. 2009. *Carcharhinus plumbeus*. The IUCN Red List of Threatened Species 2009: e.T3853A10130397. http://dx.doi.org/10.2305/IUCN.UK.2009-2.RLTS.T3853A10130397.en. Downloaded on 22 May 2019.

Nedelec, S.L., Campbell, J., Radford, A.N., Simpson, S.D. and Merchant, N.D., 2016. Particle motion: the missing link in underwater acoustic ecology. Methods in Ecology and Evolution doi: 10.1111/2041-210X.12544.

NERA 2021. Collaborative Seismic Environment Plan Project Commercial Fishing Industry Adjustment Protocol. National Energy Resources Australia.

Newman, S., Buckworth, R., Mackie, M., Lewis, P., Bastow, T., & Ovenden, J. (1998). Spatial subdivision of adult assemblages of Spanish mackerel, *Scomberomorus commerson* (Pisces: Scombridae) from western, northern and eastern Australian waters through stable isotope ratio analysis of sagittal otolith carbonate. The stock structure of Northern and Western Australian Spanish mackerel. Final Report, Fisheries Research & Development Corporation Project, 159.

Newman, D.J., Smith, K.A., Skepper, C.L. and Stephenson, P.C. 2008. Northern Demersal Scalefish Managed Fishery, ESD Report, Series No. 6, June 2008. Department of Fisheries, Western Australia.

Newman, S., Ferridge, R., Syers, C. and Kallinowski, P. (2015). in Gaughan, D.J. and Santoro, K. (Ed.) Status Reports of the Fisheries and Aquatic Resources of Western Australia: The State of Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Newman, S. Trinnie, F., Saunders, T. and Wakefield, C. (2020a). Rankin Cod (2020). Available at: https://fish.gov.au/report/333-Rankin-Cod-2020, Accessed 18/07/2022.

Newman, S., Wakefield, C., Lunow, C., Saunders, T. and Trinnie, F. (2020b). Red Emperor (2020). Available at: https://fish.gov.au/report/354-Red-Emperor-2020, Accessed 18/07/2022.

Newman, S., Wakefield, C., Saunders, T. and Trinnie, F. (2020c). Bluespotted Emperor (2020). Available at: https://fish.gov.au/report/362-Bluespotted-Emperor-2020, Accessed 18/07/2022.

Newman, S.J., Young, G. C., Travers, M. J., Pember, M. B., Skepper, C. L., Williamson, P. C., and Potter, I. C. 2003. Characterisation of the inshore fish assemblages of the Pilbara and Kimberley coasts. Final Report to the Fisheries Research and Development Corporation for Project 2000/132. Fisheries Research and Development Corporation, Canberra, ACT.

Newman, S.J., Wise, B.S., Santoro, K.G. and Gaughan, D.J. (eds). 2020. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2019/20: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Newman, S J, Moore, J, and Gaughan, D J. (2024), State of the fisheries: Status reports of the fisheries and aquatic resources of Western Australia 2023/24. Department of Primary Industries and Regional Development, Western Australia, Perth. Book. https://library.dpird.wa.gov.au/an_sofar/17

NMFS (2024). Update to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In-Air Criteria for Onset of Auditory Injury and Temporary Threshold Shifts. National Marine Fisheries Service. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-71, 182 p.

Nyangumarta Warrarn Aboriginal Corporation and Yamatji Marlpa Aboriginal Corporation (2022) Nyangumarta Warrarn Indigenous Protected Area Management Plan 2022 — 2032 , 34 pp., https://www.ymac.org.au/wp-content/uploads/2022/12/Nyangumarta-Warrarn-IPA-2022-single-low-res-002.pdf

O'Connor, S 1999. 30,000 Years of Aboriginal Occupation in the Kimberley, northwest Australia. ANH Publications, Centre for Archaeological Research, Australian National University, Canberra.

Odell, D.K. and MacMurray, C., 1986. Behavioral response to oil. In: Vargo, S., Lutz, P.L., Odell, D.K., van Vleet, T. and Bossart, G., (eds.), Study of effects of oil on marine turtles: Final report, U.S. Dept. of the Interior, Minerals Management Servive, Gulf of Mexico OCS Region, New Orleans, L.A. OCS Study MMS 86-0070.

Oil and Gas UK, 2014. Guidance on risk related decision making (Issue No. 2). United Kingdom Offshore Operators Association, London.

Otway, N. M., Burke, A. L., Morrison, N. S., Parker, P. C., 2003. Monitoring and identification of NSW critical habitat sites for conservation of grey nurse sharks. New South Wales Fisheries Final Report Series No. 47. NSW Fisheries Office of Conservation, Nelson Bay, NSW. 62 pp

Ovenden, J.R., Salini, J., O'Connor, S. and Street, A.R. 2004. Pronounced genetic population structure in a potentially vagile fish species (*Pristipomoides multidens*, Teleostei; Perciformes; Lutjanidae) from the East Indies triangle. Molecular Ecology 13(7): 1991–1999.

Palmer C, Parra, G.J,, Rogers, T & Woinarski, J, 2014. Collation and review of sightings and distribution of three coastal dolphin species in waters of the Northern Territory, Australia. *Pacific Conservation Biology*, 20(1) 116-125.

Parry, G.D. and Gason, A. 2006. The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. Fisheries Research 79:272-284.

Parry, G.D., Heislers, S., Werner, G.F., Asplin, M.D. and Gason, A., 2002. Assessment of Environmental Effects of Seismic Testing on Scallop Fisheries in Bass Strait. Marine and Freshwater Resources Institute Report No. 50. Marine and Freshwater Resources Institute, Queenscliff, Victoria.

Parsons, D.M., Morrison, M.A., McKenzie, J.R., Hartill, B.W., Bian, R. and Francis, R.C. 2011. A fisheries perspective of behavioural variability: differences in movement behaviour and extraction rate of an exploited sparid, snapper (*Pagrus auratus*). Canadian Journal of Fisheries and Aquatic Sciences 68(4): 632–42.

Parsons, M. J., Barneche, D. R., Speed, C. W., McCauley, R. D., Day, R. D., Dang, C., ... & Meekan, M. G. (2023). A large-scale experiment finds no consistent evidence of change in mortality or commercial productivity in silverlip pearl oysters (Pinctada maxima) exposed to a seismic source survey. Marine Pollution Bulletin, 115480.

Parvin, S., 2005. Limits for underwater noise exposure of human divers and swimmers. Subacoustech. Presented at the National Physics Laboratory Seminar on Underwater Acoustics, Teddington, UK.

Patterson, H., Larcombe, J., Nicol, S. and Curtotti, R., 2018. Fishery status reports 2018, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

Patterson, H, Bromhead, D, Galeano, D, Larcombe, J, Timmiss, T, Woodhams, J and Curtotti, R 2022, Fishery status reports 2022, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. CC BY 4.0. https://doi.org/10.25814/gx9r-3n90.Paulay, G., Kirkendale, L., Lambert, G. and Meyer, C. 2002. Anthropogenic Biotic Interchange in a Coral Reef Ecosystem: A Case Study from Guam. Pacific Science. 56. 10.1353/psc.2002.0036.

Paxton, A.B., Taylor, J.C., Nowacek, D.P., Dale, J., Cole, E. Voss, C.M. and Peterson, C.H. 2017. Seismic survey noise disrupted fish use of a temperate reef. Marine Policy 78: 68-73.

Payne, J. F., Coady, J. and White, D. 2009. Potential effects of seismic air gun discharges on monkfish eggs (*Lophius americanus*) and larvae. National Energy Board, Canada.

Payne, J.F. 2004. Potential effect of seismic surveys on fish eggs, larvae and zooplankton. CSAS Research Document 2004/125. Canadian Science Advisory Secretariat, Department of Fisheries and Oceans, Canada.

Payne, J.F., Andrews, C., Fancey, L., White, D. and Christian, J., 2008. Potential Effects of Seismic Energy on Fish and Shellfish: An Update since 2003. Report Number 2008/060. Canadian Science Advisory Secretariat. 22 pp.

Pearce, A., Buchan, S., Chiffings, T., D'Adamo, N., Fandry, C., Fearns, P., Mills, D., Phillips, R. and Simpson, C. 2003. A review of the oceanography of the Dampier Archipelago, Western Australia, Museum of Western Australia, Perth, Western Australia.

Pearson, W.H., Skalski, J.R. and Malme, C.I. 1992. Effects of sounds from a geophysical survey device on behaviour of captive rockfish (*Sebastes* spp.). Canadian Journal of Aquatic Science 49(7): 1343–1356.

Pearson, W.H., Skalski, J.R., Sulkin, S.D., and Malme, C.I. 1994. Effects of seismic releases on the survival of development of zoeal larvae of Dungeness crab (*Cancer magister*). Marine Environmental Research 38: 93-113.

Peel., D., Smith., J.N. and Childerhouse, S., 2016. Historical data on Australian whale vessel strikes. Presented to the IWC Scientific Committee. SC/66b/HIM/05.

Peña, H., Handegard, N.O., and Ona, E., 2013. Feeding herring schools do not react to seismic air gun surveys. ICES Journal of Marine Science 70: 1174–1180.

Pendoley, K.L., Schofield, G., Whittock, P.A., Ierodiaconou, D and Hays G.C. 2014. Protected species use of a coastal marine migratory corridor connecting marine protected areas, vol. 161, no. 6, pp. 1455-1466.

Peverell, S. 2007. Dwarf Sawfish *Pristis clavata*. Marine Education Society of Australia. Available at http://www.mesa.edu.au/seaweek2008/info_sheet05.pdf. Accessed 11 April 2019.

Peverell, S., Gribble, N., and Larson, H. 2004. Sawfish, in National Oceans Office, Descriptions of Key Species Groups in the Northern Planning Area. Commonwealth of Australia, Hobart, Tasmania.

Peverell, S.C. 2005. Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on sawfish ecology, Environmental Biology of Fishes, vol. 73, no. 4, pp. 391-402.

Popper, A., Hawkins, A., Fay, R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W., Gentry, R., Halvorsen, M., Løkkeborg, S., Rogers, P., Southall, B., Zeddies, D. and Tavolga, W., 2014, ASA S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Part of the series SpringerBriefs in Oceanography pp 15-16.

Popper, A.N. and Clarke, N.L. 1976. The auditory system of the goldfish (Carassius auratus): effects of intense acoustic stimulation. Comparative Biochemistry Physiology Part A: Physiology 53:11–18.

Popper, A.N. and Fay, R.R., 2011. Rethinking sound detection by fishes. Hearing Research 273, 25-36.

Popper, A.N. and Hawkins, A.D., 2018. The importance of particle motion to fishes and invertebrates. Journal of the Acoustical Society of America 143 (1): 470-488.

Popper, A.N. and Hawkins, A.D., 2019. An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. Journal of Fish Biology 2019: 1-22.

Popper, A.N., Carlson, T.J., Gross, J.A., Hawkins, A.D., Zeddies, D.G., Powell, L. and Young, J., 2016. Effects of seismic air guns on pallid sturgeon and paddlefish. In: Popper, A.N. and Hawkins, A.D. (eds.). The Effects of Noise on Aquatic Life II. Volume 875. Springer, New York. pp 871-878.

Popper, A.N., Halvorsen, M.B., Kane, E., Miller, D.L., Smith, M.E., Song, J., Stein, P. and Wysocki, l.E. 2007. The effects of high-intensity, low-frequency active sonar on rainbow trout. Journal of the Acoustical Society of America 122:623–635.

Popper, A.N., Hawkins, A.D., Sand, O. and Sisneros, J.A. 2019. Examining the hearing abilities of fishes. Journal of the Acoustical Society of America, 146(2): 948-955.

Popper, A.N., Smith, M.E., Cott, P.A., Hanna, B.W., MacGillivray, A.O., Austin, M.E and Mann, D.A., 2005. Effects of exposure to seismic airgun use on hearing of three fish species. Journal of the Acoustical Society of America 117: 3958.

PTTEP 2013. Montara Environmental Monitoring Program, Report of Search. PTTEP Australia, Western Australia. Available at http://www.au.pttep.com/wp-content/uploads/2013/10/2013-Report-of-Research-Book-vii.pdf. Accessed 16 May 2019

Przeslawski, R., Bruce, B., Carroll, A., Anderson, J., Bradford, R., Durrant, A., Edmunds, M., Foster, S., Huang, Z., Hurt, L., Lansdell, M., Lee, K., Lees, C., Nichols, P. and Williams, S., 2016b. Marine Seismic Survey Impacts on Fish and Invertebrates: Final Report for the Gippsland Marine Environmental Monitoring Project. Record 2016/35. Geoscience Australia, Canberra. 63 pp.

Przeslawski, R., Hurt, L., Forrest, A., Carrol, A. and Geoscience Australia, 2016a. Potential short-term impacts of marine seismic surveys on scallops in the Gippsland Basin. Canberra. April. CC BY 3.0.

Quijano, J. E. and McPherson, C.R., 2020. 3D Oil Sauropod 3-D Marine Seismic Survey: Acoustic Modelling for Assessing Marine Fauna Sound Exposures. Document 01781, Version 1.1. Technical report by JASCO Applied Sciences for Environmental Resources Management.

Radford, C.A., Montgomery, J.C., Caiger, P. and Higgs, D.M. 2012 Pressure and particle motion detection thresholds in fish: a re-examination of salient auditory cues in teleosts. Journal of Experimental Biology 215: 3429–3435.

Raudino, H.C., Douglas, C.R. & Waples, K.A., 2018. How many dolphins live near a coastal development? *Regional Studies in Marine Science*, 2018;19:25–32.

Reeves, R.R., B.D. Smith, E.A. Crespo, and G. Notarbartolo di Sciara, eds. (2003). Dolphins, Whales and Porpoises: 2002-2010 Conservation Action Plan for the World's Cetaceans. Switzerland and Cambridge: IUCN/SSC Cetacean Specialist Group. IUCN, Gland.

Richardson, A.J., Matear, R.J. and Lenton, A., 2017. Potential impacts on zooplankton of seismic surveys. CSIRO, Australia. 34 pp.

Richardson, W.J., Greene, C.R., Malme, C.I. and Thomson, D.H., 1995. Marine Mammals and Noise. Academic Press, San Diego, 576 pp.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. and Winker, H. 2019. *Isurus paucus* – The IUCN Red List of Threatened Species. Available at https://www.iucnredlist.org/species/60225/3095898. Accessed 11 April 2019.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019b. *Carcharhinus longimanus*. The IUCN Red List of Threatened Species 2019: e.T39374A2911619. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39374A2911619.en. Downloaded on 10 June 2021.

Roberts, L., Cheesman, S., Elliott, M. and Breithaupt, T. 2016. Sensitivity of *Pagurus bernhardus* (L.) to substrate-borne vibration and anthropogenic noise. Journal of Experimental Marine Biology and Ecology 474: 185–194.

Anthony Roelofs, Toby Piddocke, Crispian Ashby, Simon Conron, Klaas Hartmann, Alex Hesp, Patrick Hone, Ian Jacobsen, Marlee Jesson-Kerr, Stephen Mayfield, John Stewart, Michael Usher, James Woodhams and Daniel Wright (eds) 2024, Status of Australian Fish Stocks Reports 2024, Fisheries Research and Development Corporation, Canberra.

Sætre, R. and Ona, E., 1996. Seismic investigations and harmful effects on fish eggs and larvae. An assessment of the possible effects on the level of recruitment. Fisken og Havet, Havforskningsinstituttet, Bergen (Norway), 1996, no. 8, 25 pp.

Salgado Kent, C., McCauley, R.D., Duncan, A., Erbe, C., Gavrilov, A., Lucke, K. and Parnum, I., 2016. Underwater Sound and Vibration from Offshore Petroleum Activities and their Potential Effects on Marine Fauna: An Australian Perspective. Centre for Marine Science and Technology (CMST), Curtin University. April 2016. Project CMST 1218; Report 2015-13. 184 pp.

Salgado Kent, C.P., Gavrilov, A.N., Recalde-Salas, A., Burton, C.L.K., McCauley, R.D. and Marley, S. 2012. Passive acoustic monitoring of baleen whales in Geographe Bay, Western Australia, Proceedings of Acoustics, Nov 21-23, 2012. Acoustical Society of Australia, Freemantle, Western Australia.

Salmon, M., Witherington, B.E., 1995. Artificial lighting and seafinding by loggerhead hatchlings: evidence for lunar modulation. Copeia 931–938.

Santos Ltd 2019. Keraudren Seismic Survey Environment Plan Summary. Santos Ltd, Perth, Western Australia. Document number QE-91-RI-20012.04

Santos Ltd 2020. Keraudren Extension Seismic Survey Environment Plan. Santos Ltd, Perth, Western Australian. Document number SO-91-BI-20006.01

Santos Ltd. 2018. Bethany 3D Marine Seismic Survey Environment Plan Summary. A6657652. Report prepared by Santos Ltd., Perth, Western Australia.

Santulli, A., Modica, A., Messina, C., Ceffa, L., Curatolo, A., Rivas, G., Fabi, G. and D'Amelio, V. 1999. Biochemical responses of European Sea Bass (*Dicentrarchus labrax L.*) to the stress induced by off shore experimental seismic prospecting. Marine Pollution Bulletin 38: 1105–1114.

Saunders, T., Dawson, A., Trinnie, F. and Newman, S.J. 2018. Goldband Snapper (2018). Accessed online on 20 March 2019 at https://www.fish.gov.au/report/221-Goldband-Snapper-2018

Scholik, A.R. and Yan, H.Y. 2001. Effects of underwater noise on auditory sensitivity of a cyprinid fish. Hearing Research 152:17–24.

Scholz, D., Michel, J., Shigenaka, G. and Hoff, R., 1992. Biological resources. In: Hayes M., Hoff R., Michel J., Scholz D. and Shigenaka G. Introduction to coastal habitats and biological resources for spill response, report HMRAD 92-4. National Oceanic and Atmospheric Administration, Seattle.

Semeniuk, V., Chalmer, P.N. and Le Provost, I. 1982. The marine environments of the Dampier Archipelago, Journal of the Royal Society of Western Australia 65: 97–114.

Simmonds, J.E. and MacLennan, D. 2005. Fisheries acoustics: theory and practice. Second edition. Blackwell Science, Oxford, United Kingdom.

Simmonds, M., Dolman, S. and Weilgart, L., 2004. Oceans of Noise. A Whale and Dolphin Conservation Society Science Report. The Whale and Dolphin Conservation Society. Chippernam, Wiltshire, United Kingdom.

Sivle, L. D., Forland, T. N., Hansen, R. R., Andersson, M., Grimsbø, E., Linne, M., & Karlsen, H. E. (2017). Behavioural effects of seismic dose escalation exposure on captive mackerel (Scomber scombrus). Rapport fra havforskningen.

Sleeman, J. C., M.G. Meekan, B.J. Fitzpatrick, C.R. Steinberg, R. Ancel and C.J.A. Bradshaw (2010). Oceanographic and atmospheric phenomena influence the abundance of whale sharks at Ningaloo Reef, Western Australia. Journal of Experimental Marine Biology and Ecology. 383:77-81.

Slotte, A., Hansen, K., Dalen, J. and Ona, E., 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fisheries Research 67: 143-150.

Smith, M.E., Coffin, A.B., Miller, D.L., Popper, A.N. 2006. Anatomical and functional recovery of the goldfish (Carassius auratus) ear following noise exposure. Journal of Experimental Biology 209:4193–4202.

Smith, M.E., Kane, A.S., Popper, A.N. 2004a. Noise-induced stress response and hearing loss in goldfish (*Carassius auratus*). Journal of Experimental Biology 207:427–435.

Smith, M.E., Kane, A.S., Popper, A.N. 2004b. Acoustical stress and hearing sensitivity in fishes: does the linear threshold shift hypothesis hold water? Journal of Experimental Biology 207:3591–3602.

Smith, M.E., Schuck, J.B., Gilley, R.R., Rogers, B.D. 2011. Structural and functional effects of acoustic exposure in goldfish: evidence for tonotopy in the teleost saccule. BMC Neuroscience 12:19.

Son Roque, C. (2006) On "Tjukurrpa", Painting Up, and Building Thought Craig San Roque Social Analysis: The International Journal of Anthropology 50, (2),,148-172.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, *et al.*, 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33(4): 411-521.

Southall, BL, Bowles, AE, Ellison, WT, Finneran, JJ, Gentry, RL, Greene Jr., CR, Kastak, D, Ketten, DR, Miller, JH, Nachtigall, PE, Richardson, WJ, Thomas, JA and Tyack, PL. 2007. Marine mammal sound exposure criteria: Initial scientific recommendations. Aquatic Mammals, vol. 33, iss. 4, pp. 411-509.

Spaulding, M.L., Kolluru, V.S., Anderson, E. and Howlett, E., 1994. Application of three-dimensional oil spill model (WOSM/OILMAP) to hindcast the Braer Spill. Spill Science and Technology Bulletin 1(1), 23–35.

Spaulding, M.S., Mendelsohn, D., Crowley, D., Li, Z. and Bird, A., 2015. Technical Reports for Deepwater Horizon Water Column Injury Assessment- WC_TR.13: Application of OILMAP DEEP to the Deepwater Horizon Blowout. RPS APASA, 55 Village Square Drive, South Kingstown, RE 02879.

Stevens, J.D., McAuley, R.B., Simpfendorfer, C.A., and Pillans, R.D. 2008. Spatial distribution and habitat utilisation of sawfish (*Pristis* spp) in relation to fishing in northern Australia, A report to the Department of the Environment, Water, Heritage and the Arts. CIRO and Western Australian Department of Fisheries.

Stevens, J.D., Pillans, R.D., and Salini, J. 2005. Conservation Assessment of Glyphis sp. A (Speartooth Shark), Glyphis sp. C (Northern River Shark), *Pristis microdon* (Freshwater Sawfish) and *Pristis zijsron* (Freen Sawfish). CSIRO Marine Research, Hobart, Tasmania.

Tang, K.W., Gladyshev, M.I., Dubovskaya, O.P., Kirillin, G. and Grossar, H-P., 2014. Zooplankton carcasses and non-predatory mortality in freshwater and inland sea environments. Journal of Plankton Research, 36: 597–612.

Taylor, J.G., 2007. Ram filter-feeding and nocturnal feeding of whale sharks (*Rhincodon typus*) at Ningaloo Reef, Western Australia, Fisheries Research 84(1): 65–70.

Thomson, P. 2015. The ocean's microscopic unsung heroes. UWA Oceans Institute, Oceans Online, Issue 5. Available at http://www.oceans.uwa.edu.au/community/oceans-online/the-oceans-microscopic-unsung-heroes. Accessed 2 May 2019

Thorburn, D., Morgan, D., Gill, H., Johnson, M., Wallace-Smith, H., Vigilante, T., Croft, I. and Fenton, J. 2004. Biology and cultural significance of the freshwater sawfish (*Pristis microdon*) in the Fitzroy River Kimberley, Western Australia. Report to the Threatened Species Network.

Thums, M., Ferreira, L., Jenner, C., Jenner, M., Harris, D., Davenport, A., Andrews-Goff, V., Double, M., Moller, L., Attard, C. R. M., Bilgmann, K., Thomson, P, & McCauley, R. 2022. Pygmy blue whale movement, distribution and important areas in the Eastern Indian Ocean. *Global Ecology and Conservation,* e02054. Available at: https://doi.org/10. 1016/j.gecco.2022.e02054

Tourism Western Australia, 2019. Attraction – Rowley Shoals. Available at https://www.westernaustralia.com/en/Attraction/ Rowley_Shoals/56b2678f2cbcbe7073ae16b8#/. Accessed 15 May 2019.

Turnpenny, A.W.H. and Nedwell, J.R. 1994. The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. Report by Fawley Aquatic Research Laboratories Ltd, Hampshire, United Kingdom for United Kingdom Offshore Operators Association, London, United Kingdom.

Underwood, J.N., Smith, L.D., van Oppen, M.J.H. and Gilmour, J., 2009. Ecologically relevant dispersal of a brooding and a broadcast spawning coral at isolated reefs: implications for managing community resilience, Ecological Applications, vol. 19, no. 1, pp. 18-29.

van Duinkerken, D. 2010. Movements and site fidelity of the reef manta ray, *Manta alfred*i, along the coast of southern Mozambique. Mater Thesis, Utrecht University, Utrecht, Netherlands.

van Herwerden, L., Aspden, W.J., Newman, S.J., Pegg, G.G. Briskey, L. and Sinclair, W. 2009. A comparison of the population genetics of *Lethrinus miniatus* and *Lutjanus sebae* from the east and west coasts of Australia: evidence for panmixia and isolation, Fisheries Research, 100 (2): 148–155.

Vereide, E., Mihaljevic, M., Browman, H., Fields, D., Agersted, M., Titelman, J. and de Jong, K. 2023. Effects of airgun discharges used in seismic surveys on development and mortality in nauplii of the copepod Acartia tonsa. Environmental Pollution. 327. 121469. 10.1016/j.envpol.2023.121469.

Veron, J.E.N. 1986. Part II: Reef-building corals, in Berry, P. (Ed.), Fauna Surveys of the Rowley Shoals, Scott Reef and Seringapatam Reef, North0-western Australia. Records of the Western Australian Museum, Supplement No. 25, pp. 27-35.

Veron, J.E.N. 1993. Part 2: Hermatypic Corals of Ashmore Reef and Cartier Islands, in Berry. P. (Ed.), Marine Fauna Surveys of Ashmore Reef and Cater Island, North-western Australia. Records of the Western Australian Museum, Supplement No. 44, pp. 13-20.

Wakefield, C.W., Denham, A., Trinnie, F., Hesp, S.A., Marks, R., Boddington, D., and Newman, S.J. 2024. Assessment of the status of the Pilbara Demersal Scalefish Resource. Fisheries Research Report No. 338. Department of Primary Industries and Regional Development, Western Australia. 103 p.

Walker D.I. and Prince, R.I.T. 1987. The Distribution and Biogeography of Seagrass Species on the Northwest Coast of Australia, Aquatic Biology vol. 29, no. 1, pp. 19-32.

Wardle, C.S., Carter, T.J., Urquhart, G.G., Johnstone, A.D.F., Ziolkowski, A.M., Hampson, G. and Mackie, D., 2001. Effects of seismic air guns on marine fish. Continental Shelf Research 21: 1005-1027.

Webster, F.J., Wise, B.S., Fletcher, W.J. and Kemps, H., 2018. Risk Assessment of the potential impacts of seismic air gun surveys on marine finfish and invertebrates in Western Australia. Fisheries Research Report No. 288 Department of Primary Industries and Regional Development, Western Australia. 42 pp.

Weigmann, S. 2016. Annotated checklist of the living sharks, batoids and chimaeras (Chondrichthyes) of the world, with a focus on biogeographical diversity. Journal of Fish Biology 88(3): 837-1037.

Weinhold, R.J. and Weaver, R.R., 1972. Seismic air guns effect on immature coho salmon. Preprint for the 42nd Annual Meeting of the Society of Exploration Geophysicists. Alaska Department. of Fish and Game. 16 pp.

Wells, F. E., McDonald, J. I. and Huisman, J. M. 2009. Introduced Marine Species in Western Australia. Fisheries Occasional Publications No. 57. Department of Fisheries, Perth, Western Australia. 102 pp.

Whitty, J.M., Morgan, D.L., Thorburn, D.C., Fazeldean, T. and Peverell, S.C. 2008. Tracking the movements of Freshwater Sawfish (*Pristis microdon*) and the Northern River Sharks (Glyphis sp. C): including genetic analysis of *P. microdon* across northern Australia. A report to the Department of the Environment, Water, Heritage and the Arts. Centre for Fish and Fisheries Research, Murdoch University.

Williamson, M. and Fitter, A. 1996. 'The Characteristics of Successful Invaders', Biological Conservation, vol. 78, pp. 163-170.

Wilson S.G., Carlton, J.H. and Meekan, M.G. 2003. Spatial and temporal patterns in the distribution and abundance of macrozooplankton on the southern North West Shelf, Western Australia, Journal of Estuarine Coastal and Shelf Science, 56: 897–908.

Wilson, S.G., Polovina, J.J., Stewart, B.S. and Meekan, M.G. 2006. Movements of whale sharks (*Rhincodon typus*) tagged at Ningaloo Reef, Western Australia, Marine Biology, vol. 148, no. 55, pp. 1157-1166.

Witherington, BE. and Martin, RE. 2003. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Fish and Wildlife Conservation Commission FMRI Technical Report TR-2 3rd Edition Revised: 74pp.

CGG Energy Ltd. 2011. Impacts of seismic airgun noise on fish behaviour: a coral reef case study. Maxima 3D MSS Monitoring Program Information Sheet 1. CGG Energy Ltd., Perth, Western Australia.

Wyatt, R. 2008. Joint Industry Programme on sound and marine life: Review of existing data on underwater sounds produced by the oil and gas industry. Issue 1. Seiche Measurements Limited.

Yamamoto, T., Takahashi, A., Katsumata, N., Sato, K. and Trathan, P.N. 2010. At-Sea Distribution and Behavior of Streaked Shearwaters (Calonectris leucomelas) During the Nonbreeding Period, the Auk, vol. 127, no. 4, pp. 871-881.

Yamatji Marlpa Aboriginal Corporation (2016) Traditional Ecolgoical Knowledge of Nyangumarta Warrarn Indigenous Protected Area. Ethno-booklet, available at https://www.ymac.org.au/wp-content/uploads/2013/05/899-Ethno-booklet.pdf

Yawuru RNTBC (2014) Yawuru Indigenous Protected Area: Walyjalajala nagulagabu birrangan buru Plan of Management 2016-2026: Yawuru RNTBC, 85 pp., https://www.yawuru.org.au/wp-content/uploads/2019/05/IPA-FINAL-APPROVED_Nov2016_High_Res-ID-167653.pdf

Young, C.N., Carlson, J.K. The biology and conservation status of the oceanic whitetip shark (*Carcharhinus longimanus*) and future directions for recovery. Rev Fish Biol Fisheries 30, 293–312 (2020). https://doi.org/10.1007/s11160-020-09601-3.

Appendix A: CGG Environment Policy

Care+Protect
WHAT MATTERS

VIRIDIEN

ESG POLICY

Purpose

At Viridien, we consider the health of the environment, climate responsibility, ethics and socially responsible operations are critical moral duties essential to the global well-being and to the sustainability of our company. We're committed to making continuous progress in these areas to ensure sustainable practices, enhance transparency, and address stakeholder concerns about risks and impacts related to climate, social equity, and governance.

Scope

This policy applies to all Viridien employees as well as contractors and site visitors within our prevailing influence.

Environment

We are committed to minimizing our environmental impact and promoting sustainable practices across our activities.

- We set measurable targets and regularly assess our progress against these goals. We report environmental data across our operations, measuring and monitoring the Carbon Footprint.
- We are committed to reducing our overall carbon footprint by tackling direct and indirect emissions (scopes 1, 2 and 3) across our entire value chain. We aim at carbon neutrality by 2050 in our scopes 1 & 2 of the Greenhouse Gas Protocol.
- We foster the development of low-carbon products and sustainable services to cater for our customer needs and we collaborate on their carbon footprint reduction projects and initiatives.
- We aim at the complete decarbonization of our energy supply supporting our activities and we strive to reduce our energy consumption encouraging smart technologies and constantly improving our energy efficiency.
- We focus on reducing waste, improving water management, and promoting circular economy principles to reduce our consumption and promote recycling and reuse.

Social

We are committed to promoting a diverse, equitable and inclusive workplace and positively impacting all our stakeholders.

- We strengthen our work environment and our culture around diversity, equity and inclusion.
- We ensure our work environment enables the engagement, development and training of our employees and attracts the best talents.
- We act as a positive influence for our employees, suppliers, and communities.
- We maintain a robust HSE-Operating Management System which is built around and complies with recognized International and Industry standards and supports our commitments.

Governance

We are committed to maintaining a strong corporate governance which shall guide our operations.

- We maintain an independent board of Directors with clear responsibilities for ESG reporting oversight and are committed to transparency through regular disclosure of our ESG performance.
- We conduct our business in a responsible manner, assessing the risks and potential impacts of our decisions.
- We act responsibly and ethically and abide by all applicable laws and regulations, providing our employees and contractors with guidance and support to enable compliance and we enforce a strong ethical leadership through our Business Code of Conduct, mandatory trainings and whistleblower program.
- We are accountable on data security and privacy with comprehensive cybersecurity programs to protect our stakeholders' information ensuring compliance with all regulations.
- We collaborate with all stakeholders to develop a sustainable supply chain that integrates environmental, social and economic considerations into the process of sourcing, producing and delivering goods and services. We aim at minimizing negative environmental impacts, ensuring fair labor practices and promoting ethical sourcing, we prioritize sourcing with partners with strong ESG performance.



Sophie ZURQUIYAH
Chief Executive Officer

Date: September 2024 - **Review Period:** September 2026

Appendix B: Existing Environment Search Reports

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 26-Jun-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Search Area: Operational Area

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	19
Listed Migratory Species:	35

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	57
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	4
Key Ecological Features (Marine):	1
Biologically Important Areas:	3
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Papasula abbotti](#) Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
[Phaethon lepturus fulvus](#) Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
[Phaethon rubricauda westralis](#) Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat likely to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
SHARK		
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
[Pristis zijsron](#) Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Sphyrna lewini](#) Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
[Anous stolidus](#) Common Noddy [825]		Species or species habitat may occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat likely to occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Trachyrhamphus bicoarctatus](#) Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
[Trachyrhamphus longirostris](#) Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		
[Aipysurus duboisii](#) Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
[Aipysurus laevis](#) Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
[Aipysurus mosaicus as Aipysurus eydouxii](#) Mosaic Sea Snake [87261]		Species or species habitat may occur within area
[Aipysurus tenuis](#) Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
[Ephalophis greyae as Ephalophis greyi](#) Mangrove Sea Snake [93738]		Species or species habitat may occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
[Delphinus delphis](#) Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
[Feresa attenuata](#) Pygmy Killer Whale [61]		Species or species habitat may occur within area
[Globicephala macrorhynchus](#) Short-finned Pilot Whale [62]		Species or species habitat may occur within area
[Grampus griseus](#) Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
[Kogia breviceps](#) Pygmy Sperm Whale [57]		Species or species habitat may occur within area
[Kogia sima](#) Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
[Lagenodelphis hosei](#) Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]		Breeding known to occur within area

Current Scientific Name	Status	Type of Presence
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Controlled action			
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Not controlled action (particular manner)			
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Seabirds		
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
[Phaethon lepturus](#) White-tailed Tropicbird [1014]	Breeding	Known to occur
Sharks		
[Rhincodon typus](#) Whale Shark [66680]	Foraging	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

© Commonwealth of Australia
Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 26-Jun-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Search Area: EMBA

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	26
Listed Migratory Species:	48

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	1
Listed Marine Species:	88
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	5
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	11
Key Ecological Features (Marine):	2
Biologically Important Areas:	21
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Phaethon lepturus fulvus](#) Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
[Phaethon rubricauda westralis](#) Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Breeding known to occur within area
[Sternula albifrons](#) Little Tern [82849]	Vulnerable	Breeding known to occur within area
MAMMAL		
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Migration route known to occur within area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
[Orcaella heinsohni](#) Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
[Sousa sahulensis](#) Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
[Aipysurus apraefrontalis](#) Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
[Aipysurus foliosquama](#) Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		

Scientific Name	Threatened Category	Presence Text
[Anous stolidus](#) Common Noddy [825]		Species or species habitat may occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat likely to occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Breeding known to occur within area
[Phaethon rubricauda](#) Red-tailed Tropicbird [994]		Breeding known to occur within area
[Sterna dougallii](#) Roseate Tern [817]		Breeding likely to occur within area
[Sternula albifrons](#) Little Tern [82849]	Vulnerable	Breeding known to occur within area
[Sula leucogaster](#) Brown Booby [1022]		Breeding known to occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Heritage Places		[Resource Information]
Name	State	Status
Natural		
Mermaid Reef - Rowley Shoals	WA	Listed place

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Phaethon rubricauda](#) Red-tailed Tropicbird [994]		Breeding known to occur within area
[Sterna dougallii](#) Roseate Tern [817]		Breeding likely to occur within area
[Sternula albifrons as Sterna albifrons](#) Little Tern [82849]	Vulnerable	Breeding known to occur within area
[Sula leucogaster](#) Brown Booby [1022]		Breeding known to occur within area
[Thalasseus bengalensis as Sterna bengalensis](#) Lesser Crested Tern [66546]		Breeding known to occur within area
Fish		
[Acentronura larsonae](#) Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
[Bhanotia fasciolata](#) Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
[Bulbonaricus brauni](#) Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
[Campichthys tricarinatus](#) Three-keel Pipefish [66192]		Species or species habitat may occur within area
[Choeroichthys brachysoma](#) Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
[Choeroichthys latispinosus](#) Muiron Island Pipefish [66196]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		

Scientific Name	Threatened Category	Presence Text
[Dugong dugon](#) Dugong [28]		Species or species habitat may occur within area
Reptile		
[Aipysurus apraefrontalis](#) Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
[Aipysurus duboisii](#) Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
[Aipysurus foliosquama](#) Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
[Aipysurus laevis](#) Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
[Aipysurus mosaicus as Aipysurus eydouxii](#) Mosaic Sea Snake [87261]		Species or species habitat may occur within area
[Aipysurus tenuis](#) Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Crocodylus porosus](#) Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Sea Snake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Park Name	Zone & IUCN Categories
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)

Park Name	Zone & IUCN Categories
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Mermaid Reef	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

[Resource Information]

Scientific Name	Behaviour	Presence
All year (Jun - Aug)		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur

Extra Information

State and Territory Reserves

[Resource Information]

Protected Area Name	Reserve Type	State
Rowley Shoals	Marine Park	WA

Nationally Important Wetlands

[Resource Information]

Wetland Name	State
Mermaid Reef	EXT

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Controlled action			
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Not controlled action (particular manner)			
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
Koolama 2D Seismic Survey Dampier Basin	2010/5420	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Phoenix 3D Seismic Survey, Bedout Sub-Basin	2010/5360	Not Controlled Action (Particular Manner)	Post-Approval
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
River shark		

Scientific Name	Behaviour	Presence
Pristis clavata Dwarf Sawfish [68447]	Foraging	Known to occur
Pristis clavata Dwarf Sawfish [68447]	Nursing	Known to occur
Pristis clavata Dwarf Sawfish [68447]	Pupping	Known to occur
Pristis pristis Largetooth Sawfish [60756]	Foraging	Known to occur
Pristis pristis Largetooth Sawfish [60756]	Pupping	Likely to occur
Pristis zijsron Green Sawfish [68442]	Nursing	Known to occur
Pristis zijsron Green Sawfish [68442]	Pupping	Known to occur
Seabirds		
Ardenna tenuirostris Short-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Resting	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur

Scientific Name	Behaviour	Presence
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

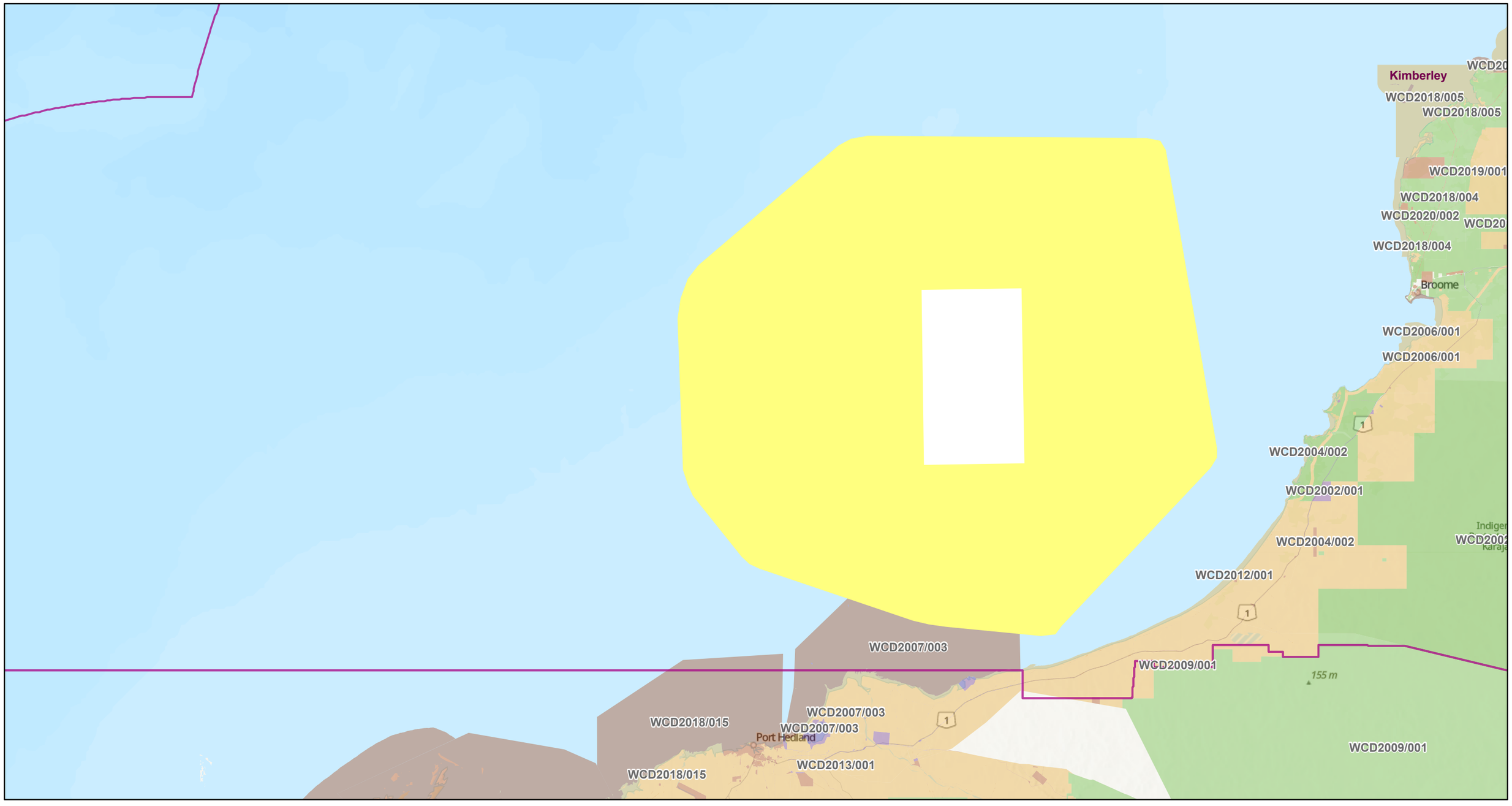
-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

© Commonwealth of Australia
Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

Native TitleVision Web Map



9/15/2025, 6:11:22 PM

1:2,311,162

0 25 50 100 mi

0 40 80 160 km

falseColor
8
RATSIB Areas

Determined Outcomes
Native title does not exist
Native title exists (exclusive)
Native title exists (non-exclusive)
Native title extinguished

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

Native TitleVision

Esri, USGS | Esri, TomTom, Garmin, FAO, METI/NASA, USGS | National Native Title Tribunal, © Commonwealth of Australia |

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Search Criteria

55 Aboriginal Cultural Heritage (ACH) Lodged in Custom search area - Polygon - 122.413580956052°E, 16.8605885950071°S (GDA94) : 122.523444237302°E, 16.9709539538004°S (GDA94) : 122.441046776364°E, 17.0602498666978°S (GDA94) : 122.358649315427°E, 17.0917558894873°S (GDA94) : 122.375128807614°E, 17.1652492150388°S (GDA94) : 122.314704002927°E, 17.2439597608346°S (GDA94) : 122.248786034177°E, 17.2911699937498°S (GDA94) : 122.215827049802°E, 17.4222459189288°S (GDA94) : 122.204840721677°E, 17.5637022831503°S (GDA94) : 122.254279198239°E, 17.6893485698161°S (GDA94) : 122.265265526364°E, 17.7992170521714°S (GDA94) : 122.265265526364°E, 17.8515116406625°S (GDA94) : 122.292731346677°E, 17.9142448586663°S (GDA94) : 122.413580956052°E, 17.9142448586663°S (GDA94) : 122.424567284177°E, 18.0605359326046°S (GDA94) : 122.397101463864°E, 18.1597356181854°S (GDA94) : 122.237799706052°E, 18.248445514514°S (GDA94) : 121.902716698239°E, 18.5195116509258°S (GDA94) : 121.842291893552°E, 18.5299287407475°S (GDA94) : 121.814826073239°E, 18.5820046621834°S (GDA94) : 121.842291893552°E, 18.644474766734°S (GDA94) : 121.825812401364°E, 18.717327516015°S (GDA94) : 121.721442284177°E, 18.7797477636805°S (GDA94) : 121.573126854489°E, 19.0655438107469°S (GDA94) : 121.435797752927°E, 19.3145641043614°S (GDA94) : 121.177619041989°E, 19.5735574357215°S (GDA94) : 121.117194237302°E, 19.5994339870086°S (GDA94) : 121.111701073239°E, 19.454471841606°S (GDA94) : 121.358893456052°E, 19.2160386307523°S (GDA94) : 121.606085838864°E, 18.8005493795266°S (GDA94) : 121.589606346677°E, 18.6809050564231°S (GDA94) : 121.661017479489°E, 18.4986755681928°S (GDA94) : 121.836798729489°E, 18.3892445941472°S (GDA94) : 121.913703026364°E, 18.3892445941472°S (GDA94) : 122.045538963864°E, 18.2797440926438°S (GDA94) : 122.276251854489°E, 18.1336358856814°S (GDA94) : 122.325690331052°E, 18.0500905960285°S (GDA94) : 122.309210838864°E, 17.992630159891°S (GDA94) : 122.199347557614°E, 18.0500905960285°S (GDA94) : 122.122443260739°E, 17.9821807949406°S (GDA94) : 122.138922752927°E, 17.9090179373421°S (GDA94) : 122.177374901364°E, 17.8515116406625°S (GDA94) : 122.149909081052°E, 17.6736475753284°S (GDA94) : 122.105963768552°E, 17.558465123481°S (GDA94) : 122.116950096677°E, 17.3016595135703°S (GDA94) : 122.160895409177°E, 17.2282203312398°S (GDA94) : 122.204840721677°E, 17.1180068402732°S (GDA94) : 122.413580956052°E, 16.8605885950071°S (GDA94)

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the *Aboriginal Heritage Act 1972*.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register established and maintained under the *Aboriginal Heritage Act 1972*.

Location information data licensed from Western Australian Land Information Authority (WALIA) trading as Landgate. Copyright in the location information data remains with WALIA. WALIA does not warrant the accuracy or completeness of the location information data or its suitability for any particular purpose.

Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- **Boundary Reliable (Yes/No):** Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- **Boundary Restricted = No:** Represents the actual location of the ACH as understood by the Department..
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Culturally Sensitive = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- **Culturally Sensitive = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- **Culturally Sensitive Nature:**
  - **No Gender / Initiation Restrictions:** *Anyone* can view the information.
  - **Men only:** Only *males* can view restricted information.
  - **Women only:** Only *females* can view restricted information.

Status:

- **Register:** Aboriginal cultural heritage places that are assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Lodged:** Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the *Aboriginal Heritage Act 1972.*
- **Historic:** Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the *Aboriginal Heritage Act 1972*. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.
Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

Basemap Copyright

Map was created using ArcGIS software by Esri. ArcGIS and ArcMap are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri software, please visit www.esri.com.

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
431	JUGURRUGUN	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
432	RED POINT	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
433	GANTHEAUME PT. 3	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
434	GANTHEAUME PT.4.	No	No	No	No Gender / Initiation Restrictions	Lodged	Birthplace; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
1015	FRAZIER DOWNS STATION.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Historical	*Registered Knowledge Holder names available from DPLH	
12395	NULUNGU.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
12416	GANTHEAUME PT: DOG DREAMING	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12417	NULUNGU	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
12424	KULMUGARIGUN CLAYPAN.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
12425	PIDINGKANGKUN.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Water Source	*Registered Knowledge Holder names available from DPLH	
12426	MURTJUL CREEK	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12427	PIDIRAKUNDJUNU CREEK.	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp	*Registered Knowledge Holder names available from DPLH	
12428	MUMMARARRA ROCKS	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12436	BIDJADANGA SKELETAL FIND	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Burial; Fish Trap	*Registered Knowledge Holder names available from DPLH	
12463	GURURU CREEK.	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp; Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
12464	JUNGOO BURIAL GROUND	No	No	No	No Gender / Initiation Restrictions	Lodged	Burial	*Registered Knowledge Holder names available from DPLH	
12465	BUNDABUNDA.	No	No	No	No Gender / Initiation Restrictions	Lodged	Water Source	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12466	JUDIMULANBA.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp; Water Source	*Registered Knowledge Holder names available from DPLH	
12467	FALSE CAPE BOSSUT MIDDEN.	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	
12684	INBALLAL KARNBOR.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Hunting Place; Other; Water Source	*Registered Knowledge Holder names available from DPLH	
12698	KUMBILLEBILLEKAN.	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Burial; Camp	*Registered Knowledge Holder names available from DPLH	
12832	MILIBUNYARI.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp	*Registered Knowledge Holder names available from DPLH	
12834	YALYURR	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Ritual / Ceremonial; Midden	*Registered Knowledge Holder names available from DPLH	
12836	WANGKUNAN.	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp; Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	
12837	MANANGKABU.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp	*Registered Knowledge Holder names available from DPLH	
12840	YARRARRA.	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Camp; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12841	MARNALAKUN.	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Burial; Camp	*Registered Knowledge Holder names available from DPLH	
12874	ROEBUCK BAY MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
12885	NIMALAICA CLAYPAN.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Camp; Hunting Place; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	
12887	BALLIWANDUNA	Yes	No	Yes	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12889	NUNUKURAKUN	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
12890	JIBIDANGKUN.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp	*Registered Knowledge Holder names available from DPLH	
12899	KULMUKARAKUN JUNO 2	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
12900	NGARRIMARRAN JUNO QUARRY	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12901	MURRDUDUN	No	No	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Creation / Dreaming Narrative; Midden; Other	*Registered Knowledge Holder names available from DPLH	
12941	BINDINGANKUNY 1.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	
12942	BINDINGANKUNY 2.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	
12943	BINDINGANKUNY 3.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	
13731	PIDIRNGAPA.	No	No	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
13732	JIDAMUNGA.	Yes	No	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Landscape / Seascape Feature	*Registered Knowledge Holder names available from DPLH	
13733	JINJAGURIN / NUNDUNARR.	Yes	No	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
13734	LALUJADU.	No	No	No	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative; Other	*Registered Knowledge Holder names available from DPLH	
14271	MINARRINGY.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Burial; Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	
14311	CAPE GOURDON	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
14437	COWAN CREEK, LAGRANGE.	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp	*Registered Knowledge Holder names available from DPLH	
14559	BROOME	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
14868	BARGAJOC.	No	No	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	
17566	CAPE VILLARET AREA 01	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
17754	CAPE JAUBERT NORTH	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	
17755	CAPE FREZIER (CHINAMAN'S BEACH)	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Fish Trap	*Registered Knowledge Holder names available from DPLH	
17756	YARDOOGARA 1 + 2 (CAPE VILLARET)	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Fish Trap	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
17757	YARDOOGARA 3	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Fish Trap	*Registered Knowledge Holder names available from DPLH	
17850	BAMBOO LANDING	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Other	*Registered Knowledge Holder names available from DPLH	
35208	Bidyadanga Ceremonial Camp Site and Buriel Site	No	Yes	No		Lodged	Burial; Other	*Registered Knowledge Holder names available from DPLH	
36482		No	No	No	No Gender / Initiation Restrictions	Lodged		*Registered Knowledge Holder names available from DPLH	

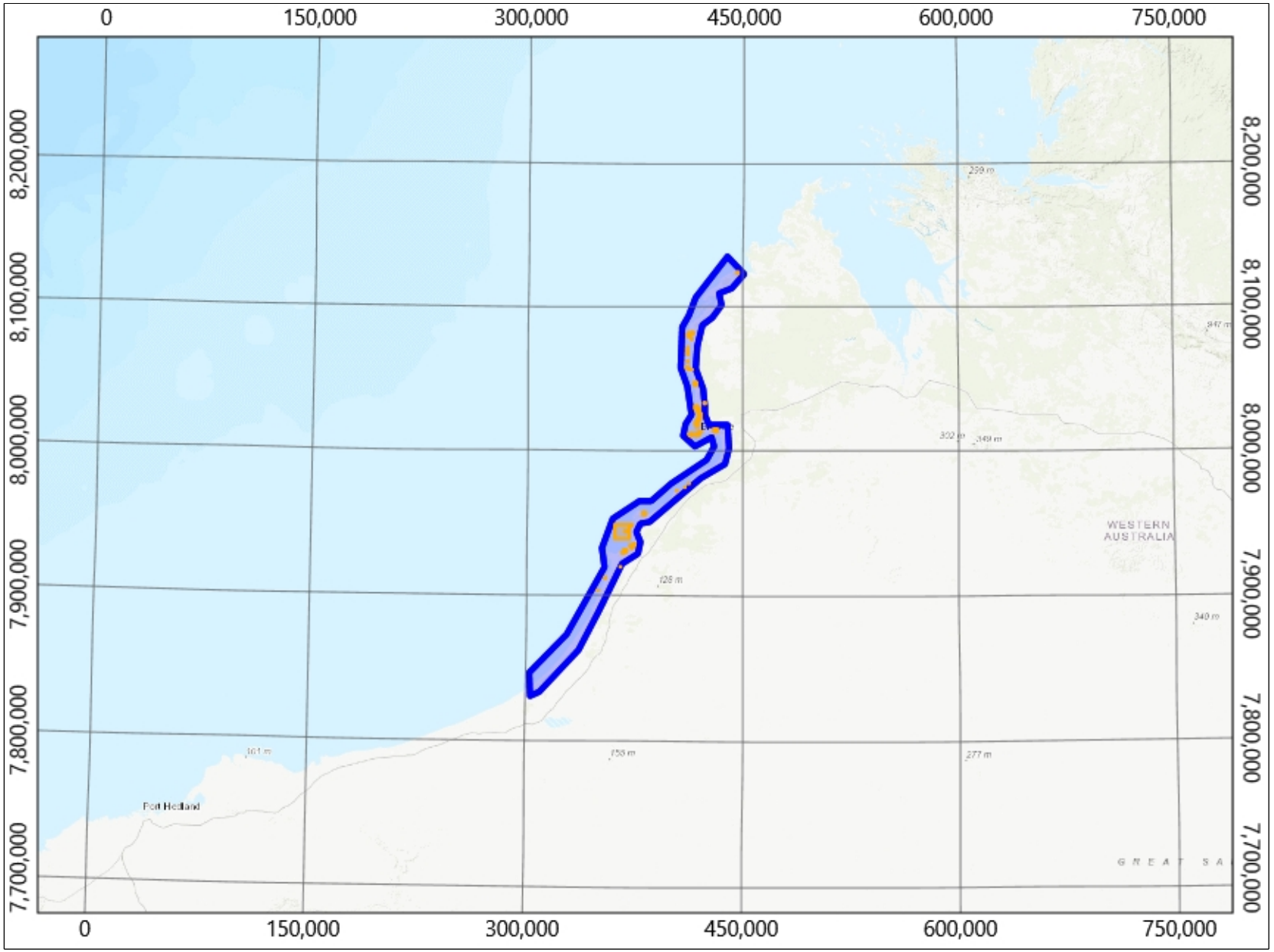
Department of **Planning, Lands and Heritage**

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use



Legend

- Aboriginal Cultural Heritage (ACH) Lodged
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

139.73 kilometres

Map Scale 1 : 4,230,000

MGA Zone 51 (GDA2020)

Copyright for topographic map information shall at all times remain the property of the Commonwealth of Australia, Geoscience Australia - National Mapping Division. All rights reserved.

Aerial Photos, Cadastre, Local Government Authority, Native Title boundary, Roads data copyright © Western Australian Land Information Authority (Landgate).

Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (Department of Mines, Industry Regulation and Safety).



Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Search Criteria

71 Aboriginal Cultural Heritage (ACH) Lodged in Custom search area - Polygon - 121.172125877907°E, 19.4220964890925°S (GDA94) : 121.174872459938°E, 19.5437942640372°S (GDA94) : 120.974371971657°E, 19.6472946348778°S (GDA94) : 120.683234276345°E, 19.7714070017095°S (GDA94) : 120.246527733376°E, 19.9238294386214°S (GDA94) : 120.040534081032°E, 19.9677205600328°S (GDA94) : 119.875739159157°E, 19.9857898262747°S (GDA94) : 119.79334169822°E, 19.9961141909785°S (GDA94) : 119.694464745095°E, 20.055466142239°S (GDA94) : 119.557135643533°E, 20.1251115390631°S (GDA94) : 119.362128319314°E, 20.0219221404919°S (GDA94) : 119.213812889627°E, 19.9806273901615°S (GDA94) : 119.17810732322°E, 20.0399851853509°S (GDA94) : 119.123175682595°E, 20.0219221404919°S (GDA94) : 118.963873924783°E, 20.1663682588682°S (GDA94) : 119.032538475564°E, 20.2359642301675°S (GDA94) : 118.977606834939°E, 20.3055290516891°S (GDA94) : 118.810065331033°E, 20.3287103880439°S (GDA94) : 118.727667870096°E, 20.3493131038465°S (GDA94) : 118.626044334939°E, 20.3982335388088°S (GDA94) : 118.527167381814°E, 20.3544633536139°S (GDA94) : 118.378851952127°E, 20.3982335388088°S (GDA94) : 118.194830956033°E, 20.4033821555499°S (GDA94) : 118.109686913065°E, 20.4162529444496°S (GDA94) : 118.112433495096°E, 20.3415874072519°S (GDA94) : 118.167365135721°E, 20.3055290516891°S (GDA94) : 118.249762596658°E, 20.3312858776863°S (GDA94) : 118.529913963846°E, 20.2694622973381°S (GDA94) : 118.788092674783°E, 20.2514257744721°S (GDA94) : 118.941901268533°E, 20.0812643435201°S (GDA94) : 118.969367088845°E, 20.009018694878°S (GDA94) : 119.070990624002°E, 19.936739858419°S (GDA94) : 119.408820213845°E, 19.9341578588495°S (GDA94) : 119.579108299783°E, 20.0245027025705°S (GDA94) : 119.735663475564°E, 19.9419037309413°S (GDA94) : 119.982855858376°E, 19.9005880259453°S (GDA94) : 120.230048241189°E, 19.8747602308992°S (GDA94) : 120.636542381813°E, 19.7352175138401°S (GDA94) : 120.974371971657°E, 19.5696755943505°S (GDA94) : 121.172125877907°E, 19.4220964890925°S (GDA94)

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the Aboriginal Heritage Act 1972.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register established and maintained under the Aboriginal Heritage Act 1972.

Location information data licensed from Western Australian Land Information Authority (WALIA) trading as Landgate. Copyright in the location information data remains with WALIA. WALIA does not warrant the accuracy or completeness of the location information data or its suitability for any particular purpose.

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: Represents the actual location of the ACH as understood by the Department..
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- Register: Aboriginal cultural heritage places that are assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

Basemap Copyright

Map was created using ArcGIS software by Esri. ArcGIS and ArcMap are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri software, please visit www.esri.com.

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
6039	WILSON STREET A.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Shell	*Registered Knowledge Holder names available from DPLH	
10170	COOKE POINT	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Burial	*Registered Knowledge Holder names available from DPLH	
10635	WHIM CREEK 27, PACKSADDLE.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Lodged	Burial; Modified Tree; Rock Shelter	*Registered Knowledge Holder names available from DPLH	
12961	NEW COOTENBRAND WELL 1.	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	
12962	NEW COOTENBRAND WELL 2	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
12963	CAPE KERAUDREN 1	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
13338	COOTENBRAND FISH TRAPS	No	No	No	No Gender / Initiation Restrictions	Lodged	Fish Trap	*Registered Knowledge Holder names available from DPLH	
14272	CAPE KERAUDREN	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Burial; Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	
20192	Two Mile Ridge - Area A	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Shell	*Registered Knowledge Holder names available from DPLH	
20193	Two Mile Ridge - Area B	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving	*Registered Knowledge Holder names available from DPLH	
20194	Two Mile Ridge - Area C	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Traditional Structure; Midden	*Registered Knowledge Holder names available from DPLH	
20195	Two Mile Ridge - Area D	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Historical; Midden	*Registered Knowledge Holder names available from DPLH	
20196	Two Mile Ridge - Area E	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
20197	Two Mile Ridge - Area F	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
20198	Two Mile Ridge - Area G	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Historical	*Registered Knowledge Holder names available from DPLH	
20199	Two Mile Ridge - Area H	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Historical; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	
20200	Two Mile Ridge - Area I	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
20201	Two Mile Ridge - Area J	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving	*Registered Knowledge Holder names available from DPLH	
20202	Two Mile Ridge - Area K	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
20203	Two Mile Ridge - Area L	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
20204	Two Mile Ridge - Area M	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving	*Registered Knowledge Holder names available from DPLH	
20205	Two Mile Ridge - Area N	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving	*Registered Knowledge Holder names available from DPLH	
20206	Two Mile Ridge - Wilson St - Stone Structure 1	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Traditional Structure	*Registered Knowledge Holder names available from DPLH	
20207	Two Mile Ridge - Wilson St - Stone Structure 2	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Traditional Structure	*Registered Knowledge Holder names available from DPLH	
20208	Two Mile Ridge - Area O	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
20209	Two Mile Ridge - Area P	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Historical; Shell	*Registered Knowledge Holder names available from DPLH	
21476	WPH/01 - Old Well Midden	No	No	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
22717	PHPF23	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22724	PHPF58	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22736	PHPF75	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22740	PHPF71a	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22743	PHPF69	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22744	PHPF68c	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22759	PHPF9	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Other	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
22760	PHPF10	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Other	*Registered Knowledge Holder names available from DPLH	
22761	PHPF11	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22764	PHPF15	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Other	*Registered Knowledge Holder names available from DPLH	
22774	PHPF31	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22776	PHPF33	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22784	PHPF42	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22869	FMGPETH 04-001	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp; Hunting Place	*Registered Knowledge Holder names available from DPLH	
22872	FMGPETH 04-004	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp; Hunting Place	*Registered Knowledge Holder names available from DPLH	
22873	FMGPETH 04-005	No	No	No	No Gender / Initiation Restrictions	Lodged	Camp; Hunting Place	*Registered Knowledge Holder names available from DPLH	
22875	FMGP04-071	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
22876	FMGP04-083	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
23609	FMG PAR 06-06	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
23610	FMG PAR 06-07	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
23611	FMG PAR 06-08	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
23612	FMG PAR 06-09	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
24569	Finucane Island Burial	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Burial	*Registered Knowledge Holder names available from DPLH	
25661	HDMSP 04-06	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
26699	LAN 08 - 02	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
26700	LAN 08 - 03	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
26701	LAN 08 - 04	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27816	MAI-09 - MD09	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27817	MAI-09 - MD10	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27821	MAI-09 - MD14	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27830	MAI-09 - MD-23	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27831	MAI-09 - MD-24	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27834	MAI-09 - MD-27	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27839	MAI-09 - MD-32	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
30617	Three Mile Limestone Outcrop Camp Site	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Camp; Grinding areas / Grooves; Midden; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	
32061	BD 08-24	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Shell	*Registered Knowledge Holder names available from DPLH	
32709	Mourambine Kariyarra 2	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	
32710	Mourambine Kariyarra 3	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Engraving; Traditional Structure	*Registered Knowledge Holder names available from DPLH	
34480	LAN22-11-18	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
34481	LAN22-11-19	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
34482	LAN22-11-20	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
34483	LAN22-11-21	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
35216	LAN22-11-22	No	Yes	No		Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
36971	Pardoo Grinding Grooves	No	Yes	No		Lodged		*Registered Knowledge Holder names available from DPLH	

Department of **Planning, Lands and Heritage**

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Lodged

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use



Legend

- Aboriginal Cultural Heritage (ACH) Lodged
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

108.92 kilometres

Map Scale 1 : 3,300,000

MGA Zone 50 (GDA2020)

Copyright for topographic map information shall at all times remain the property of the Commonwealth of Australia, Geoscience Australia - National Mapping Division. All rights reserved.

Aerial Photos, Cadastre, Local Government Authority, Native Title boundary, Roads data copyright © Western Australian Land Information Authority (Landgate).

Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (Department of Mines, Industry Regulation and Safety).



Search Criteria

122 Aboriginal Cultural Heritage (ACH) Register in Custom search area - Polygon - 122.413580956052°E, 16.8605885950071°S (GDA94) : 122.523444237302°E, 16.9709539538004°S (GDA94) : 122.441046776364°E, 17.0602498666978°S (GDA94) : 122.358649315427°E, 17.0917558894873°S (GDA94) : 122.375128807614°E, 17.1652492150388°S (GDA94) : 122.314704002927°E, 17.2439597608346°S (GDA94) : 122.248786034177°E, 17.2911699937498°S (GDA94) : 122.215827049802°E, 17.4222459189288°S (GDA94) : 122.204840721677°E, 17.5637022831503°S (GDA94) : 122.254279198239°E, 17.6893485698161°S (GDA94) : 122.265265526364°E, 17.7992170521714°S (GDA94) : 122.265265526364°E, 17.8515116406625°S (GDA94) : 122.292731346677°E, 17.9142448586663°S (GDA94) : 122.413580956052°E, 17.9142448586663°S (GDA94) : 122.424567284177°E, 18.0605359326046°S (GDA94) : 122.397101463864°E, 18.1597356181854°S (GDA94) : 122.237799706052°E, 18.248445514514°S (GDA94) : 121.902716698239°E, 18.5195116509258°S (GDA94) : 121.842291893552°E, 18.5299287407475°S (GDA94) : 121.814826073239°E, 18.5820046621834°S (GDA94) : 121.842291893552°E, 18.644474766734°S (GDA94) : 121.825812401364°E, 18.717327516015°S (GDA94) : 121.721442284177°E, 18.7797477636805°S (GDA94) : 121.573126854489°E, 19.0655438107469°S (GDA94) : 121.435797752927°E, 19.3145641043614°S (GDA94) : 121.177619041989°E, 19.5735574357215°S (GDA94) : 121.117194237302°E, 19.5994339870086°S (GDA94) : 121.111701073239°E, 19.454471841606°S (GDA94) : 121.358893456052°E, 19.2160386307523°S (GDA94) : 121.606085838864°E, 18.8005493795266°S (GDA94) : 121.589606346677°E, 18.6809050564231°S (GDA94) : 121.661017479489°E, 18.4986755681928°S (GDA94) : 121.836798729489°E, 18.3892445941472°S (GDA94) : 121.913703026364°E, 18.3892445941472°S (GDA94) : 122.045538963864°E, 18.2797440926438°S (GDA94) : 122.276251854489°E, 18.1336358856814°S (GDA94) : 122.325690331052°E, 18.0500905960285°S (GDA94) : 122.309210838864°E, 17.992630159891°S (GDA94) : 122.199347557614°E, 18.0500905960285°S (GDA94) : 122.122443260739°E, 17.9821807949406°S (GDA94) : 122.138922752927°E, 17.9090179373421°S (GDA94) : 122.177374901364°E, 17.8515116406625°S (GDA94) : 122.149909081052°E, 17.6736475753284°S (GDA94) : 122.105963768552°E, 17.558465123481°S (GDA94) : 122.116950096677°E, 17.3016595135703°S (GDA94) : 122.160895409177°E, 17.2282203312398°S (GDA94) : 122.204840721677°E, 17.1180068402732°S (GDA94) : 122.413580956052°E, 16.8605885950071°S (GDA94)

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the Aboriginal Heritage Act 1972.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register established and maintained under the Aboriginal Heritage Act 1972.

Location information data licensed from Western Australian Land Information Authority (WALIA) trading as Landgate. Copyright in the location information data remains with WALIA. WALIA does not warrant the accuracy or completeness of the location information data or its suitability for any particular purpose.

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: Represents the actual location of the ACH as understood by the Department..
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- Register: Aboriginal cultural heritage places that are assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

Basemap Copyright

Map was created using ArcGIS software by Esri. ArcGIS and ArcMap are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri software, please visit www.esri.com.

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
1022	ROLLAH MIDDEN.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Historical; Midden	*Registered Knowledge Holder names available from DPLH	K02894
1023	WANGALNGURRU.	No	Yes	No	No Gender / Initiation Restrictions	Register	Historical; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02895
12410	LINTAPITJIN/LOT 2065PORT DR	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Midden	*Registered Knowledge Holder names available from DPLH	K02819
12412	THANGOO CEMETERY	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	K02822
12429	GNH LOT 1208	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	K02785
12468	GALYUNGA	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Creation / Dreaming Narrative; Fish Trap	*Registered Knowledge Holder names available from DPLH	K02772
12469	GUNJI CEREMONIAL GROUND	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	K02773
12470	GULGUDUNG	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K02774
12471	MARUNGUDA	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K02775
12472	BUDALGI	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02776
12473	TIPS TANK MIDDEN.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02777
12475	MARARR.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02779
12522	ONE MILE CAMP.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp	*Registered Knowledge Holder names available from DPLH	K02722
12552	CLEMENTSON ST. SITE COMPLEX	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K02700
12590	RED BANK.	No	No	No	No Gender / Initiation Restrictions	Register	Camp; Creation / Dreaming Narrative; Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	K02636
12591	BROOME OLD JETTY.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02637
12685	BUNGARUGUN.	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Fish Trap; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02521

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12697	WIBIJAKUN.	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02533
12793	UNDANDA.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	K02417
12835	LAMBINJINMAN.	No	No	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02405
12838	JILBANUNG.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Midden	*Registered Knowledge Holder names available from DPLH	K02408
12839	BILLINGURRU.	Yes	Yes	Yes	Men only	Register	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K02409
12842	INBALMARRA.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	K02412
12872	GANTHEAUME POINT 2.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	K02331
12873	ENTRANCE POINT	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02332
12875	BARRED CREEK	Yes	No	Yes	Men only	Register	Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	K02334
12888	BALJARKURUKUN.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	K02347
12902	KUNDANDU.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02308
12903	MURRJAL.	Yes	Yes	Yes	Women only	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02309
12904	RURRJAMAN.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other; Plant Resource; Water Source	*Registered Knowledge Holder names available from DPLH	K02310
12905	NORTH BARRED CREEK.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02311
12906	WILLIES CREEK COMPLEX.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Hunting Place; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02312

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12907	COCONUT WELL 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02313
12908	COCONUT WELL 1.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Creation / Dreaming Narrative; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02314
12909	COCONUT WELL ISLAND	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02315
12910	NORTH CABLE BEACH 6	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02316
12911	NORTH CABLE BEACH 5	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02317
12912	JURLIRR.	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02318
12913	NORTH CABLE BEACH 4	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02319
12914	NORTH CABLE BEACH 3	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02320
12915	NORTH CABLE BEACH 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02321
12916	NORTH CABLE BEACH 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02322
12917	CABLE BEACH 6.	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Camp; Meeting Place; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02323
12918	CABLE BEACH 4.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02324
12919	CABLE BEACH 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other	*Registered Knowledge Holder names available from DPLH	K02325
12920	CABLE BEACH 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other	*Registered Knowledge Holder names available from DPLH	K02326
12921	MINYIRR.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02327
12922	JUNGKURR	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Other	*Registered Knowledge Holder names available from DPLH	K02328

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12923	NGAKALYALYA	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Other	*Registered Knowledge Holder names available from DPLH	K02329
12924	GANTHEAUME POINT 1	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Creation / Dreaming Narrative; Midden; Other	*Registered Knowledge Holder names available from DPLH	K02330
12944	KURAKARAMUNJUNO 1.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	K02298
12945	KURAKARAMUNJUNO 2.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	K02299
12946	KURAKARAMUNJUNO 3.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	K02300
12947	KURAKARAMUNJUNO 4.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02301
12948	FLAT ROCK 1.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02302
12949	FLAT ROCK 2.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02303
12950	KULMUKARAKUN JUNO 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K02304
13075	MANGALAGUN+IWALAN GANJDANJ.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Creation / Dreaming Narrative; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02163
13076	WALMADAN (James Price Point)	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Fish Trap; Hunting Place; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K02164
13320	WUNDORDA	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Ritual / Ceremonial; Midden	*Registered Knowledge Holder names available from DPLH	K01927
13321	BULGURGUN.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Creation / Dreaming Narrative; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K01928
13350	FRAZIER DOWNS BEACH	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	K01902
13351	Ngilirirrbanjin	Yes	Yes	Yes	Men only	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K01903
13463	WULLULONG GROUND	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Other	*Registered Knowledge Holder names available from DPLH	K01692

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
13464	WULLULONG GROUND	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register		*Registered Knowledge Holder names available from DPLH	K01693
13465	WIRGANJU GROUND	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register		*Registered Knowledge Holder names available from DPLH	K01694
13503	WIRRAR.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K01677
13504	KARDILAKAN - JAJAL.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Fish Trap; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K01678
13729	RESERVE 21801 BROOME	Yes	No	Yes	Men only	Register	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Traditional Structure; Other	*Registered Knowledge Holder names available from DPLH	K01380
14240	FISHERMENS BEND 2	No	No	No		Register	Burial; Ritual / Ceremonial; Other	*Registered Knowledge Holder names available from DPLH	K00850
14241	FISHERMENS BEND 3	Yes	Yes	Yes	Men only	Register	Ritual / Ceremonial; Creation / Dreaming Narrative; Other; Repository / Storage Place	*Registered Knowledge Holder names available from DPLH	K00851
14242	FISHERMENS BEND 4	Yes	No	Yes	Men only	Register	Creation / Dreaming Narrative; Other	*Registered Knowledge Holder names available from DPLH	K00852
14243	FISHERMENS BEND 5	Yes	No	Yes	Men only	Register	Creation / Dreaming Narrative; Other	*Registered Knowledge Holder names available from DPLH	K00853
14291	FISHERMENS BEND 1.	Yes	No	Yes	Men only	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K00849
14312	CAPE VILLARET	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K00817
14313	RALLAH WELL	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K00818
14432	CAPE JAUBERT	No	Yes	No	No Gender / Initiation Restrictions	Register	Fish Trap	*Registered Knowledge Holder names available from DPLH	K00650
14433	PORT SMITH.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Camp; Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	K00651
14434	ADMIRAL BAY	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	K00652

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
14435	FOOTPRINT CREEK A+B	No	Yes	No	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Midden; Other	*Registered Knowledge Holder names available from DPLH	K00653
14436	FRAZIER DOWNS	No	No	No	No Gender / Initiation Restrictions	Register	Traditional Structure; Painting	*Registered Knowledge Holder names available from DPLH	K00654
14438	BLACKROCK POINT 2.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	K00656
14439	BIDIR-NGA:BA	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative; Fish Trap	*Registered Knowledge Holder names available from DPLH	K00657
14440	BLACKROCK POINT 1.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden	*Registered Knowledge Holder names available from DPLH	K00658
14441	POST OFFICE, LAGRANGE.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp	*Registered Knowledge Holder names available from DPLH	K00659
14442	LAGRANGE.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K00660
14444	BEACON HILL	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	K00662
14445	CAPE VILLARET BURIAL	No	No	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	K00663
14489	BIDIYANABA FOOTPRINT	No	Yes	No	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K00589
14557	CABLE BEACH 5.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Ritual / Ceremonial; Creation / Dreaming Narrative; Hunting Place; Midden; Other	*Registered Knowledge Holder names available from DPLH	K00497
14560	TITIRRKUN/KENNEDY HILL.	Yes	Yes	Yes	Men only	Register	Artefacts / Scatter; Ritual / Ceremonial; Creation / Dreaming Narrative; Grinding areas / Grooves; Hunting Place; Midden; Other; Water Source	*Registered Knowledge Holder names available from DPLH	K00500
14561	SACRED STORES/ BROOME	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Repository / Storage Place	*Registered Knowledge Holder names available from DPLH	K00501
14609	CABLE BEACH 3.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden; Other	*Registered Knowledge Holder names available from DPLH	K00496
14894	LAGRANGE	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Repository / Storage Place	*Registered Knowledge Holder names available from DPLH	K00094

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
17132	Yardugarra Site	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
17567	CAPE VILLARET AREA 02 / DARRLARNARNGABA	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Grinding areas / Grooves; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	
17568	CAPE VILLARET AREA 03 / HOMESTEAD SITE	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17569	CAPE VILLARET AREA 04	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17570	CAPE VILLARET AREA 05	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other; Rock Shelter	*Registered Knowledge Holder names available from DPLH	
17571	CAPE VILLARET AREA 06	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Other; Rock Shelter	*Registered Knowledge Holder names available from DPLH	
17572	CAPE VILLARET AREA 07 / BARNES BEACH MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17573	CAPE VILLARET AREA 08	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden; Ochre	*Registered Knowledge Holder names available from DPLH	
17574	CAPE VILLARET AREA 09	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
17575	CAPE VILLARET AREA 10	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
17576	CAPE VILLARET AREA 11 / GUMALIINGA	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
17577	CAPE VILLARET AREA 12	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17578	CAPE VILLARET AREA 13	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
17579	CAPE VILLARET AREA 14	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17580	CAPE VILLARET AREA 15	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	
17851	BALDWIN CREEK	No	No	No	No Gender / Initiation Restrictions	Register	Fish Trap	*Registered Knowledge Holder names available from DPLH	
17918	Yardoogarra Reburial	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
19799	Mungullagun Blackberry Tree Midden	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
19999	Broome Bird Observatory Solar Panel Site	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20252	SPB27 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20253	SPB26 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20254	SPB25 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20255	SPB24 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20256	SPB23 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20257	SPB21 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
20259	SPB17 - Sandy Point Burial	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Historical	*Registered Knowledge Holder names available from DPLH	
21408	Broome Crocodile Farm	Yes	Yes	Yes	Men only	Register	Camp; Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
32447	Gardalargun South	No	Yes	No	No Gender / Initiation Restrictions	Register		*Registered Knowledge Holder names available from DPLH	

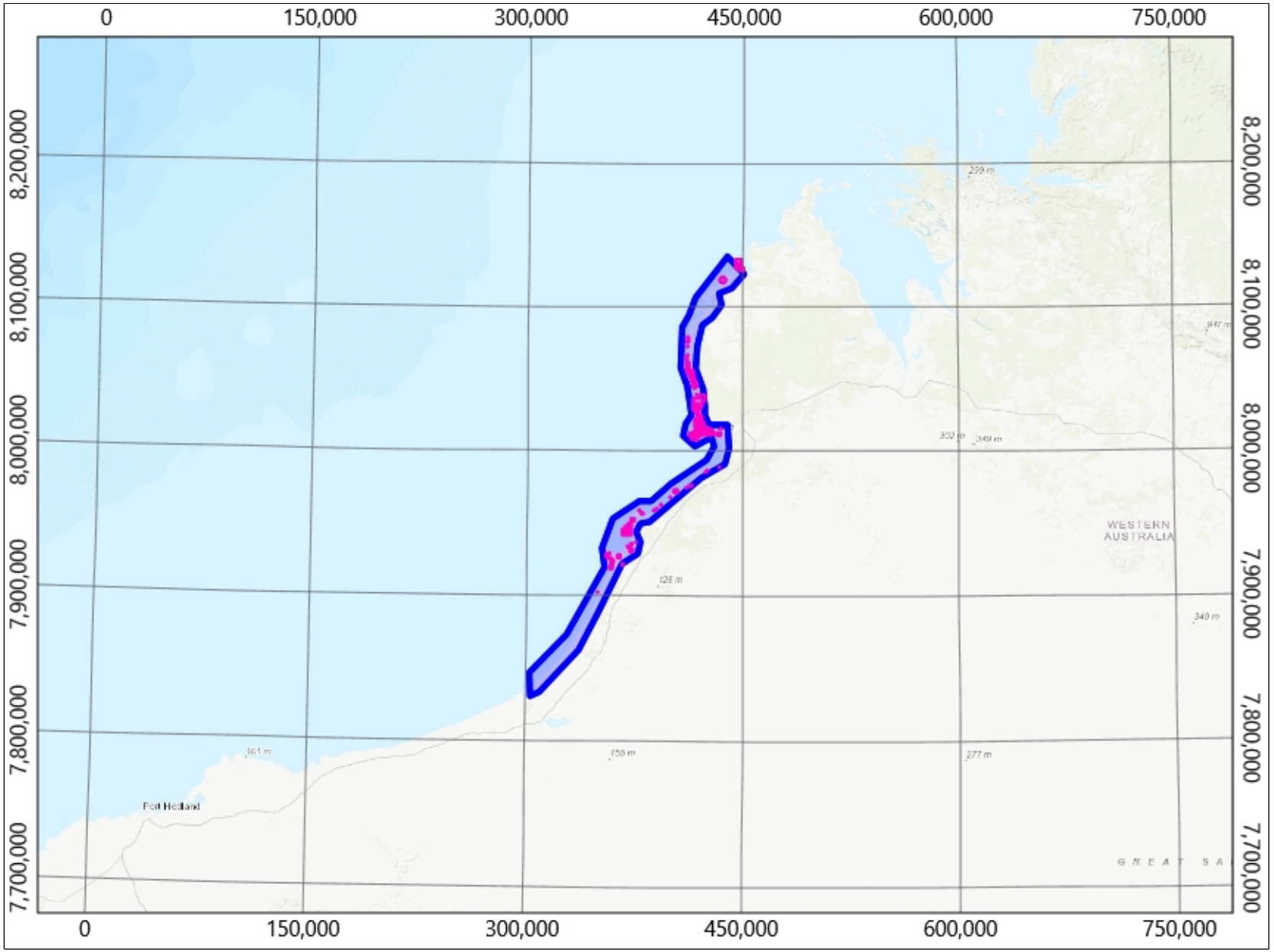
Department of **Planning, Lands and Heritage**

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use



Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

139.73 kilometres

Map Scale 1 : 4,230,000

MGA Zone 51 (GDA2020)

Copyright for topographic map information shall at all times remain the property of the Commonwealth of Australia, Geoscience Australia - National Mapping Division. All rights reserved.

Aerial Photos, Cadastre, Local Government Authority, Native Title boundary, Roads data copyright © Western Australian Land Information Authority (Landgate).

Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (Department of Mines, Industry Regulation and Safety).



Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Search Criteria

150 Aboriginal Cultural Heritage (ACH) Register in Custom search area - Polygon - 121.172125877907°E, 19.4220964890925°S (GDA94) : 121.174872459938°E, 19.5437942640372°S (GDA94) : 120.974371971657°E, 19.6472946348778°S (GDA94) : 120.683234276345°E, 19.7714070017095°S (GDA94) : 120.246527733376°E, 19.9238294386214°S (GDA94) : 120.040534081032°E, 19.9677205600328°S (GDA94) : 119.875739159157°E, 19.9857898262747°S (GDA94) : 119.79334169822°E, 19.9961141909785°S (GDA94) : 119.694464745095°E, 20.055466142239°S (GDA94) : 119.557135643533°E, 20.1251115390631°S (GDA94) : 119.362128319314°E, 20.0219221404919°S (GDA94) : 119.213812889627°E, 19.9806273901615°S (GDA94) : 119.17810732322°E, 20.0399851853509°S (GDA94) : 119.123175682595°E, 20.0219221404919°S (GDA94) : 118.963873924783°E, 20.1663682588682°S (GDA94) : 119.032538475564°E, 20.2359642301675°S (GDA94) : 118.977606834939°E, 20.3055290516891°S (GDA94) : 118.810065331033°E, 20.3287103880439°S (GDA94) : 118.727667870096°E, 20.3493131038465°S (GDA94) : 118.626044334939°E, 20.3982335388088°S (GDA94) : 118.527167381814°E, 20.3544633536139°S (GDA94) : 118.378851952127°E, 20.3982335388088°S (GDA94) : 118.194830956033°E, 20.4033821555499°S (GDA94) : 118.109686913065°E, 20.4162529444496°S (GDA94) : 118.112433495096°E, 20.3415874072519°S (GDA94) : 118.167365135721°E, 20.3055290516891°S (GDA94) : 118.249762596658°E, 20.3312858776863°S (GDA94) : 118.529913963846°E, 20.2694622973381°S (GDA94) : 118.788092674783°E, 20.2514257744721°S (GDA94) : 118.941901268533°E, 20.0812643435201°S (GDA94) : 118.969367088845°E, 20.009018694878°S (GDA94) : 119.070990624002°E, 19.936739858419°S (GDA94) : 119.408820213845°E, 19.9341578588495°S (GDA94) : 119.579108299783°E, 20.0245027025705°S (GDA94) : 119.735663475564°E, 19.9419037309413°S (GDA94) : 119.982855858376°E, 19.9005880259453°S (GDA94) : 120.230048241189°E, 19.8747602308992°S (GDA94) : 120.636542381813°E, 19.7352175138401°S (GDA94) : 120.974371971657°E, 19.5696755943505°S (GDA94) : 121.172125877907°E, 19.4220964890925°S (GDA94)

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the Aboriginal Heritage Act 1972.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register established and maintained under the Aboriginal Heritage Act 1972.

Location information data licensed from Western Australian Land Information Authority (WALIA) trading as Landgate. Copyright in the location information data remains with WALIA. WALIA does not warrant the accuracy or completeness of the location information data or its suitability for any particular purpose.

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: Represents the actual location of the ACH as understood by the Department..
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- Register: Aboriginal cultural heritage places that are assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

Basemap Copyright

Map was created using ArcGIS software by Esri. ArcGIS and ArcMap are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri software, please visit www.esri.com.

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
108	FINUCANE IS EAST 10	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P07600
677	SIX MILE CREEK	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P07390
678	NYARTAWKA NYUKA	No	Yes	No	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	P07391
679	PURIYAKANNYA.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Water Source	*Registered Knowledge Holder names available from DPLH	P07392
680	LOCK HOSPITAL.	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial; Historical; Traditional Structure; Midden	*Registered Knowledge Holder names available from DPLH	P07393
681	EAST CREEK	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07394
731	FOUR MILE ENGRAVINGS	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	P07389
753	PORT HEDLAND HOTEL	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P07357
782	SOUTH WEST CREEK 6	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	P07334
783	SOUTH WEST CREEK 7	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Midden	*Registered Knowledge Holder names available from DPLH	P07335
791	FINUCANE IS. EAST 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P07303
6021	PORT HEDLAND TOWNSITE	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	P07119
6040	WILSON STREET B.	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Other; Water Source	*Registered Knowledge Holder names available from DPLH	P07087
6041	WILSON STREET C.	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Other; Shell	*Registered Knowledge Holder names available from DPLH	P07088
6295	BITTERNS	No	No	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P06664
6296	LIMESTONE QUARRY 1	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06665
6297	LIMESTONE QUARRY 2	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06666

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
6321	ANDERSON ST, PORT HEDLAND.	No	Yes	No	No Gender / Initiation Restrictions	Register	Camp; Engraving	*Registered Knowledge Holder names available from DPLH	P06638
6325	COWERIE WELL	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	P06642
6332	PORT HEDLAND MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06649
6566	TABBA TABBA MOUTH 1.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Ritual / Ceremonial; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	P06411
6567	TABBA TABBA MOUTH 2	No	No	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P06412
6568	TABBA TABBA MOUTH 3	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06413
6569	TABBA TABBA MOUTH 4	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P06414
7784	BUNNEENYA.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	P05053
7785	WALUBIDI-MARINGDJINE.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	P05054
7786	BAALYINNYE.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	P05055
11397	PARDOO 1	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Repository / Storage Place	*Registered Knowledge Holder names available from DPLH	P00747
11448	23 MILE CREEK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Engraving	*Registered Knowledge Holder names available from DPLH	P00744
11449	PARDOO 2.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	P00745
11586	UDA DALU, BOODARIE STN	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	P00557
11632	BURGESS POINT	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Traditional Structure; Other	*Registered Knowledge Holder names available from DPLH	P00549
11636	PORT HEDLAND SOUTH-WEST	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00553
11943	TWO MILE RIDGE, NELSON POINT	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Engraving; Other	*Registered Knowledge Holder names available from DPLH	P00219

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
12069	SOUTH WEST CREEK 1,2,3.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Camp; Creation / Dreaming Narrative; Engraving; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	P00088
12071	SOUTH WEST CREEK 4.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Camp; Ritual / Ceremonial; Engraving; Traditional Structure; Midden; Other	*Registered Knowledge Holder names available from DPLH	P00090
12072	SOUTH WEST CREEK 5:BOODARI.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Engraving; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	P00091
12550	CONDINI LANDING WEST	No	No	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	K02698
12964	CAPE KERAUDREN 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	K02265
12965	CAPE KERAUDREN 3.	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	K02266
12966	CAPE KERAUDREN 4	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	K02267
12967	CAPE KERAUDREN 5	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Burial; Midden	*Registered Knowledge Holder names available from DPLH	K02268
12968	CAPE KERAUDREN 6	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	K02269
12969	WARRA MURRANGA TALU	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	K02270
14341	SHELLBOROUGH 1-3.	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Grinding areas / Grooves; Traditional Structure; Midden; Other	*Registered Knowledge Holder names available from DPLH	K00773
15883	BOODARIE 01	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15885	BOODARIE 04	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15886	BOODARIE 05	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15887	BOODARIE 06	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15888	BOODARIE 07	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
15890	BOODARIE 10	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15892	BOODARIE 13	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15893	BOODARIE 15	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15894	BOODARIE 16	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15902	BOODARIE 27	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
15904	BOODARIE 30	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Other; Shell	*Registered Knowledge Holder names available from DPLH	
21512	Railway 4	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
21515	Finucane Island Burial & Midden Site	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial; Midden	*Registered Knowledge Holder names available from DPLH	
22722	PHPF48 (FMGP04-075 FMGP04-078 FMGP04-106)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22723	PHPF46	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22726	PHPF60 (FMGP04-097 FMGP04-098)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22729	PHPF68d	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22741	PHPF71	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22748	PHPF66 (FMGP04-014)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22766	PHPF17	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
22769	PHPF20	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22783	PHPF39	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
22785	PHPF43 (PHPF65 FMGP04-019 FMGP04-087)	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
22786	PHPF44 (FMGP04-086)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22788	PHPF49 (FMGP04-041)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22791	PHPF52	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22792	PHPF53 (FMGP04-074)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22793	PHPF54 (FMGP04-076)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22794	PHPF55 (FMGP04-079 FMGP04-080 FMGP04-081 FMGP04-082)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22796	PHPF57 (FMGP04-002)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22797	PHPF63 (FMGP04-015)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22798	PHPF64 (FMGP04-016)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22805	PHPF82	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22837	FMGP04-018	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22863	FMGP04-077	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22865	FMGP04-94	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22870	FMGPETH 04-002	No	No	No	No Gender / Initiation Restrictions	Register	Camp; Hunting Place	*Registered Knowledge Holder names available from DPLH	
22871	FMGPETH 04-003	No	No	No	No Gender / Initiation Restrictions	Register	Camp; Hunting Place	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
22874	Marapikurrinya Yintha Site	No	Yes	No	No Gender / Initiation Restrictions	Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	
22878	FMGP04-104	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
22879	FMGP04-105	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
23284	DS05-01	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
23286	DS05-03	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
23295	CB 08-36	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	
23296	DS05-06	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
23297	DS05-07	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
23298	DS05-08	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
23548	FMG PAR 06-01 (Shell midden scatter)	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
23605	FMG PAR 06-02	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
23606	FMG PAR 06-03	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
24396	Nelson Point Fuel Facility 07-01	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
24993	WN 07 - 01	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
24995	WN 07 - 03	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
24999	WN 07 - 07	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25005	WN 07 - 13	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
25008	WN 07 - 16	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25010	WN 07 - 18	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25011	WN 07 - 19	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25012	WN 07 - 20	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25013	WN 07 - 21	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25014	WN 07 - 22	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25015	WN 07 - 23	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25016	WN 07 - 24	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25621	BD 08-02	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25632	BD 08-13	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25633	BD 08-14	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25634	BD 08-15	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25636	BD 08-17	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25646	BD 08-28	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25663	HDMSP 04-08	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25665	FI 08-01	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25666	FI 08-02	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
25667	FI 08-03	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
25669	Insert B/EA01	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	
27003	CKAR 08-001	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27005	CKAR 08-003	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27007	CKAR 08-005	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27008	CKAR 08-006	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27009	CKAR 08-007	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27011	CKAR 08-009	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27014	CKAR 08-012	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	
27813	MAI-09 - MD01	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27814	MAI-09 - MD03	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27815	MAI-09 - MD04	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27818	MAI-09 - MD11	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27819	MAI-09 - MD12	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27820	MAI-09 - MD13	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27828	MAI-09 - MD-21	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27833	MAI-09 - MD-26	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
27835	MAI-09 - MD-28	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27837	MAI-09 - MD-30	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27838	MAI-09 - MD-31	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
27841	MAI-09 - AS-01	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden; Shell	*Registered Knowledge Holder names available from DPLH	
28249	Pretty Pool	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Creation / Dreaming Narrative; Midden	*Registered Knowledge Holder names available from DPLH	
30205	POR04-11-01	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	
30377	PORP21007	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30378	PORP21008	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30379	PORP21012	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	
30382	PORP21015	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30384	PORP21017	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30386	PORP21022	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30387	PORP21037	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30388	PORP21038	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
30389	PORP21046	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Midden	*Registered Knowledge Holder names available from DPLH	
32041	PIL3381	No	Yes	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	

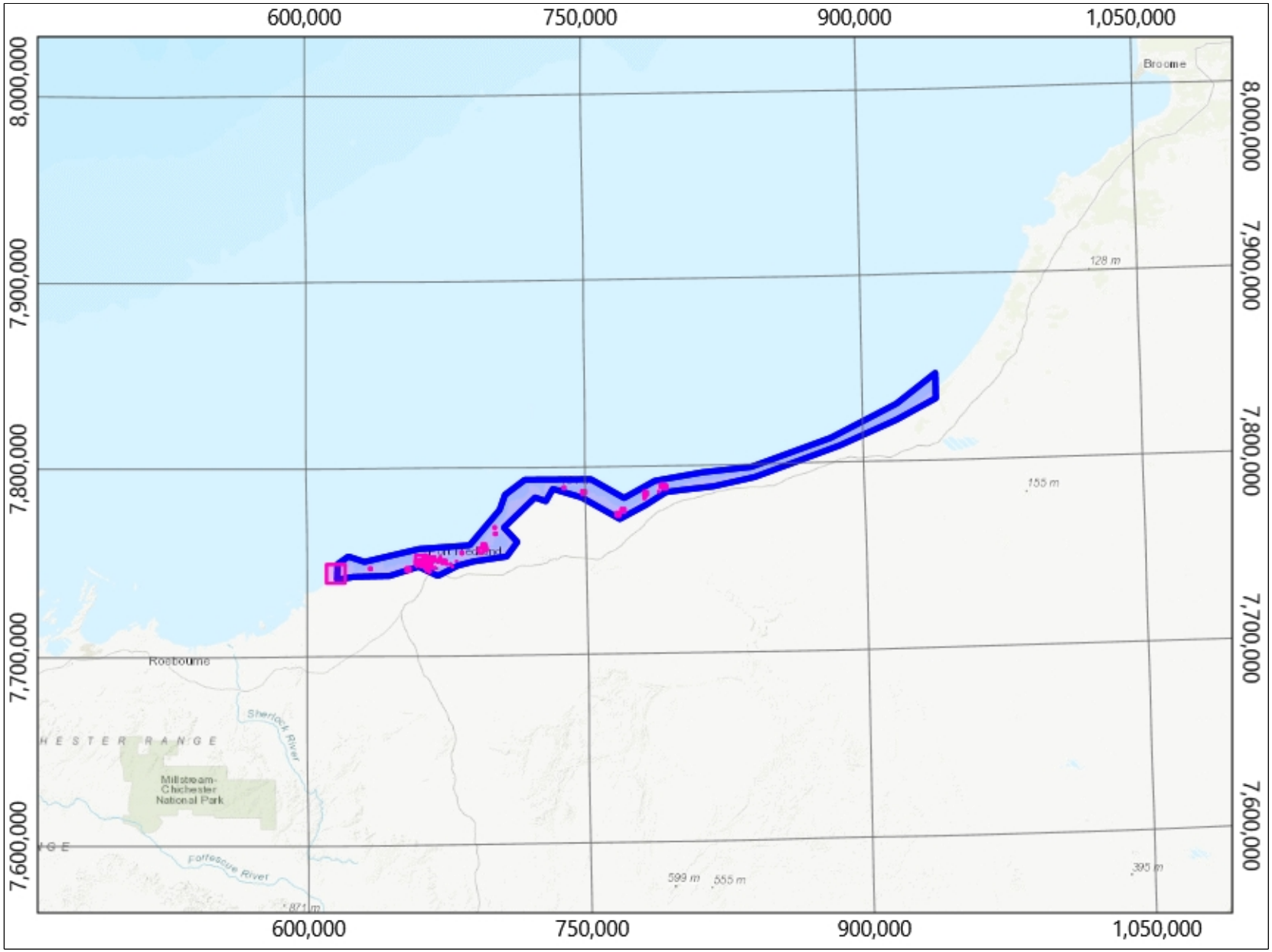
Department of **Planning, Lands and Heritage**

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

For further important information on using this information please see the WA.gov.au website's Terms of Use at https://www.wa.gov.au/terms-of-use



Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

108.92 kilometres

Map Scale 1 : 3,300,000

MGA Zone 50 (GDA2020)

Copyright for topographic map information shall at all times remain the property of the Commonwealth of Australia, Geoscience Australia - National Mapping Division. All rights reserved.

Aerial Photos, Cadastre, Local Government Authority, Native Title boundary, Roads data copyright © Western Australian Land Information Authority (Landgate).

Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (Department of Mines, Industry Regulation and Safety).



Appendix C: Relevant Person Consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
3D Energi Limited (prev 3D Oil Limited)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
3D Energi Limited (prev 3D Oil Limited)	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
3D Energi Limited (prev 3D Oil Limited)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
3D Energi Limited (prev 3D Oil Limited)	19/04/2024	08:30 AM	E018	Email						
3D Energi Limited (prev 3D Oil Limited)	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
3D Energi Limited (prev 3D Oil Limited)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
AEP (formerly APPEA)	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
AEP (formerly APPEA)	11/01/2024	8:10 PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
AEP (formerly APPEA)	19/04/2024	08:30 AM	E018	Email						
AEP (formerly APPEA)	19/04/2024	08:30 AM	E018	Email						
AEP (formerly APPEA)	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
AEP (formerly APPEA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Albany Tuna No3 Pty Ltd	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
Albany Tuna No3 Pty Ltd	28/08/2025	E023	E023	Registered Post	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	31/07/2023	01:35 PM	Follow up	Phone	31/07/2023	Phone	The AUSTFISH representative provided the phone number of the Managing Director and recommended CGG call them.	No objections or claims.	NA	CGG called AUSTFISH to confirm that they had received the consultation information and ask whether they would like to discuss the project.
AUSTFISH PTY LTD	31/07/2023	01:39 PM	Follow up	Phone	31/07/2023	Phone	Reception would remind the managing director to check and acknowledge the email	No objections or claims.	NA	CGG called the office of the Managing Director and spoke to the receptionist who said she would remind them to check and acknowledge the email.
AUSTFISH PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
AUSTFISH PTY LTD	19/04/2024	8:30AM	E018	Email						
AUSTFISH PTY LTD	19/04/2024	8:30AM	E018	Email						
AUSTFISH PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	29/07/2025	4:01PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the listed contact and left a voicemail message asking whether they had received the consultation material and to find out if they had any concerns or queries about the project. CGG requested a return call.
AUSTFISH PTY LTD	26/08/2025	03:20 AM	E023	Email	NA	NA	NA	NA	NA	NA
AUSTFISH PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Australian Border Force	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Australian Border Force	14/08/2023	02:10 PM	E016	Email	NA	NA	NA	NA	NA	NA
Australian Border Force	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Australian Border Force	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	NA	NA	
Australian Border Force	24/06/2025	3:08PM	E020	Email	24/06/2024 3:09PM	Email	Automatic reply noting Brooms International Airport is a restricted airport and emails to this address are only monitored during business hours.	No objections or claims.	NA	No response
Australian Border Force	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Fisheries Management Authority (AFMA)	2/06/2023	03:28 PM	E010 - AFMA specific	Email	2/6/2023 3:28PM	Email	Email bounced back	NA	NA	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines. CGG to send information to an alternative email address.
Australian Fisheries Management Authority (AFMA)	16/06/2023	05:11 PM	Follow up	Email	16/6/2023 3:02PM	Email	AFMA responded to the consultation to inform CGG that the activity occurs near a number of Commonwealth Managed Fisheries in particular the North West Slope Trawl Fishery and to encourage CGG to contact the relevant fishing industry associations directly. They specifically recommended contacting the Commonwealth Fisheries Association (CFA).	Claim that fishers active in the proposed area must be contacted, in particular the CFA. This claim is merited due to AFMA's role in Commonwealth fishery regulation.	No additional relevant persons have been identified to those that were already considered for this activity. CGG is already in contact the Commonwealth Fisheries Association (CFA)	CGG sent the relevant person update letter. CGG responded to confirm that they are contacting the fishing associations including the CFA. CGG noted that if AFMA have any further questions to please let them know.
Australian Fisheries Management Authority (AFMA)	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Australian Fisheries Management Authority (AFMA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Australian Fisheries Management Authority (AFMA)	19/04/2024	8:30AM	E018	Email						
Australian Fisheries Management Authority (AFMA)	24/06/2025	4:22PM	E020 - AFMA specific	Email	NA	NA	NA	NA	NA	NA
Australian Fisheries Management Authority (AFMA)	25/06/2025	11:44AM	Response	Email	25/06/2025 9:14AM	Email	AFMA responded to the consultation to inform CGG that the activity occurs near a Commonwealth Managed Fishery, the North West Slope Trawl Fishery, and to encourage CGG to contact the relevant fishing industry associations directly. AFMA provided the association contact details, and	The claim that fishers active in the proposed area must be contacted, in particular the CFA, is merited. This claim is merited due to AFMA's role in Commonwealth fishery regulation.	No additional relevant persons have been identified to those that were already considered for this activity. CGG is already in contact the Commonwealth Fisheries Association (CFA).	CGG thnked AFMA for their timely response, and confirmed CGG are consulting with various fisheries in the area, including the CFA. CGG updated the AFMA contact email address. CGG noted that if AFMA have any further questions to please let them know.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							noted that the AFMA contact address had been updated.			
Australian Fisheries Management Authority (AFMA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Fisheries Management Authority (AFMA)	1/09/2025	7:30AM	Response	Email	29/8/2025 5:12AM	Email	AFMA contact informed CGG that they recently had email forwarded to them that has been sent to the general AFMA “info” email address. The AFMA contact provided the correct contact address for correspondence, including updates, and requested CGG amend their mailing list to reflect this.	Request to update contact details only.	No new controls adopted. CGG will update contact records and send updates to the address provided.	CGG thanked the AFMA contact for their response and confirmed CGG will update email records as per their request. CGG requested that in the meantime, if they have any questions, or require any further information on the Sauropod seismic survey, please let us know.
Australian Hydrographic Office (AHO)	2/06/2023	03:28 PM	E010	Email	5/6/2023 6:39AM	Email	Automated response noting the receipt of the email. Stated that the data CGG supplied will now be registered, assessed, prioritised and validated in preparation for updating their Navigational Charting products.	Automated message, No Objections or claims.	NA	No response
Australian Hydrographic Office (AHO)	14/08/2023	02:10 PM	E016	Email	15/8/2023 5:56AM	Email	Automatic response acknowledging CGG's email	Automated message, No Objections or claims.	NA	No response
Australian Hydrographic Office (AHO)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Australian Hydrographic Office (AHO)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Automated response noting the receipt of the email. Stated that the data CGG supplied will now be registered, assessed, prioritised and validated in preparation for updating their Navigational Charting products.	Automated message, No Objections or claims.	NA	
Australian Hydrographic Office (AHO)	24/06/2025	3:08PM	E020	Email	25/06/2025 8:25AM	Email	Automated response noting the receipt of the email. Stated that the data CGG supplied will now be registered, assessed, prioritised and validated in preparation for updating their Navigational Charting products.	No objections or claims.	NA	NA
Australian Hydrographic Office (AHO)	25/06/2025	11:46AM	Response	Email	25/06/2025 9:38AM	Email	AHO thanked CGG for the invitation to comment and noted that they have no concerns with any of the activities proposed. Noted that going forward, they only require further updates once activity is due to begin. Provided a Fact Sheet for CGG to refer to.	No objections or claims.	NA	CGG responded to thank AHO for their quick feedback, and noted that as requested they will inform AHO when the activity is due to begin and will keep them updated from there.
Australian Hydrographic Office (AHO)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Hydrographic Office (AHO)	NA	NA	NA	NA	27/8/2025 7:53AM	Email	Automated response acknowledging that CGG's E022 email has been received by the AHO, stating the data CGG supplied will now be registered, assessed, prioritised and validated in preparation for updating their Navigational Charting products.'	No objections or claims	NA	No response
Australian Institute of Marine Science (AIMS)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Australian Institute of Marine Science (AIMS)	31/07/2023	01:43 PM	Follow up	Phone	31/07/2023	Phone	AIMS said that the email CGG used was a generic one that only stores information for a week. Provided a better email address and said they would	No objections or claims. Request that the infomration is sent to a different email address.	CGG will send the information to the email address supplied	CGG called AIMS to confirm that they had received the project information. CGG will send the information to the provided email address.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							forward the information through to the correct person.			
Australian Institute of Marine Science (AIMS)	1/08/2023	09:33 AM	E010	Email	8/08/2023	Email	AIMS acknowledged receipt of the email and confirmed that it had been forwarded to the WA AIMS Team Leaders and the Project Manager for their information.	No objections or claims.	NA	CGG resent the consultation information to the new email address that AIMS had provided.
Australian Institute of Marine Science (AIMS)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Australian Institute of Marine Science (AIMS)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Australian Institute of Marine Science (AIMS)	19/04/2024	8:30AM	E018	Email						
Australian Institute of Marine Science (AIMS)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Australian Institute of Marine Science (AIMS)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Marine Oil Spill Centre (AMOSC)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Australian Marine Oil Spill Centre (AMOSC)	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
Australian Marine Oil Spill Centre (AMOSC)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will be managed as per the process outlined in the EP.
Australian Marine Oil Spill Centre (AMOSC)	16/01/2024	10:21 AM	Follow up	Email	12/1/2024	Email	Please keep us updated once activties commence.	No objections or claims.	NA	CGG will keep AMOSC updated.
Australian Marine Oil Spill Centre (AMOSC)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Confirmation of reciept	No objections or claims	NA	
Australian Marine Oil Spill Centre (AMOSC)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Australian Marine Oil Spill Centre (AMOSC)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Maritime Safety Authority (AMSA)	2/06/2023	03:28 PM	E010 - AMSA specific	Email	NA	NA	NA	NA	NA	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines and a request that if this is incorrect, that CGG should be notified.
Australian Maritime Safety Authority (AMSA)	14/08/2023	02:10 PM	E016	Email	15/07/2023 1:46PM	Email	AMSA responded to CGGs consultation update to request that CGG contact JRCC and the AHO. AMSA also noted that vessels should exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). Also noted that CGG should evaluate and implement adequate anti-collision measures.	The following claims are merited due to AMSA's role: 1) request that CGG contact JRCC and the AHO 2) vessels should exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG should evaluate and implement adequate anti-collision measures.	1) CGG is in contact with the JRCC and AHO regarding this activity. 2) vessels will exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG has evaluated and has already implemented controls to reduce the risk of collission, these include reference to Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 58, issuance of marine navigation warning and NtM, Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings.	CGG responded to AMSA to thank them for their email and to confirm that CGG will ensure that all the agencies listed are notified as required and as instructed, and will also ensure that suitable and required collision mitigation measures are implemented.
Australian Maritime Safety Authority (AMSA)	17/08/2023	02:42 PM	Follow up	NA	NA	NA	NA	NA	NA	CGG responded to AMSA to thank them for their email and to confirm that CGG will ensure that all the agencies listed below are notified as required and as

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										instructed, and will also ensure that suitable and required collision mitigation measures are implemented.
Australian Maritime Safety Authority (AMSA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Australian Maritime Safety Authority (AMSA)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Australian Maritime Safety Authority (AMSA)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Australian Maritime Safety Authority (AMSA)	24/06/2025	4:27PM	E020 - AMSA specific	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Australian Maritime Safety Authority (AMSA)	3/07/2025	12:41PM	Response	Email	3/07/2025 7:55AM	Email	AMSA thanked CGG for its consultation regarding the Sauropod 3D MSS project in WA-527-P off the Kimberley coast and provided a vessel traffic plot for the area, noting the presence of heavy and local vessel traffic. AMSA explained a number of notification requirements that they requested CGG follow including to the JRCC and the AHO. AMSA reminded CGG of its obligations under COLREGs, including proper use of lights, shapes, and AIS settings. Additionally, AMSA advised CGG to evaluate and implement collision avoidance measures and referred them to AMSA's spatial data portals for further traffic data and customised information requests.	The following claims are merited due to AMSA's role: 1) request that CGG contact JRCC and the AHO 2) vessels should exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG should evaluate and implement adequate anti-collision measures.	No new controls adopted. 1) CGG is in contact with the JRCC and AHO regarding this activity. Minor revisions were made to the Notifications & Reporting section of the EP (Section 9.12) to reflect the most up to date notification requirements and contact details as per the information provided by AMSA. 2) vessels will exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG has evaluated and has already implemented controls to reduce the risk of collision, these include reference to Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 58, issuance of marine navigation warning and NtM, Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings.	CGG acknowledged AMSA's feedback and expressed appreciation for the information provided. CGG confirmed that the required information would be submitted within the requested timeframes. They also offered to provide further details or answer any questions if needed.
Australian Maritime Safety Authority (AMSA)	4/07/2025	5:28PM	Follow up	Email	3/07/2025 7:55AM	Email	NA	NA	NA	CGG sent a further email to AMSA in response to their email on 3/7/2025 to acknowledge receipt of the consultation response and note minor revisions made to Section 9.12 of the draft EP regarding notification and reporting. CGG confirmed that management measures described in Section 7.4.4 align with those in the consultation, including compliance with international maritime safety regulations (COLREGS and SOLAS), use of appropriate safety measures such as lighting, radar, and continuous watch, issuance of navigation warnings, pre-survey notifications, and a communications protocol to

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										coordinate with other marine users. Additionally, a support or chase vessel will accompany the survey vessel during operations when conditions permit.
Australian Maritime Safety Authority (AMSA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Australian Maritime Safety Authority (AMSA)	NA	NA	NA	NA	27/8/2025 8:44AM	Email	AMSA thanked CGG for its consultation regarding the Sauropod 3D MSS project in WA-527-P off the Kimberley coast and requested that in the future, please send all offshore oil and gas exploration related emails and queries through to a specific email address that was provided. AMSA noted that the NavSafety team did respond back to CGG in July this year with regard to this survey. As with the July AMSA response, AMSA provided a vessel traffic plot for the area, noting the presence of heavy and local vessel traffic. AMSA explained a number of notification requirements that they requested CGG follow including to the JRCC and the AHO. AMSA reminded CGG of its obligations under COLREGs, including proper use of lights, shapes, and AIS settings. Additionally, AMSA advised CGG to evaluate and implement collision avoidance measures and referred them to AMSA's spatial data portals for further traffic data and customised information requests.	The following claims are merited due to AMSA's role: 1) request that CGG contact JRCC and the AHO 2) vessels should exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG should evaluate and implement adequate anti-collision measures.	As stated in CGG's previous email reply to AMSA on 4/7/2025: 1) CGG is in contact with the JRCC and AHO regarding this activity. 2) vessels will exhibit appropriate lights and shapes to reflect the nature of operations, reminding vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs). 3) CGG has evaluated and has already implemented controls to reduce the risk of collision, these include reference to Adherence with requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 58, issuance of marine navigation warning and NtM, Pre-survey notification to AMSA JRCC, issue of AUSCOAST warnings.	No response (see previous email reply to AMSA on 4/7/2025 for CGG's response to these claims).
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	31/07/2023	01:47 PM	Follow up	Phone	31/07/2023	Phone	ASBTIA asked where the project is located, and subsequently said the north west is not where they fish. Their operations are in GAB, but Tuna Australia extend further. ASBTIA does not consider themselves relevant and would like to be removed from the relevant persons list.	No objections or claims.	NA	CGG called ABSITA to confirm that they had received the project information and check if they wanted to discuss the project. CGG explained that we had identified them as a relevant person due to our overlap with the migration route and distribution of the southern bluefin tune species more

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										generally and acknowledging that the association may have some concerns or interest in the stock in general. CGG asked if ASBTIA wanted to be resent the info so that they could have another look and decide if they want to be considered relevant.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
BARDSLEY FISHERIES PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
BARDSLEY FISHERIES PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
BARDSLEY FISHERIES PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
BARDSLEY FISHERIES PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
BARDSLEY FISHERIES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
BARDSLEY FISHERIES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
BILYARA HOLDINGS PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
BILYARA HOLDINGS PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
BILYARA HOLDINGS PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
BILYARA HOLDINGS PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
BILYARA HOLDINGS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
BILYARA HOLDINGS PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
BREFJEN NOMINEES PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
BREFJEN NOMINEES PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
BREFJEN NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
BREFJEN NOMINEES PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
BREFJEN NOMINEES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
BREFJEN NOMINEES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Broome Visitor Centre	8/06/2023	02:39 PM	Inquiry of availability	Phone	NA	NA	No answer.	NA	NA	Left phone message for Operations manager to call back.
Broome Visitor Centre	15/06/2023	10:40 AM	Inquiry of availability	Phone	NA	NA	No answer.	NA	NA	Left phone message for Operations manager to call back.
Broome Visitor Centre	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Broome Visitor Centre	18/08/2023	03:04 PM	Follow up	In person	18/08/2023	In person	The operations manager is not available today, come back on Monday midday.	No objections or claims.	NA	Enquired if the operations manager is available to chat. Let know am in town until next Friday. Will return on Monday.
Broome Visitor Centre	21/08/2023	11:04 AM	Follow up	In person	21/08/2023	In person	Operations manager has an urgent meeting and is not available. There isn't a better person to talk to or alternate way of traying to make a meeting time besides the emails and phone calls. They aren't aware of other people we should be talking to.	No objections or claims.	NA	Enquired if the operations manager is available to chat. Let know am in town until next Friday. Enquired if there was a better way to contact or a better person to talk to about the proposed survey, or if aware of any other relevant parties who may be affected by the survey that we should talk to.
Broome Visitor Centre	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Broome Visitor Centre	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Broome Visitor Centre	19/04/2024	8:30AM	E018	Email						
Broome Visitor Centre	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Broome Visitor Centre	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Care For Hedland Environmental Association	22/06/2023	11:35 AM	Inquiry of availability	Email	20/06/2023 8:37AM	Email	The founder of the Care For Hedland Environmental Association emailed CGG to request a meeting. Requested to be listed as an interested person and to receive information.	No objections or claims.	CGG to add the Association to the list of Relevant Persons and set up a meeting with them	CGG responded to thank them for reaching out, proving CGG's availability windows for an online meeting the following week. Provided them with the consultation information brochure and confirmed that CGG had added them to the list of Relevant Persons for future correspondence.
Care For Hedland Environmental Association	23/06/2023	04:47 PM	Inquiry of availability	Email	26/06/2023 12:13PM	Email	The relevant person thanked CGG for the consultation material, and discussed the possible days and times for the meeting.	No objections or claims.	NA	CGG responded to confirm a meeting day and time.
Care For Hedland Environmental Association	26/06/2023	12:43 PM	Inquiry of availability	Email	NA	NA	The relevant person agreed to the meeting time.	No objections or claims.	NA	No response, CGG will attend the confirmed meeting.
Care For Hedland Environmental Association	27/06/2023	03:45 PM	Discussion	In person	27/06/2023	In person	The relevant person explained their concerns about turtles and hatchlings, and noted that they will send through a formal submission.	The following claims are merited due to Care For Hedland's status as a relevant person for this EP: - the impact of the survey on turtle hatchlings	CGG to await the relevant persons formal submission of feedback.	CGG had an online meeting with the relevant person where they discussed the EP and explained the risk assessment process.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Care For Hedland Environmental Association	9/08/2023	05:42 PM	Follow up	Email	14/7/2023 7:32PM	Email	The representative of Care For Hedland Environmental Association provided formal written feedback on the project. The association noted their appreciation for the mitigation measures that CGG has already developed, and outlined a number of factors they believe need to be taken into consideration, including: - cumulative impacts from nearby surveys - greater detail of potential impacts and management of impacts with regards to marine turtles - the impact of the survey on flatback turtle inter-nesting activities, and request that the survey take place in the March - May section of the activity window - the impact of the survey on flatback turtle hatchlings, the movements of which are not well known. An additional factor in the request for the survey to take place in the March - May window	The following claims are merited due to Care For Hedland's status as a relevant person for this EP: - cumulative impacts from nearby surveys - management of impacts with regards to marine turtles - the impact of the survey on flatback turtle inter-nesting activities - the impact of the survey on flatback turtle hatchlings	CGG will respond to the relevant person to let them kow that the following measure will be included in the EP: - the Superbowl MSS will be included in the EP, even though the assessment does not include surveys that have not been submitted to NOPSEMA. Modelling shows no significant discernible cumulative impacts to fish given the minimum distance of 40 km between seismic surveys.	CGG responded to the relevant persons concerns. - please share the papers with the turtle tracking data - confirmed that the Superbowl MSS will be included in the EP, even though the assessment does not include surveys that have not been submitted to NOPSEMA. Modelling shows no significant discernible cumulative impacts to fish given the minimum distance of 40 km between seismic surveys. - The proposed timing for Sauropod means that there will be overlap with the nesting and breeding seasons for green, flatback, loggerhead, hawksbill and olive ridley turtles in the region (October to March). Due to timing and duration of the survey, the distances to BIAs and 'Habitat Critical' areas, and the control measures, predicted noise levels from seismic are not considered likely to cause PTS, displace individuals from the internesting BIA or 'Habitat Critical', or result in any ecologically significant impacts at a population level. As such, CGG will not reduce the potential activity window based on this criteria. - Adult and hatchling turtles that may be present within the Operational Area during the survey may be attracted to the survey and support vessel lighting. However, attraction of turtles to the vessels would be localised, short-term and affect a small proportion of the population. - sound emissions are expected to act as a localised and temporary deterrent to approaching adult turtles. - the relevant person had been added to the relevant person register for this project and will receive project updates to this email address.
Care For Hedland Environmental Association	14/08/2023	02:10 PM	E011	Email	14/8/2023 4:52PM	Email	Care for Hedland thanked CGG for the update.	No objections or claims.	NA	No response

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Care For Hedland Environmental Association	15/08/2023	03:32 PM	Follow up	Email	14/8/2023 4:44PM	Email	Care for Hedland provided CGG with a report that contained some of the information referenced in their official written response to the project. This included their 10 year report, which also referenced a number of Pendoley Environmental reports. The reports included information on turtle satellite tracking. Care for Hedland clarified that there has been no tracking of hatchlings to date.	No objections or claims.	NA	CGG thanked the relevant person for the information and said that they will keep Care for Hedland updated with progress but to let CGG know if they have any questions in the meantime.
Care For Hedland Environmental Association	15/08/2023	NA	NA	NA	15/8/2023 3:34PM	Email	Care for Hedland thanked CGG and agreed that they will contact CGG if they have any queries.	No objections or claims.	NA	No response
Care For Hedland Environmental Association	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Any objections or claims raised will be managed as per the process outlined in the EP.
Care For Hedland Environmental Association	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Care For Hedland Environmental Association	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Care For Hedland Environmental Association	24/06/2025	03:08 PM	E020	Email	24/06/2024 3:08PM	Email	Automatic reply: email will be forwarded to most appropriate team	No objections or claims.	NA	No response
Care For Hedland Environmental Association	18/07/2025	3:18PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the listed contact and left a voicemail message explaining CGG are proposing to conduct a seismic survey off the coast from Broome and Port Headland. CGG asked if they had received the consultation material and whether they had any concerns or queries about the project. CGG requested a return call or to contact them using any of the methods provided in the consultation letter.
Care For Hedland Environmental Association	26/08/2025	3:15PM	E022	Email	26/08/2025 3:15PM	Email	Autoreply stating email is currently not being monitored and all emails are being forwarded. Provides alternative email address and phone number for the Operations Manager.	No objections or claims.	NA	No response
Care For Hedland Environmental Association	NA	NA	NA	NA	26/8/2025 5:28PM	Email	Care for Headland contact thanked CGG for the updated letter and information.	No objections or claims.	NA	No response
Carnarvon Energy Limited	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Carnarvon Energy Limited	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
Carnarvon Energy Limited	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Carnarvon Energy Limited	19/04/2024	8:30AM	E018	Email						
Cervan Marine Pty Ltd	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply stating they are out of office until Monday Jun 12th	No objections or claims.	NA	No response
Cervan Marine Pty Ltd	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
Cervan Marine Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Cervan Marine Pty Ltd	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	NA	NA	
Cervan Marine Pty Ltd	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
Cervan Marine Pty Ltd	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
Cervan Marine Pty Ltd	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
Cervan Marine Pty Ltd	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF01	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF01	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF01	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF01	18/04/2024	3:55 PM	E018	Registered Post						
CF01	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF01	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF02	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF02	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF02	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF02	18/04/2024	3:55 PM	E018	Registered Post						
CF02	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF02	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF03	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF03	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF03	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF03	18/04/2024	3:55 PM	E018	Registered Post						
CF03	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF03	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF04	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF04	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF04	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted,

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF04	18/04/2024	3:55 PM	E018	Registered Post						
CF04	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF04	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF05	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
CF05	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
CF05	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF05	19/04/2024	8:30AM	E018	Email						
CF05	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
CF05	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF05	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
CF05	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF06	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF06	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF06	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will be managed as per the process outlined in the EP.
CF06	18/04/2024	3:55 PM	E018	Registered Post						
CF06	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF06	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF07	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF07	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF07	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF07	18/04/2024	3:55 PM	E018	Registered Post						

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
CF07	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF07	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF08	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF08	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF08	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF08	18/04/2024	3:55 PM	E018	Registered Post						
CF08	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF08	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
CF09	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF09	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF09	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF09	18/04/2024	3:55 PM	E018	Registered Post						
CF09	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF09	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF10	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF10	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
CF10	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF10	18/04/2024	3:55 PM	E018	Registered Post						
CF10	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF10	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF11	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF11	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF11	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF11	18/04/2024	3:55 PM	E018	Registered Post						
CF11	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF11	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF12	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF12	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF12	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF12	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF12	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF13	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF13	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF13	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF13	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF13	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
CF14	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
CF14	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
CF14	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
CF14	18/04/2024	3:55 PM	E018	Registered Post						
CF14	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
CF14	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Commonwealth Fisheries Association (CFA)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Commonwealth Fisheries Association (CFA)	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Commonwealth Fisheries Association (CFA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Commonwealth Fisheries Association (CFA)	19/04/2024	8:30AM	E018	Email						
Commonwealth Fisheries Association (CFA)	19/04/2024	8:30AM	E018	Email						
Commonwealth Fisheries Association (CFA)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Commonwealth Fisheries Association (CFA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	19/04/2024	8:30AM	E018	Email						
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Conservation Council of WA (CCWA)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Conservation Council of WA (CCWA)	14/08/2023	02:10 PM	E011	Email	17/8/23 1:39PM	Email	CCWA responded to inform CGG that they are interested in engaging on this but will need more time to review the documentation.	No objections or claims.	NA	CGG thanked CCWA for their response, and requested that they get back in touch after they have reviewed the information as CGG would be happy to discuss the survey further.
Conservation Council of WA (CCWA)	17/08/2023	5:49PM	Follow up	Email	NA	NA	NA	NA	NA	CGG thanked CCWA for their response, and requested that they get back in touch after they have reviewed the information as CGG would be happy to discuss the survey further.
Conservation Council of WA (CCWA)	18/10/2023	N/A	Public comment	NA	18/10/2023	Public comment	CCWA believes that there has been inadequate consultation with CCWA (insufficient time to consult, inconsistent with international best practice) and their previously raised concerns regarding impacts to marine parks have not been adequately addressed in the EP.	The following claims are merited due to CCWA's status as a relevant person for this EP: 1) there has been inadequete consultation with the CCWA 2) previously raised concerns regarding ipacts to marine parks have not been addressed in the EP.	No controls have been proposed to be adopted in respose to this consultation.	CGG does not consider from 2/6/23 to 18/10/23 to be insufficient time to review the proposed activity. Note that as a relevant person for this activity, consultation from relevant person via the public comment period will still be assessed according to the relevant person consultation process that is detailed in the EP. CCWA has duplicated the previous query regarding potential impacts to marine life. CGG provided a comprehensive response to the previous query, including section references to where in the EP the queries were already adressed. The information provided included and section references for the EP to demonstrate where impacts to marine parks have been asssessed in the EP. This information has not changed since the previous response. The previous response provided for reference. Request for the CCWA to provide clairty on what aspects of CGG's response they would like clarified.
Conservation Council of WA (CCWA)	27/10/2023	4:29PM	Follow up	Email	NA	NA	NA	NA	NA	CGG provided response as above.
Conservation Council of WA (CCWA)	27/10/2023	4:33PM	Follow up	Email	NA	NA	NA	NA	NA	CGG re-sent letter to CCWA as directed by the out of office response.
Conservation Council of WA (CCWA)	30/10/2023	09:21 AM	NA	NA	30/10/2023	Email	Thank you for your response. In future, if you can provide CCWA with ample time to go over newly released documents, that would be greatly appreciated. We have a small team who are submitting comments on many proposals on a weekly basis and	No new objections or claims	NA	CGG will wait for CCWAs response.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							are not always able to respond to both industry and regulatory requests for consultation.			
Conservation Council of WA (CCWA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Conservation Council of WA (CCWA)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Automatic reply: acknowledgement of receipt	No objections or claims.	NA	No response
Conservation Council of WA (CCWA)	24/06/2025	3:08PM	E020	Email	24/06/2024 3:09PM	Email	Automatic reply: acknowledgement of receipt	No objections or claims.	NA	No response
Conservation Council of WA (CCWA)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Automatic reply: acknowledgement of receipt	No objections or claims.	NA	No response

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Conservation Council of WA (CCWA)	10/12/2025	9:08AM	Response to public comment	Email	17/11/2025	Via public comment portal	Concern 1 (pt 1): The Proposal will produce unacceptable impacts to Marine Protected Areas and marine wildlife. CCWA reiterates the concerns it has raised in previous submissions. CCWA argues that the Sauropod 3D Marine Seismic Survey poses unacceptable risks to marine ecosystems and wildlife. The proposed survey overlaps with or is near multiple sensitive areas, including Commonwealth Marine Areas, Australian Marine Parks, State Reserves, a Nationally Important Wetland, and habitats critical for threatened species. Several threatened, migratory and marine species may be affected, including critically endangered sea snakes, endangered turtles, sawfish, and whales.	The below claims are considered merited: 1) The risks to endangered sea snakes, turtles, sawfish and whales will need to be carefully considered. 2) The project contains or will produce indirect impacts to marine parks, habitat critical to the survival of a marine turtle, a Nationally Important Wetland (Mermaid Reef). 3) The Proposal contains foraging grounds, which support rich planktonic communities, critical to ecological function of the marine environment. CCWA is particularly concerned by the findings of impact to zooplankton and the possible risks to ecosystem dynamics . 4) Simultaneous activities have the potential to produce additional and cumulative risks that will need to be further assessed. 5) The operational times between January to May will overlap Pygmy Blue Whale April-May migration. 6) The operational times between January to May will overlap peak spawning of several demersal fish, seabird foraging, Flatback Turtle internesting, and nesting periods of Loggerhead Turtle. Impact to wildlife during critical migratory or breeding periods needs to be carefully assessed and strategies to eliminate risk applied. 7) The seismic blasting level is sufficient to cause impacts to a wide range of species. 8) Risks are being downplayed 9) Data gaps are being overlooked and uncertainties of knowledge disregarded. 10) Impact to sea snakes from seismic blasting could be especially pertinent given the likely presence of several species of sea snake in the EMBA, two listed as Critically Endangered, and the relative absence of data on the causes of decline in these species, and	No additional control measures are proposed to be adopted in response to this consultation with the CCWA as the controls already adopted are considered adequate to reduce impacts to ALARP and acceptable.	CGG responded to CCWA to provide a response to each of their concerns. Given the size of the collated responses please refer to the Public Comment Report (PCR) for the full text of these. The PCR will be published on NOPSEMA's website when the EP assessment process commences. On completion of the 2025 assessment process and when the EP is accepted the final EP and NOPSEMA's response to the 2025 public comments will also be published.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
								the scarcity of data for impact from underwater noise.		
Conservation Council of WA (CCWA)	10/12/2025	9:08AM	Response to public comment	Email	17/11/2025	Via public comment portal	Concern 1 (pt 2): CWA expresses concern over data gaps and the need for use of the precautionary principle. The timing of the survey coincides with critical migratory and breeding periods for pygmy blue whales, turtles, and fish, increasing potential harm. CCWA also criticizes reliance on visual monitoring, which is unreliable in poor conditions, and notes cumulative impacts from overlapping projects and other stressors like climate change. Overall, CCWA asserts that mitigation measures are inadequate and that uncertainties demand a precautionary approach, including delaying approval until risks are better understood. Key risks include noise impacts from seismic blasting (up to 255 dB SPL), which can disrupt communication, navigation, and breeding behaviours of marine mammals and other fauna. CCWA highlights data gaps on benthic communities and sea snake vulnerability.	The below claims are considered merited: 11) Delaying decision-making until such time as more data becomes available; until such time that risks can be conclusively established as insignificant; or until such time as alternative technologies or practices are available to mitigate harm. 12) CCWA was not able to clearly ascertain from the information provided the response time frames that would apply, in the event of a significant environmental event, or how an adverse wildlife event, for example, due to the seismic activities, would be reported or managed. 13) CCWA rejects visual monitoring as a reliable method. 14) The cumulative impacts of other proponent led seismic survey operations and other aspects of offshore projects (e.g., from drilling operations, spills, emissions, etc.) are not discussed in any detail in the EP. 15) Synergistic, additive, or antagonistic interactions between seismic sound impacts and other stressors has not been studied. Additional pressures to reef and other ocean ecological systems, including sea level rises; changes in sea temperature; and ocean acidification, resulting from climate change; marine debris; physical habitat modification; oil production; and invasive species (in accordance with DCCEEW 'sprat' identified pressures), should also be considered in environmental assessments for all offshore oil and gas. 16) The Proposal is to support the extraction of oil and gas for carbon storage activities.	No additional control measures are proposed to be adopted in response to this consultation with the CCWA as the controls already adopted are considered adequate to reduce impacts to ALARP and acceptable.	See above
Conservation Council of WA (CCWA)	10/12/2025	9:08AM	Response to public comment	Email	17/11/2025	Via public comment portal	Concern 2. The Proposal is to support the extraction of oil and gas or for carbon storage	These claims are not merited as they do not directly relate to the EP activity.	No additional control measures are proposed to be adopted in response to this consultation	See above

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							activities. The seismic survey supports oil and gas exploration, which contradicts urgent climate action goals. Climate change is already causing severe impacts on Western Australian ecosystems, with coral reefs, kelp forests, and forests nearing critical thresholds. CCWA concludes that approving the survey would be inconsistent with public interest and environmental protection obligations, urging NOPSEMA to reject the current Environment Plan.		with the CCWA as the controls already adopted are considered adequate to reduce impacts to ALARP and acceptable.	
Coral Expeditions	8/06/2023	04:30 PM	E010	Email	NA	NA	NA	NA	NA	NA
Coral Expeditions	31/07/2023	12:22 PM	Follow up	Phone	NA	Phone	Not sure if the information had been received and was not sure if there was a better email address to use.	No objections or claims.	NA	CGG called to confirm that they had received the project information and check if they wanted to discuss the project. The person CGG reached was not sure if the information had been received and was not sure if there was a better email address to use. CGG provided their email address to Coral Expeditions for them to follow up with.
Coral Expeditions	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Coral Expeditions	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Coral Expeditions	19/04/2024	8:30AM	E018	Email						
Coral Expeditions	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Coral Expeditions	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Coral Princess Cruises Pty Ltd	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Bounce back email	No objections or claims.	NA	CGG to attempt to find new contact details for the relevant person.
Coral Princess Cruises Pty Ltd	27/06/2023	04:28 PM	E010	Email	NA	NA	NA	NA	NA	CGG resent the consultation material to a newly sourced email address.
Coral Princess Cruises Pty Ltd	31/07/2023	12:28 PM	Follow up	Phone	NA	Phone	provided the phone number of the vessel for CGG to enquire with them about the timing of their movements	No objections or claims.	NA	CGG called to confirm that they had received the project information and check if they wanted to discuss the project. Coral Princess Cruises provided the phone number of the vessel for CGG to enquire with them about the timing of their movements.
Coral Princess Cruises Pty Ltd	31/07/2023	12:31 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG attempted to call the vessel number but the number did not connect.
Coral Princess Cruises Pty Ltd	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Coral Princess Cruises Pty Ltd	11/01/2024	8:10PM	E017	Email	11/01/24 8:11PM	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Coral Princess Cruises Pty Ltd	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	
Coral Princess Cruises Pty Ltd	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Coral Princess Cruises Pty Ltd	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
COYRECUP LAKE PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
COYRECUP LAKE PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
COYRECUP LAKE PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
COYRECUP LAKE PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
COYRECUP LAKE PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
COYRECUP LAKE PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity	14/08/2023	02:10 PM	E016	Email	14/8/2023 2:30PM	Email	The Conveyance Maritime department of DAFF emailed to say that they can support this vessel's visit into Australian territory. They outlined a number of regulatory obligations under the Biosecurity Act 2015.	No objections or claims.	NA	CGG thanked DAFF for their email, stating they have noted the requirements for vessels entering Australia and will ensure all are complied with.
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity	1/09/2023	11:23AM	Follow up	Email	NA	NA	NA	NA	NA	CGG thanked DAFF for their email, stating they have noted the requirements for vessels entering Australia and will ensure all are complied with.
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity		NA	Follow up	Email	8/09/2023 7:21AM	NA	DAFF responded to thank CGG and agree that they would like to be kept updated.	No objections or claims.	NA	No response
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	11/01/2024	8:10PM	E017	Email	11/01/24 8:11PM	Email	Autoreply and acknowledgement of receipt from the Marine and Aquatic Biosecurity Section. Autoreply noting that the Assistant Director of the Conveyance Policy	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							Section (Aircraft Policy) would be out of office until Tuesday 12 January.			functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	NA	NA	No response
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	24/06/2025	3:08PM	E020	Email	24/06/2025 3:09PM	Email	Bounceback email for two addresses (undeliverable notification)	No objections or claims	NA	No response
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	24/06/2025	3:08PM	E020	Email	24/06/2025 3:09PM	Email	Autoreply listing frequently reuested information, and noting that our email will be responded to within 10 business days if not addressed by the information provided.	No objections or claims	NA	No response

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (Marine Pests)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Autoreply listing frequently reuested information, and noting that our email will be responded to within 10 business days if not addressed by the information provided.	No objections or claims	NA	No response
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	14/08/2023	02:10 PM	E016	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	19/04/2024	8:30AM	E018	Email						
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Seaports [previously DAWE]	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply from Seaports Program noting receipt of the email	No objections or claims.	NA	Autoreply to acknowledge reciept of email, no response required.
Department of Agriculture, Fisheries and Forestry (DAFF) – Seaports [previously DAWE]	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Department of Agriculture, Fisheries and Forestry (DAFF) – Seaports [previously DAWE]	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Biodiversity, Conservation and Attractions (DBCA)	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	No response
Department of Biodiversity, Conservation and Attractions (DBCA)	9/06/2023	12:05 PM	Availability enquiry	Phone	NA	Phone	provided direct email for the Rowley Shoals parks manager to request a meeting. Manager is currently at the Rowley Shoals but will get back to us to arrange a meeting time.	No objections or claims.	NA	Spoke to reception in Broome office Requested to arrange a meeting with the Rowley Shoals coordinator when CGG consultation team is in Broome. Will send the manager an email.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Biodiversity, Conservation and Attractions (DBCA)	9/06/2023	12:05 PM	E010 & Availability enquiry	Email	9/6/2023 2:31PM	Email	Autoreply noting that the Rowley Shoals park manager would be out of office until Tuesday 13 June.	No objections or claims.	NA	CGG sent a follow up email after the phone call to provide the Rowley Shoals park manager with the consultation materials, dates of the Broome visit and a request for their availability for a meeting.
Department of Biodiversity, Conservation and Attractions (DBCA)	15/06/2023	12:30 PM	Availability enquiry	Phone	NA	Phone	No answer	No objections or claims.	NA	Left a message for a callback.
Department of Biodiversity, Conservation and Attractions (DBCA)	22/06/2023	10:30 AM	Discussion	In person	NA	In person	The DBCA representative agreed to pass on the consultation material to the manager of the Rowley Shoals MP and the manager of the 80 Mile Beach MP.	No objections or claims.	NA	CGG visited the DBCA Broome office. Provided both hardcopy and electronic copies of the consultation material.
Department of Biodiversity, Conservation and Attractions (DBCA)	14/08/2023	02:10 PM	E011	Email	14/7/2023 2:11PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	No response
Department of Biodiversity, Conservation and Attractions (DBCA)	11/01/2024	8:10PM	E017	Email	11/01/23 8:10PM	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Biodiversity, Conservation and Attractions (DBCA)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	NA	NA	
Department of Biodiversity, Conservation and Attractions (DBCA)	24/06/2025	3:08PM	E020	Email	24/06/2024	Email	Autoreply: email will be forwarded to the relevant area of the department for response.	No objections or claims.	NA	No response
Department of Biodiversity, Conservation and Attractions (DBCA)	30/06/2025	4:20PM	Follow up	Phone call	30/06/2025 3:21PM	Voicemail	DBCA representative left a voicemail for CGG stating they wanted to have a quick chat about the stakeholder consultation for the Sauropod MSS and could CGG call them back	No objections or claims.	NA	CGG called the stakeholder and discussed the timeframe for providing feedback, suggesting that a response within one month would be appreciated. It was explained that consultation is an ongoing process and any relevant feedback received after that period would still be considered, and noted they would follow up with an email.
Department of Biodiversity, Conservation and Attractions (DBCA)	30/06/2025	6:27PM	Follow up	Email	NA	NA	NA	NA	NA	CGG thanked the DBCA contact for the recent phone conversation and encouraged the department to provide any feedback as soon as possible, ideally within a month, to support the consultation process. CGG acknowledged that these processes take time and reassured DBCA that any relevant feedback received beyond the suggested timeframe would still be considered. Additionally, CGG offered to provide further information or answer any questions DBCA might have.
Department of Biodiversity, Conservation and Attractions (DBCA)	2/08/2025	10:38AM	Follow up	Email	30/07/2025 10:11AM	Email	DBCA representative acknowledged receipt of the information regarding CGG's proposed seismic survey in Commonwealth waters near environmentally sensitive areas managed under the CALM Act and BC Act. DBCA highlighted potential impacts on marine fauna, including conservation-	The following claims are merited due to DBCA's role: 1) Recommendation that CGG conduct a risk assessment of their proposed activities' potential impacts on marine fauna, considering the noise scale and biological significance. Operations	No additional control measures are proposed to be adopted in response to this consultation with the DNP as the controls already adopted are considered adequate to reduce impacts to ALARP and acceptable. 1) The EP includes a risk assessment of potential impacts on marine fauna species that	CGG thanked and acknowledged DBCA's detailed guidance on assessing and managing potential marine fauna impacts from the proposed seismic survey. CGG confirmed that both the previously accepted EP and its forthcoming revised version include a risk assessment

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							significant species vulnerable to underwater noise. It recommends CGG conduct a risk assessment considering noise scale and biological significance, with management measures aligned to risk levels. Best practice includes underwater noise modeling, establishing management zones (observation, low power, shutdown), employing Marine Fauna Observers, and using visual and acoustic monitoring with soft-start and stop-work protocols. DBCA advises applying shutdown zones for whale sharks, marine turtles, and notably the Pygmy blue whale during its migration. Further guidance can be found in EPBC Act Policy Statement 2.1. DBCA invites further discussion and requests ongoing notifications via EMBAdmin@dbca.wa.gov.au.	management should then align with the assessed level of risk. 2) Best practice for managing significant underwater noise impacts on marine fauna includes: - Underwater noise modeling to map noise impact zones, using scientific data and species-specific noise thresholds. - Establishing management zones (observation, low power, shut-down) based on behavioral or physical harm thresholds for marine species. - Implementing pre-start visual and acoustic monitoring, soft-starts, and stop-work procedures. - Having qualified Marine Fauna Observers on vessels for early detection and response. 3) Identification of additional guidance referenced from EPBC Act Policy Statement 2.1, mainly focused on seismic impacts on whales, but also includes wider species considerations. 4) Recommendation that CGG apply appropriate shut-down zones for Pygmy blue whales during their migration period, as the survey overlaps with this route.	has been informed by underwater noise modelling. 2) The EP specifies a range of management measures to mitigate potential impacts, including the use of two trained MFOs onboard the survey vessel and the application of precaution zones consistent with Part A of EPBC Act Policy Statement 2.1. See Section 7.1 of the draft EP for more details. 3) The guidance provided has been considered by CGG and is referenced in the EP. Mitigation measures are consistent with this guidance. 4) see 2)	informed by underwater noise modeling and outlines mitigation measures such as deploying two trained Marine Fauna Observers and establishing precautionary zones aligned with EPBC Act Policy Statement 2.1. CGG directed the DBCA contact to Section 7.1 of the prior EP on the NOPSEMA website for further details and noted that the draft revised EP will soon be available on the Sauropod 3D MSS website, with an upcoming consultation letter to update stakeholders on the process.
Department of Biodiversity, Conservation and Attractions (DBCA)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Autoreply: email will be forwarded to the relevant area of the department for response.	No objections or claims.		No response
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	2/06/2023	03:28 PM	E010	Email	6/6/2023 07:24AM	Email	EPBC referrals team emailed requesting the EPBC number of the project so that they may forward CGG's notice of commencement to the relevant Departmental section/officer.	No objections or claims.	CGG is not submitting an EPBC referral and thus does not have an EPBC number.	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the	11/01/2024	8:10PM	E017	Email	11/01/24 8:11PM	Email	Bounceback email from one of the several DCCEEW contact email addresses.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Environment and Water (DCCEEW)										assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	19/04/2024	8:30AM	E018	Email						
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	8/07/2025	2:50PM	Response	Email	08/07/2025 11:41AM	Email	DCCEEW contact for North WA Assessments thanked CGG for reaching reaching out to the department as a stakeholder on the proposed Sauropod 3DMSS. DCCEEW expressed that as per the NOPSEMA EPBC process,	No objections or claims.	NA	CGG thanked the DCCEEW contact for their response, noting their comments. CGG asked DCCEEW to contact them if they have any questions or require further information.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							as long as the purpose of the activity remains “to collect high-quality geophysical data about rock formations and structures beneath the seabed and assess potential for new oil and gas discoveries” the department considers the assessment of impacts to MNES will be considered as part of NOPSEMAs assessment.			
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	NA	NA	NA	NA	28/8/2025 6:32AM	Email	DCCEEW contact from Parks Australia requested that CGG remove two email addresses from their distribution list, and to let them know if CGG has any questions.	Request to remove two email addresses from CGG's distribution list only. No objections or claims.	NA	CGG confirmed the requested emails addresses have been removed from the distribution list.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	2/06/2023	03:28 PM	E010 - DNP specific	Email	NA	NA	NA	NA	NA	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines and a request that if this is incorrect, that CGG should be notified.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	21/12/2023	01:27 PM	Follow up	Phone	21/12/2023	Phone	The person who is in that role is not currently available, reception will leave · Reception noted that the person we corresponded with previously is no longer in that role, and reception cannot tell us who is in the role now. Reception left a message to call back	No objections or claims.	NA	Called general phone line requesting to talk to the assistant director of authorisations and compliance, or someone else who is now in that role CGG are trying to get in touch with the DNP about the project, we have not been receiving responses from our emails to the general mailbox.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of	22/12/2023	06:39 AM	NA	NA	22/12/2023	Email	If your enquiry relates to offshore oil and gas, please email marineparksauthorisations@dcceew.gov.au	No objection or claim, provision of information.	NA	CGG will email the provided contact, noting that this is the generic inbox that has been used for previous correspondence.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
National Parks (DNP)										
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	9/01/2024	08:38 AM	Follow up	Email	NA	NA	NA	NA	NA	As per the direction, CGG will continue to email the provided generic inbox.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	10/01/2024	09:37 AM	Follow up	Email	NA	NA	NA	NA	NA	There is one seismic survey that could occur within 100 km of the proposed Sauropod MSS, the Searcher Possum 3D MSS. As there are no accepted EPs covering seismic surveys that could be undertaken within the same timeframe as the Sauropod 3D MSS, and potentially occur within 150 km of the Operational Area, no CONOPS planning has taken place. In the event that the Searcher Possum 3D MSS or another seismic survey EP is accepted for activities within 150km of the Sauropod MSS, prior to commencement of the Sauropod 3D MSS, CGG will consult with the titleholders/proponents of these EPs to establish whether there is any likelihood of concurrent operations.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	12/01/2024	2:15 PM	NA	NA	12/1/2024	Email	Please use the marineparksauthorisations@dcceew.gov.au for communications relating to offshore energy or other marine park authorisations.	No objections or claims.	NA	CGG will continue to provide DNP updates. CGG will continue to use all of the email adresses provided.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	18/04/2024	3:55 PM	E018	Registered Post	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
- Director of National Parks (DNP)										
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	24/06/2025	4:29PM	E020 - DNP specific	Email	NA	NA	NA	NA	NA	NA
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	25/08/2025	7:31PM	Response	Email	25/08/2025 2:05PM	Email	The Director of National Parks (DNP) at DCCEEW reviewed CGG's Sauropod Marine Seismic Survey stakeholder update and confirmed that the planned activities do not overlap with any Australian Marine Parks, with the closest parks located at least 20 km away. Therefore, no DNP authorisation is required. The DNP highlighted that the Operational Area (OA) should include all related offshore petroleum activities (e.g. line turns/repositioning, equipment maintenance, deployment and recovery, crew change and resupply) which must be detailed in the Environment Plan (EP) for proper risk assessment. Any operational activity within a marine park without prior authorisation or specification in an accepted EP would breach the EPBC Act. The DNP also emphasised the need for prompt notification of any oil or gas pollution incidents impacting marine parks, outlining required information and reporting procedures. Notification should be provided to the 24 hour Marine Compliance Duty Officer on 0419 293 465. No further updates are required unless the activity changes to impact marine parks.	The following claims are merited due to DNPs role: 1) DNP requested that the project definition of the Operational Area (OA) should include all operational activities (e.g. line turns/repositioning, equipment maintenance, deployment and recovery, crew change and resupply). 2) DNP requested prompt notification of any oil or gas pollution incidents impacting a marine park, including notifying the 24 hour Marine Compliance Duty Officer.	No additional control measures adopted. 1) CGG has confirmed that the EP definition of the Operational Area (OA) as defined in Section 3.1 matches that described by DNP 2) The notification procedures outlined in Section 9.12 of the EP align with those requested by DNP.	CGG thanked the DNP contact for their response, noting their comments will be included in the EP as required. CGG requested the DNP contact let them know if they have any further questions or need more information. See CGG's follow up email below for further information.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	26/08/2025	5:10PM	Follow up	Email	25/08/2025 2:05PM	Email	NA	NA	NA	As a follow up to CGG's previous email on 26/8/2025, CGG thanked the DNP contact for their response, noting their comments will be included in the EP as required. CGG also noted DNP's request

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										to clarify the OA, and defined the OA as per the latest version of the EP (available at https://www.sauropodmss.com.au) as 'the Acquisition Area (where seismic data acquisition will occur) plus additional space for vessel activities such as line turns, run-ins, run-outs, soft-start procedures and seismic source testing. Associated activities in support of the survey are likely to include refuelling and resupply, use of support vessels as required, and crew changes within the Operational Area'. CGG requested the DNP contact let them know if they have any further questions or need more information.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Director of National Parks (DNP)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Defence	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Defence	14/08/2023	02:10 PM	E015	Email	3/10/2023 8:15AM	Email	NA	NA	NA	NA
Department of Defence	4/10/2023	2:13PM	Follow up	Email	3/10/2023 8:15AM	Email	The relevant person responded to note that they have recently taken over Defence Offshore Petroleum enquiries and will be the new point of contact. They stated that they had requested a response from Defence stakeholders by close of business Tuesday 17 October 2023.	No objections or claims.	NA	CGG responded to thank the relevant person and to say that they look forward to hearing from them when they receive the responses.
Department of Defence	17/10/2023	4:59PM	Follow up	Email	17/10/2023 1:39PM	Email	Defence reponded to state that the activity areas are located outside of any Defence Training Areas and restricted airspace. CGG is advised that unexploded ordnance (UXO) may be present on and in the sea floor. CGG must, therefore, inform itself as to the risks associated with conducting activities in the area. Defence also reiterated CGG's risks and obligations associated with its activity in relation to UXO.	Defence's claims that UXO may be present on and in the sea floor are merited.	No additional controls adopted. CGG has assessed the potential for UXO and incorporated this into the Existing Environment of the EP.	CGG responded to Defence to thank them for the email and state that their advice on UXO is well-noted, and that CGG will continue to keep DoD and AHS updated.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Defence	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Defence	19/04/2024	8:30AM	E018	Email						
Department of Defence	19/04/2024	8:30AM	E018	Email						
Department of Defence	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA
Department of Defence	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	19/04/2024	8:30AM	E018	Email						
Department of Energy, Mines, Industry	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Regulation and Safety (DEMIRS)										
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	11/11/2025	6:38PM	Follow up	Email	11/11/2025 6:25PM	Email	DMPE (formerly DEMIRS) acknowledged receipt of the information sent by CGG on 24 June 2025 and 26 August 2025 relating to the proposed Sauropod 3D Marine Seismic Survey Environment Plan (Revision 3). DMPE noted that the proposed activity will be regulated under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 and assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). DMPE noted they have reviewed the notification and do not require any further information at this stage. Requested that CGG subsequently, please: 1. provide pre-start notification confirming the start date of the proposed activity and a cessation notification to inform DMPE upon completion of the activity to petroleum.environment@dmpe.wa.gov.au. 2. ensure the environment plan includes information about the reporting of environmental incidents that could potentially impact on any land or water in State jurisdiction, including that any notifications or reports are to be sent to petroleum.environment@dmpe.wa.gov.au.	No objections or claims.	NA	CGG thanked DMPE for their email and confirmed they will ensure that pre-start and end notifications are provided as requested and that the EP contains information on reporting of any incidents that could affect state lands or waters. Noted that if DMPE have any questions, or require any further information, please let CGG know.
Department of Foreign Affairs and Trade	19/04/2024	8:30AM	E018	Email						
Department of Foreign Affairs and Trade	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Foreign Affairs and Trade	14/08/2023	02:10 PM	E015	Email	14/7/2023 2:29PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Foreign Affairs and Trade	11/01/2024	8:10PM	E017	Email	11/01/23 8:10PM	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Foreign Affairs and Trade	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	NA	NA	
Department of Foreign Affairs and Trade	24/06/2025	3:08PM	E020	Email	24/06/2024 3:08PM	Email	Automatic reply acknowledging of receipt and providing information links for the department.	No objections or claims.	NA	No response
Department of Foreign Affairs and Trade	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Industry, Science	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
and Resources (DISR)										
Department of Industry, Science and Resources (DISR)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Department of Industry, Science and Resources (DISR)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Industry, Science and Resources (DISR)	19/04/2024	8:30AM	E018	Email						
Department of Industry, Science	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
and Resources (DISR)										
Department of Industry, Science and Resources (DISR)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	2/06/2023	03:28 PM	E010	Email	5/6/2023 6:57AM	Email	ACMA stated that they have reviewed the map on the Sauropod MSS website and that further to their previous response (June 2022), they would like to highlight that the proposed activities may overlap or be in the vicinity of submarine cables. Noted that CGG can find a map and details of the Darwin-Jakarta-Singapore cable system on its website. ACMA recommended that CGG contact the AHO for further assistance identifying the locations of submarine cables, including domestic submarine cables which the ACMA may not be able to provide comment on. The AHO maintains records of the geospatial coordinates of all active and out-of-service submarine cables.	No objections or claims.	NA	NA
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	15/06/2023	01:35 PM	Follow up email	Email	NA	NA	NA	NA	NA	CGG responded to ACMA to thank them for the email and to note that they have been in touch with the AHO and will continue to keep them updated on the progress.
Department of Infrastructure, Transport, Regional	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)										
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	14/08/2023	02:10 PM	E016	Email	NA	NA	NA	NA	NA	NA
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (subsea cables)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (subsea cables)	19/04/2024	8:30AM	E018	Email						
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	N/A	NA
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	27/06/2025	1:38PM	Follow up	Email	27/06/2025 11:25AM	Email	ACMA thanked CGG for the email and noted that they do not have any comments to add since their previous comments in 2023. ACMA attached the email correspondence from the previous 2023 round of consultation. Provided an email contact for if CGG require any further information regarding the ACMA's role in relation to submarine cables.	No objections or claims.	NA	CGG confirmed that the email contact provided matched the existing one in the register. CGG noted the previous comments and stated that they will be in touch if they need any further information. Also requested that ACMA let CGG know if they have any questions.
Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) - Australian Communications and Media Authority (ACMA) (Subsea cables)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	N/A	NA
Department of Primary Industries and Regional	2/06/2023	03:28 PM	E010 - DPIRD specific	Email	NA	NA	NA	NA	NA	CGG sent the relevant person consultation information. The letter includes a description and

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Development (DPIRD) - Fisheries										acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines and a request that if this is incorrect, that CGG should be notified.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	9/06/2023	02:30 PM	E010 & Availability enquiry	Email	NA	NA	NA	NA	NA	CGG sent a follow up email with the consultation material and the dates of the CGG visit to Broome, enquiring as to the availability of the fisheries manager during that time.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	9/06/2023	12:01 PM	Availability enquiry	Phone	NA	Phone	No answer.	NA	NA	Tried to call Broome office three times to arrange face to face meeting. No answer. CGG will call back later.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	9/06/2023	02:00 PM	Availability enquiry	Phone	NA	Phone	Please email the meeting request and someone will get back to you.	No objections or claims.	NA	CGG will be in Broome in a few weeks time, would like to meet with the Fisheries manager if available. Will send a meeting request via the email provided.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	15/06/2023	12:50 PM	Availability enquiry	Phone	NA	Phone	NA	NA	NA	NA
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	22/06/2023	09:30 AM	Discussion	In-person	NA	In-person	DPIRD agreed to put the CGG flyer on the noticeboard to inform fishers of the drop in session and the project.	No objections or claims.	NA	CGG visited the DPIRD Broome office. Provided the consultation material and put a flyer up on the noticeboard.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	1/09/2023	5:40PM	Follow up	Email	1/09/2023 9:38AM	Email	Thanked CGG for the opportunity to comment on the CGG Sauropod Marine Seismic Survey. Noted that the CGG proposal has a comprehensive coverage of the activity of the fisheries with Management Areas within the survey area, and that they may also like to inform the Broome Prawn Licence holders who don't fish the survey area but whose Management Zone does overlap.	No objections or claims.	NA	CGG responded to thank DPIRD for their input, and noted that they will check whether the Broome Prawn Licence holders have been consulted already and send them the consultation information if necessary.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	19/04/2024	8:30AM	E018	Email						
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	24/06/2025	4:34PM	E020 - DPIRD specific	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Department of Primary Industries and Regional Development (DPIRD) - Fisheries	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Environs Kimberley	26/06/2023	02:50 PM	E010	Email	NA	NA	NA	10	NA	CGG emailed Environs Kimberley to explain that they were given the relevant persons details by another interested party who had noted that the member of Environs Kimberley had some questions but was unable to come along to the open session in Broome. CGG provided the consultation material and stated that if the relevant person had any more questions to please get in touch. Also noted that the relevant person had been added to the list of Relevant Persons for ongoing consultation.
Environs Kimberley	28/07/2023	12:39 PM	Follow up	Phone	NA	Phone	the relevant person could not confirm that they had received the information but did confirm that CGG had the correct email address and requested that the consultation information be resent.	No objections or claims.	CGG to resend the consultation information to the relevant person	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project. The representative of Environs Kimberley could not confirm whether they had received it. Confirmed that the email address used was the correct one. Said they would follow up with the correct person. Environs Kimberley requested that the information is resent.
Environs Kimberley	28/07/2023	12:48 PM	Follow up	Email	NA	NA	NA	NA	NA	CGG resent the consultation information as requested by the relevant person.
Environs Kimberley	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Environs Kimberley	15/08/2023	03:40 PM	Follow up	Phone	NA	Phone	Person who has been dealing with CGG will be back in the office tomorrow. Will leave a message that CGG is in town and available until next Friday.	No objections or claims.	NA	Call to advise CGG is in town until next Friday and is available for consultation.
Environs Kimberley	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Environs Kimberley	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Environs Kimberley	19/04/2024	8:30AM	E018	Email						
Environs Kimberley	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA
Environs Kimberley	18/07/2025	3:24PM	Initial phone call	Phone call	NA	Phone	The listed contact explained the staff that would have received the consultation materials were not in the office at that time, and that they would get back in contact with us next week if they are back in.	No objections or claims.	NA	CGG called the listed contact to explain the project and ask if they had recieved the consultation materials and if they have any concerns or queries about the project.
Environs Kimberley	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
FAT MARINE PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
FAT MARINE PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
FAT MARINE PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
FAT MARINE PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
FAT MARINE PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
FAT MARINE PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
GNTM PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
GNTM PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
GNTM PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
GNTM PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
GNTM PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
GNTM PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Gogolanyngor Aboriginal Corporation	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Gogolanyngor Aboriginal Corporation	8/06/2023	04:41 PM	E010	Email	NA	NA	NA	NA	NA	NA
Gogolanyngor Aboriginal Corporation	31/07/2023	02:20 PM	Follow up	Phone	NA	Phone	The KLC provided the phone number of the lawyer who represents the GAC.	No objections or claims.	NA	CGG called the relevant person to confirm that they had received the information and

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										check if they wanted to discuss the project. The contact number is that of the KLC, so CGG asked if the KLC was able to put them through to a representative of the Gogolanyngor AC. The KLC provided the phone number of the lawyer who represents the AC.
Gogolanyngor Aboriginal Corporation	31/07/2023	02:26 PM	Follow up	Phone	NA	Phone	No answer	NA	NA	CGG attempted to call the lawyer who represents the Gogolanyngor AC but there was no answer. CGG left a message to say they are checking that they received the relevant person information, and provided the dates of the August trip in case they wanted to meet up.
Gogolanyngor Aboriginal Corporation	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Gogolanyngor Aboriginal Corporation	15/08/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	Re-send of letter E011. As discussed, I am in Broome until Friday the 25th August. I understand there are no board meetings planned for the next few weeks, however if anyone from the Gogolanyngor Aboriginal Corporation wishes to meet while I am here, please be in touch.
Gogolanyngor Aboriginal Corporation	22/08/2023	06:59 AM	NA	NA	22/08/2023	Email	GAC considers that its members will not be affected by that activity. GAC and its members do not wish to be consulted further regarding that matter.	No objections or claims.	NA	CGG will remove this person from the list of relevant persons and not contact them further regarding this survey.
GP1	26/06/2023	02:33 PM	E010	Email	NA	NA	NA	NA	NA	CGG provided the relevant person with the consultation material and noted their specific concerns regarding ongoing oil and gas development and explained some of the mitigation measures. Confirmed that they had added them to the list of Relevant Persons for further communications.
GP1	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
GP1	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
GP1	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
GP1	19/04/2024	8:30AM	E018	Email						
GP1	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
GP1	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
GP2	26/06/2023	02:36 PM	E010	Email	NA	NA	NA	NA	NA	CGG provided the relevant person with the consultation material and noted their specific concerns regarding ongoing oil and gas development and explained some of the mitigation measures. Confirmed that they had added them to the list of Relevant Persons for further communications.
GP2	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
GP2	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
GP2	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
GP2	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
GP2	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
GP2	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
GP3	26/06/2023	02:39 PM	E010	Email	NA	NA	NA	NA	NA	CGG provided the relevant person with the consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										material and noted their specific concerns regarding ongoing oil and gas development and explained some of the mitigation measures. Confirmed that they had added them to the list of Relevant Persons for further communications.
GP3	14/08/2023	02:10 PM	E011	Email	14/8/2023 2:11PM	Email	Bounce back email for the email address used	NA	NA	NA
GP3	14/08/2023	03:39 PM	E011	Email	NA	NA	NA	NA	NA	CGG re-sent the consultation information to the corrected email address
GP3	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
GP3	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
GP3	19/04/2024	8:30AM	E018	Email						
GP3	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
GP3	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
GP4	26/06/2023	02:41 PM	E010	Email	NA	NA	NA	NA	NA	CGG provided the relevant person with the consultation material and noted their specific concerns regarding ongoing oil and gas development and explained some of the mitigation measures. Confirmed that they had added them to the list of Relevant Persons for further communications.
GP4	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
GP4	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
GP4	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
GP4	19/04/2024	8:30AM	E018	Email						
GP4	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
GP4	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Indigenous Land and Sea Corporation (ILSC)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Indigenous Land and Sea Corporation (ILSC)	31/07/2023	02:34 PM	Follow up	Phone	NA	Phone	No answer	NA	NA	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project.
Indigenous Land and Sea Corporation (ILSC)	14/08/2023	02:10 PM	E011	Email	14/7/2023 2:11PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	NA
Indigenous Land and Sea Corporation (ILSC)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Indigenous Land and Sea Corporation (ILSC)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	No objections or claims.	NA	
Indigenous Land and Sea Corporation (ILSC)	24/06/2025	5:16PM	E021	Email	NA	NA	NA	NA	NA	NA
Indigenous Land and Sea Corporation (ILSC)	26/08/2025	3:28PM	E024	Email	NA	NA	NA	NA	NA	NA
INPEX Browse E&P Pty Ltd	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
INPEX Browse E&P Pty Ltd	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
INPEX Browse E&P Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
INPEX Browse E&P Pty Ltd	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	No objections or claims	NA	
INPEX Browse E&P Pty Ltd	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
INPEX Browse E&P Pty Ltd	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
KAI NOMINEES PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
KAI NOMINEES PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
KAI NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
KAI NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
KAI NOMINEES PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
KAI NOMINEES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
KAI NOMINEES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Karajarri Rangers	16/06/2023	12:22 PM	Initial phone call	Phone	NA	Phone	No answer	NA	NA	CGG attempted to call, no answer so CGG left a voice message with details of the project and the trip to Broome/Port Hedland.
Karajarri Rangers	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Karajarri Rangers	17/08/2023	10:57 AM	Follow up	Phone	NA	Phone	No answer	NA	NA	No answer, left a message. Called to say in Broome until next Friday and left contact details for the person in Broome.
Karajarri Rangers	24/08/2023	10:13 AM	Follow up	Phone	NA	Phone	No answer	NA	NA	No answer, left a message. Called to say in Broome until tomorrow and left contact details for the person in Broome.
Karajarri Rangers	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Karajarri Rangers	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Karajarri Rangers	19/04/2024	8:30AM	E018	Email						
Karajarri Rangers	24/06/2025	5:19PM	E021	Email	NA	NA	NA	NA	NA	NA
Karajarri Rangers	9/07/2025	3:58PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the Karajarri Rangers and left a voicemail message describing the project and noting that CGG is currently conducting consultation on the project. Stated that CGG were calling to confirm whether they had received the consultation material, and find out if they had any concerns or queries. Also noted that CGG wanted to check if there was a better way to get in contact with them.
Karajarri Rangers	26/08/2025	3:30PM	E024	Email	NA	NA	NA	NA	NA	NA
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	16/06/2023	12:20 PM	Follow up call	Phone	NA	Phone	No answer	NA	NA	CGG called the KTLA, there was no answer so CGG left a voice message with details of the project and the trip to Broome/Port Hedland
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	21/06/2023	03:00 PM	Discussion	In-person	NA	In-person	The receptionist agreed to pass on the consultation information to management and rangers. Mentioned that CGG may be able to discuss the survey at an upcoming internal meeting over the next couple of days.	No objections or claims.	NA	CGG visited the Karajarri Traditional Lands Association office and spoke to the receptionist. CGG introduced themselves and provided the KTLA with the seismic survey information brochure. CGG explained the project to the

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										receptionist and noted that CGG would like to understand if the KTLA had any concerns or comments on the survey.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	23/06/2023	10:30 AM	Discussion	In-person	NA	In-person	CGG spoke with the KTLA Land and Sea manager, Senior Projects Manager and CEO. 1) The KTLA Land and Sea Manager stated that they weren't worried about the survey given it was short term and a long way offshore, with unlikely risk of fuel spill, and so said that CGG should highlight these aspects in an email to the KTLA. 2) The KTLA did not identify any cultural or spiritual values/features. 3) The KTLA explained that the Karajarri and Nyangumata areas bordered each other along 80 mile beach and to speak to the YMAC IPA manager. Provided a number of KTLA member contact details to include in the email. 4) The KTLA noted that they simply didn't have the resources to put towards discussions with O&G companies but also understood the need to have this consultation. They said the best thing would be for CGG to send through an email with a brief description of the survey and what CGG wants from them so that they could consider this. The KTLA noted that the current consultation process is difficult for O&G and indigenous groups, and doesn't see the point for surveys such as the Sauropod MSS.	The KTLA requested the information be sent through via email and provided contact details of a number of additional relevant persons. The KTLA did not make any objections or claims.	CGG provided the project information via email, and is already in discussion with the YMAC IPA coordinator.	CGG visited the KTLA office again to see if any additional members were free to discuss the project. CGG spoke to the Land and Sea Manager, introducing themselves and providing the stakeholder slide pdf. During the discussion, they were joined by · the Senior Projects Manager and CEO who we were also introduced to and briefed on the survey. 1) CGG discussed the project using the slide pdf as a guide, focusing on how the survey would be undertaken and potential impacts from the survey on FN cultural and spiritual values/features. 2) CGG said that we were interested in understanding if the KTLA had any concerns or comments on the survey, including if there were any cultural or spiritual values/features associated with the ancient coastline where the survey would occur or waters closer to the 80 Mile Beach and coast south of Broome where the EMBA might overlap. 3) CGG enquired as to whether there were any other relevant persons that the KTLA knew of that CGG should contact. 4) CGG asked if they could have opportunity to discuss the survey more formally during a dedicated meeting. CGG offered to recompense them for their time in considering our request and for attending the meeting.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	27/06/2023	04:36 AM	Follow up email	Email	NA	NA	NA	NA	NA	CGG contacted a number of members of the KTLA to thank them for the opportunity to talk the previous week. Provided more details of the project and the potential impacts. CGG noted that it is important to them to understand any concerns that the KTLA may have about the survey so that these can be addressed in an appropriate manner. CGG enquired into the

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										availability of the KTLA for a teams meeting to discuss any concerns of the group.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	3/08/2023	03:30 PM	Follow up	Phone	NA	Phone	The relevant person said they are aware of the project and have received the consultation materials. Informed CGG that there is a Directors Meeting coming up on the 17th & 18th of August and they could try find a slot for CGG if CGG is wanting to speak to the organisation. Stated that they would call CGG back once they had more information.	No objections or claims.	NA	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project. CGG informed them of the dates of the upcoming Broome trip and that a representative would be available if the KTLA would like to meet and discuss the project.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	7/08/2023	12:28 PM	Follow up	Phone	NA	Phone	The KTLA confirmed that CGGs interest had been sent to the appropriate people, and that the Acting CEO was intending to call but had evidently not yet done so. The receptionist noted that they would follow up. The receptionist clarified the dates and schedule of the meeting for CGG. The receptionist asked for more detail on the project, specifically whether this activity is going to go ahead no matter what. The receptionist noted that they were creating the schedule for the meetings now, and it was in their hands to determine if CGG will be given any time.	No objections or claims.	NA	CGG called the KTLA as they had not heard back regarding the Directors Meeting. Checked on clarification of the dates, and as to whether there was any more information on the schedule and if CGG could have a slot. When the KTLA receptionist asked for more detail on whether the activity going to go ahead no matter what, CGG explained that the activity is currently only a proposal, and explained the process of EP development, consultation and submission to NOPSEMA for approval. CGG explained that the consultation phase is designed to talk with people that may be affected to learn if there are any concerns relating to the activity and to understand the affect it might have on sensitivities and values.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Karajarri Traditional Lands Association (Aboriginal	15/01/2024	09:42 AM	Follow up	Phone call	15/01/2024	Phone	Reception will need to check with the board if they require a meeting to discuss the activity further. If CGG sends an email with the query they wil get back	No objections or claims. Request for written follow up of this conversation.	NA	Noted CGG had Visited the Broome office in June 2023. KTLC had Stated in June that the KTLA does not have any concerns about the survey.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation) RNTBC							in a few days. Can you please email this query through. We don't need anything else at this stage.			CGG understands the stretch on your time. There has been previous discussion about having a formal meeting. Does the KTLA require a formal meeting to discuss the potential impacts of the survy on your functions, interests or activities? Or have you been provided sufficient information? Is there anything else the KTLA requires from CGG?
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	16/01/2024	11:30 AM	Follow up	Email	NA	NA	NA	NA	NA	During our visit to Broome in June 2023, where we presented the details of the activity and any potential impacts of the activity on your organisation's functions, interests or activities, the Land and Sea manager stated that the KTLA did not have any concerns regarding the survey. Does the KTLA require a formal meeting to further discuss the potential impacts of the survey on your functions, interests or activities? please let us know if you: • Have any preference on how we contact you in the future. • Need anything further from us to assist you with comments you might wish to make. • Are aware of any other relevant parties who may be affected by the survey. • Are aware of any people, who in accordance with Indigenous tradition, may have spiritual and cultural connections to the environment that may be affected by the activity that have not yet been afforded the opportunity to provide information that may inform the management of the activity • Have any information you wish to provide on cultural features and/or heritage values within the activity area.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	19/01/2024	12:30 AM	Follow up	Phone	19/01/2024	Phone	No answer	NA	NA	Left a message for call back.
Karajarri Traditional Lands Association	23/01/2024	09:43 AM	Follow up	Phone	23/01/2024	Phone	No answer	NA	NA	Left a message for call back.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
(Aboriginal Corporation) RNTBC										
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	25/01/2024	11:30 AM	Follow up	Phone	25/01/2024	Phone	No answer	NA	NA	Left a message for call back.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	29/01/2024	10:30 AM	Follow up	Phone	29/01/2024	Phone	The CEO is in the office tomorrow, they will call during the day. A meeting invite is not required.	NA	NA	CGG has been trying to get in touch with some people to talk about the Sauropod marine surevy. Can we send a meeting invite to speak with the CEO tomorrow? Provided phone number to call.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	30/01/2024	04:00 PM	Follow up	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Any objections or claims raised will be managed as per the process outlined in the EP.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	19/04/2024	8:30AM	E018	Email						
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	24/06/2025	5:19PM	E021	Email	NA	NA	NA	NA	NA	NA
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	9/07/2025	4:10PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the Karajarri Traditional Lands Association and left a voicemail message describing the project and noting that CGG is currently conducting consultation on the project. Stated that CGG were calling to confirm whether they had received the consultation material, and find out if they had any concerns or queries. Also noted that CGG wanted to check if there was a better way to get in contact with them.
Karajarri Traditional Lands Association (Aboriginal Corporation) RNTBC	26/08/2025	3:32PM	E024	Email	NA	NA	NA	NA	NA	NA
Kariyarra Aboriginal Corporation	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Kariyarra Aboriginal Corporation	16/06/2023	12:46 PM	Initial phone call	Phone	NA	Phone	No answer	NA	NA	CGG to call, no answer and no voicemail machine
Kariyarra Aboriginal Corporation	19/06/2023	9:00 AM?	Visit to Port Hedland Office	In person	NA	In person	In-person visit to the South Hedland office of the Kariyarra Aboriginal Corporation. Spoke to the Chief Financial Officer who explained that the KAC had recently opened a second office in Port Hedland and we needed to go there to speak to their Heritage and Environmental group. The CFO also showed a map of their Country including Sea Country which indicated a minor overlap with the EMBA. Stated that they were only just getting started with Sea Country related activities.	No objections or claims.	NA	CGG visited the South Hedland office and left a copy of the Sauropod MSS Activity Information brochure and the Community Consultation flyer. CGG made plans to meet with the Heritage and Environmental group.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Kariyarra Aboriginal Corporation	20/06/2023	11:30 AM	Discussion	In-person	NA	In-person	Met with a member of the KAC Heritage and Environmental group. They agreed that the EMBA was unlikely to overlap significantly with their sea country, but would send through coordinates to confirm. (Note that these coordinates were never recieved). Also noted that they will send the contact details of the Perth based heritage officer. Expressed their appreciation for the visit and interest. Noted they would passion the information to the Sea Rangers and attend the drop in session that evening.	No objections or claims.	CGG will send a follow up request to the KAC representative for the coordinated and contact details of the Perth member if they do not send them through after the meeting.	CGG attended a meeting with a member of the KAC Heritage and Environmental group. Discussed any potential overlap of their sea country with the project area.
Kariyarra Aboriginal Corporation	5/07/2023	11:30 AM	Follow up email	NA	NA	NA	Bounce back email	No objections or claims.	NA	CGG emailed the relevant person to thank them for the talk in Port Hedland, to request that the survey be formally considered by the Kariyarra AC and any concerns provided to CGG. CGG also proposed a teams meeting to discuss their concerns. CGG provided the consultation material.
Kariyarra Aboriginal Corporation	5/07/2023	08:27 PM	Follow up email	Email	5/7/2023 8:28PM	Email	Bounce back email for both addresses	No objections or claims.	NA	CGG sent a follow up email to thank the Kariyarra AC for the discussion in Broome and to provide further information on the project. CGG also enquired as to whether the relevant person would be available for a teams meeting to discuss it further.
Kariyarra Aboriginal Corporation	7/07/2023	04:43 PM	Follow up email	Email	7/7/2023 4:43PM	Email	Bounce back email for one of the two addresses	No objections or claims.	NA	CGG resent the email
Kariyarra Aboriginal Corporation	3/08/2023	03:49 PM	Follow up	Phone	NA	Phone	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project. KAC asked CGG to explain the project in more detail, which CGG did. CGG noted the dates of their upcoming August Broome trip, and the KAC representative recommended they contact the Heritage and Environment staff member as they would be the appropriate person to speak to.	No objections or claims.	NA	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project. KAC asked CGG to explain the project in more detail, which CGG did. CGG noted the dates of their upcoming August Broome trip, and the KAC representative recommended they contact the Heritage and Environment staff member as they would be the appropriate person to speak to.
Kariyarra Aboriginal Corporation	3/08/2023	04:08 PM	Follow up	Phone	NA	Phone	CGG called the Heritage and Environment staff member of KAC. They said they had just arrived back in Perth and could not talk but asked for CGG to	No objections or claims.	NA	CGG called the Heritage and Environment staff member of KAC. They said they had just arrived back in Perth and could not talk but asked for CGG to

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							send them their contact number so KAC could call back tomorrow.			send them their contact number so KAC could call back tomorrow.
Kariyarra Aboriginal Corporation	3/08/2023	06:07 PM	Follow up	Text message	3/8/2023 6:23PM	Text message	The Heritage and Environment staff member of KAC thanked CGG and said they would call tomorrow.	No objections or claims.	NA	CGG texted the Heritage and Environment staff member of KAC to provide their best contact number.
Kariyarra Aboriginal Corporation	14/08/2023	02:10 PM	E011	Email	14/8/2023 2:10PM	Email	Bounce back email for one of the Kariyarra AC email addresses used.	No objections or claims.	NA	NA
Kariyarra Aboriginal Corporation	14/08/2023	03:39 PM	E011	Email	NA	NA	NA	NA	NA	CGG resent the consultation information to the corrected email address
Kariyarra Aboriginal Corporation	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Kariyarra Aboriginal Corporation	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Email thanking for the information	No objections or claims	NA	NA
Kariyarra Aboriginal Corporation	24/06/2025	5:22PM	E021	Email	24/06/2025	Email	Automatic reply from one of the addresses stating they no longer work at YMAC and providing an alternative email address.	No objections or claims	NA	CGG removed the contact from the register. CGG already had the alternative contact, who was included it in the initial E021 email on 24/06/2025.
Kariyarra Aboriginal Corporation	9/07/2025	4:14PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the KAC office number, with no answer. CGG then called the mobile number for another KAC contact and left a voicemail stating CGG are proposing a seismic survey offshore from Port Hedland and are conducting consultation. Stated that CGG had previously spoken with KAC a few years ago, which is when the contact provided their number, and that CGG were just updating the date of the survey and are getting in touch to see if anyone had any new queries or concerns. CGG requested a call back when they get a chance.
Kariyarra Aboriginal Corporation	26/08/2025	5:08PM	E024	Email	NA	NA	NA	NA	NA	NA
KFM LEASING PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
KFM LEASING PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
KFM LEASING PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
KFM LEASING PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
KFM LEASING PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
KFM LEASING PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Kimberley Boat Cruises	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Kimberley Boat Cruises	28/07/2023	12:49 PM	Follow up	Phone	NA	Phone	The relevant person said they are a booking agency not an operator. Their concerns are from a tourism perspective - don't know how it would affect what they're doing, might block people from going out there. the relevant person provided their direct email and requested the information be resent so that they could consider it more closely. Stated that the survey will be outside the peak tourism season but is concerned about more general impacts on whale migration and wildlife and general by oil and gas industry activities.	The following claims/objections are merited due to Kimberley BoatCruises's function as a booking agency: 1) displacement of other marine users during the survey period 2) concerned about general impacts on whale migration and wildlife 3) concerned about impacts from oil and gas in general.	No additional control measures are proposed to be adopted in respose to these objections or claims, as the current controls in the EP manage impacts to whales, marine wildlife and other users in general to an acceptable and ALARP level. Impacts to the environment from oil and gas in general cannot be managed by CGG and CGG will not respond on this point.	CGG called the relevant person to confirm that they had received the information and check if they wanted to discuss the project. CGG will resend the consultation information as requested.
Kimberley Boat Cruises	28/07/2023	01:21 PM	Follow up email	Email	NA	NA	NA	NA	NA	CGG resent the consultation information as requested by the relevant person
Kimberley Boat Cruises	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Kimberley Boat Cruises	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Kimberley Boat Cruises	19/04/2024	8:30AM	E018	Email						
Kimberley Boat Cruises	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Kimberley Boat Cruises	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Kimberley Land Council (KLC)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Kimberley Land Council (KLC)	6/06/2023	11:01 AM	Follow up email	Email	NA	NA	NA	NA	NA	CGG emailed the executive assistant providing updated dates that CGG will be visiting Port Hedland and Broome (19-23 June) and requested details on the availability of the executive team.
Kimberley Land Council (KLC)	6/06/2023	10:28 AM	Initial phone call	Phone	6/06/2023 10:28am	Phone	KLC confirmed that they had received the consultation information and advised that CGG should contact the executive assistant and	No objections or claims.	NA	CGG confirmed whether KLC had received the Invitation to Consultation letter sent the previous Friday, and inquired as to whether KLC representatives

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							provided the email address. Also advised that it is their first day and so it is unlikely they would reply that day. KLC also advised that most companies are emailing the PBC's directly and that this is the method they would recommend to CGG for contacting each of the Native Title RNTBCs.			would have any availability the following week as CGG was planning to visit Broome to discuss the project. CGG will contact the executive assistant by email as per the recommendation by the KLC receptionist.
Kimberley Land Council (KLC)	6/06/2023	10:56 AM	Inquiry of availability	Email	NA	NA	NA	NA	NA	CGG emailed the executive assistant requesting details of the availability of the executive team in the coming weeks.
Kimberley Land Council (KLC)	8/06/2023	11:20 AM	Follow up call	Phone	NA	Phone	CGG was forwarded to the executive assistant who said that the CEO may be in Kununurra that week but said she would confirm and call back.	No objections or claims.	NA	CGG called the KLC to follow up about receiving information on the availability of the executive team for a meeting when CGG visits Broome. CGG confirmed the new dates for the visit, 19th June - 23rd June. CGG to await confirmation of availability.
Kimberley Land Council (KLC)	12/06/2023	01:47 PM	Follow up call	Phone	12/6/2023 2:30PM	Phone	KLC executive assistant did not answer the initial call from CGG but tried to call back later and left a voice message. CGG then tried to return that call but the line was engaged.	No objections or claims.	NA	CGG called the KLC executive assistant, no answer so left a message reiterating the dates of the visit.
Kimberley Land Council (KLC)	14/06/2023	03:31 PM	Inquiry of availability	Email	14/6/2023 9:38AM	Email	KLC executive assistant emailed to advise that unfortunately their CEO and DCEO are unable to attend this meeting as they have other commitments they are travelling for on that week. Follow up email minutes later to say KLC executive assistant emailed to advise that unfortunately their CEO and DCEO are unable to attend this meeting as they have other commitments they are travelling for on that week. Requested that CGG resend the consultation letter.	No objections or claims.	CGG will continue to stay in contact with the KLC to see if alternative arrangements can be made during the July visit.	CGG responded to thank them for the update, and to say that they will stay in touch as there is another trip being planned for July. CGG resent the consultation documentation.
Kimberley Land Council (KLC)	14/06/2023	04:07 PM	Inquiry of availability	Email	14/6/2023 9:27AM	Email	KLC executive assistant emailed to confirm that they were aware of the new dates of the visit, stating that they would be able to confirm by 16 June if a meeting is possible. Requested the consultation material be re-sent. KLC thanked CGG for resending the information and noted that both the CEO and DCEO have full diaries for July so to please let them know when the dates	No objections or claims.	CGG will inform KLC once they are aware of what dates they will be visiting Broome in July	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							are known so that they can lock in a meeting			
Kimberley Land Council (KLC)	16/06/2023	03:21 PM	Inquiry of availability	Email	19/6/2023 8:37AM	Email	The KLC responded to thank CGG	No objections or claims.	NA	CGG responded to the KLC to thank them for confirming their availability. Informed the KLC that they understand that given how busy the Executive Team is, an in-person meeting might not be the most suitable method for the KLC, and to please let CGG know if there is a method of communication that would better suit them, for example an online meeting. CGG also noted that there may be other non-executive members of the KLC that might want to meet, such as the LAND and Sea Unit Manager, and asked if the EA could please pass on the information and invitation for a meeting on to these members.
Kimberley Land Council (KLC)	20/06/2023	PM	Availability enquiry	Website message system	NA	NA	No answer.	NA	NA	CGG sent a message to the KLC in Broome via their website to say they would like to meet up to discuss the CGG survey and overlap with Sea Country.
Kimberley Land Council (KLC)	21/06/2023	AM	Discussion	In-person	NA	In-person	KLC informed CGG that the Land and Sea Manager was out of office. The Media Officer stated that they would get in touch after they have talked to their lawyer about meeting up. The Executive Assistant also suggested talking to the Karajarri AC.	No objections or claims.	NA	CGG visited the KLC Broome office. KLC informed them that the Land and Sea Manager was out of office. The Media Officer stated that they would get in touch after they have talked to their lawyer about meeting up. The Executive Assistant also suggested talking to the Karajarri AC.
Kimberley Land Council (KLC)	22/06/2023	11:00 AM	Discussion	In-person	NA	In-person	KLC informed CGG that they were taking a good approach to consultation, and that the only additional approach might be to request that a discussion of the survey and any concerns be put on the next meeting agenda as it is usually a group discussion rather than each individual providing comment. Also noted that CGG should continue contact PBC's directly as they have varying and changing levels of association with the KLC. Recommended CGG meet with the KLC board of directors.	No objections or claims.	CGG to: a) request that the topic of the survey and any associated concerns be put on the next meeting agenda b) continue contacting the PBC's directly c) try to coordinate a meeting with the KLC board of directors	CGG visited the KLC Broome office and had a discussion with the receptionist about the most effective way to communicate with the KLC and other local groups.
Kimberley Land Council (KLC)	28/06/2023	06:25 PM	Follow up email	Email	NA	NA	NA	NA	NA	CGG contacted the KLC to request that the survey be formally considered by the KLC and any concerns provided to CGG. CGG also proposed a

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										teams meeting with the executive team. CGG provided the consultation material.
Kimberley Land Council (KLC)	24/07/2023	09:47 AM	Follow up	Email	5/7/2023 6:16PM	Email	The KLC executive assistant contacted CGG to enquire into any progress on confirming the July Broome trip dates.	No objections or claims.	NA	CGG responded to update the KLC. CGG explained that the July trip was no longer taking place, and that a representative would instead be in Broome from 14 - 25 August. CGG stated they would be happy to meet with the CEO & DCEO of the KLC during those weeks.
Kimberley Land Council (KLC)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Kimberley Land Council (KLC)	17/08/2023	11:09 AM	Follow up	Phone	NA	Phone	Have received the email from Monday. Will call back if the CEO and DCEO with to meet up. There is no better email to send to than the one we already have.	No objections or claims.	NA	Called to say that CGG are in Broome until next Friday. Request confirmation that they received the letter from Monday. Are available to meet if they wish. Is there a better email address to contact than the one we are using?
Kimberley Land Council (KLC)	22/08/2023	09:59 AM	Follow up	Phone	NA	Phone	Thanks for providing the recent documents. Know was hoping to meet while in town but unavailable. Is keen to make contact, however doesn't have time at the time right now. No, many thanks for asking, nothing we can do to facilitate consultation for them, if they need anything further they will be in touch.	No objections or claims.	NA	Many thanks for taking the time to get in touch, completely understand the pressure of consultation they are currently under. Asked if there was anything that we could do to facilitate consultation with them.
Kimberley Land Council (KLC)	22/08/2023	08:57 AM	NA	NA	22/08/2023 8:57AM	Phone	Please give a call back.	No objections or claims.	NA	NA
Kimberley Land Council (KLC)	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Kimberley Land Council (KLC)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Kimberley Land Council (KLC)	19/04/2024	8:30AM	E018	Email	30/04/2024	Email	We have received two emails, can you please confirm who the intended recipients are?	No objections or claims, request for more information	NA	One email was for the KLC, the other was for the Nyangumarta Karajarri PBC, however we have no other contact email for them, can you please provide a better contact if you have it
Kimberley Land Council (KLC)	24/06/2025	5:43PM	E021	Email	NA	NA	NA	NA	NA	NA
Kimberley Land Council (KLC)	14/07/2025	5:40PM	Initial phone call	Phone call	NA	Phone	The KLC contact confirmed the contact address was correct, and suggested the most appropriate way to consult KLC was to send the information to an executive assistant email address (which CGG already has). For other PCBs, CGG should send to the KLC legal secretary email address (which CGG already has), who acts as the support contact for other aboriginal corporations. At CGG's request, they forwarded the call to a relevant contact for Nyangumarta Karajarri Aboriginal Corporation as they have the KLC number listed.	No objections or claims.	NA	CGG called KLC and asked to confirm their contact address, if they had recieved the consultation information, and if this was the most appropriate way to consult with the KLC. CGG also asked if the contact could forward us to a relevant contact for the Nyangumarta Karajarri Aboriginal Corporation as they have the KLC number listed.
Kimberley Land Council (KLC)	26/08/2025	3:39PM	E024	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Kimberley Marine Tourism Association	8/06/2023	04:04 PM	E010	Email	NA	NA	No response	NA	NA	CGG sent a follow up email following the phone calls to provide Kimberley Marine Tourism Association with the consultation material and requested they distribute it to their member base. Noted that a CGG representative would be in Broome the week of the 19th July (corrected to 19th June in a follow up email at 4:27PM) and will be available to meet.
Kimberley Marine Tourism Association	8/06/2023	03:15 PM	Inquiry of availability	Phone	NA	Phone	No answer.	NA	NA	Not able to leave a message. CGG will try the other contact numbers provided on the website.
Kimberley Marine Tourism Association	8/06/2023	03:40 PM	Inquiry of availability	Phone	NA	Phone	No longer the chairman, please contact the current chairman	No objections or claims.	NA	CGG will call the current chairman
Kimberley Marine Tourism Association	8/06/2023	03:43 PM	Inquiry of availability	Phone	NA	Phone	Please send the activity letter Committee is getting together next week, will raise at the meeting if anyone has concerns. Chairman is ex-oil ad gas industry and understands that a survey 50km off the Rowley's would not have impacts that their members or committee would be concerned about, but will raise with the committee anyway. Can distribute to the member base and let them know CGG will be in town.	No objections or claims.	NA	CGG will send the activity letter to the association email address.
Kimberley Marine Tourism Association	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Kimberley Marine Tourism Association	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Kimberley Marine Tourism Association	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Kimberley Marine Tourism Association	19/04/2024	8:30AM	E018	Email						
Kimberley Marine Tourism Association	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Kimberley Marine Tourism Association	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Kunin (Native Title) Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Kunin (Native Title) Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Kunin (Native Title) Aboriginal Corporation RNTBC	17/08/2023	11:28 AM	Follow up	Phone	NA	Phone	No answer.	NA	NA	Trying to get in contact regarding the sauropod mss proposed activity near the Rowley shoals. In Broome until next Friday. Please give us a call if you would like to meet (provided phone number).

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Kunin (Native Title) Aboriginal Corporation RNTBC	24/08/2023	11:15 AM	Follow up	In person	NA	In person	NA	NA	NA	Went to physical address, no-one there.
Kunin (Native Title) Aboriginal Corporation RNTBC	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Kunin (Native Title) Aboriginal Corporation RNTBC	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Kunin (Native Title) Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Kunin (Native Title) Aboriginal Corporation RNTBC	24/06/2025	5:46PM	E021	Email	NA	NA	NA	NA	NA	NA
Kunin (Native Title) Aboriginal Corporation RNTBC	9/07/2025	4:22PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the office contact number for Kunin AC, with no answer. Voicemail was full so no couldn't leave a message.
Kunin (Native Title) Aboriginal Corporation RNTBC	26/08/2025	3:43PM	E024	Email	NA	NA	NA	NA	NA	NA
LENDEN NOMINEES PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
LENDEN NOMINEES PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
LENDEN NOMINEES PTY LTD	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
LENDEN NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
LENDEN NOMINEES PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
LENDEN NOMINEES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
LENDEN NOMINEES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply stating they are out of office and providing a generic email if the matter is urgent.	No objections or claims.	CGG to send E010 to the generic email address provided	NA
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	27/06/2023	04:26 PM	E010	Email	NA	NA	NA	NA	NA	CGG resent the consultation information to the generic email address, as well as resending to the original one.
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	31/07/2023	02:45 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG attempted to call the relevant person to confirm that they had received the consultation information and to check if they wanted to discuss the project. No answer.
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	11/01/2024	8:10PM	E017	Email	11/01/23 8:10PM	Email	Autoreply stating their office days and providing a generic email if the matter is urgent.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply stating their office days and providing a generic email if the matter is urgent.	No objections or claims.	NA	
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	No response
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	26/08/2025	3:20PM	E023	Email	26/8/2025 3:20PM	Email	Autoreply stating out of office and providing a generic email if the matter is urgent.	No objections or claims	NA	No response
M G KAILIS PTY. LTD.; MG KAILIS PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Marine Tourism Association of Western Australia	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Marine Tourism Association of Western Australia	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Marine Tourism WA	19/04/2024	8:30AM	E018	Email						
Marine Tourism WA	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Marine Tourism WA	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
National Indigenous Australians Agency	19/04/2024	8:30AM	E018	Email						
National Indigenous Australians Agency (NIAA)	5/07/2023	08:34 PM	E010	Email	NA	NA	NA	NA	NA	CGG provided the relevant person with the consultation material and provided detailed information on the project.
National Indigenous Australians Agency (NIAA)	31/07/2023	02:49 PM	Follow up	Phone	NA	Phone	The relevant person forwarded the information on to a number of additional relevant people in the organisation.	No objections or claims.	NA	CGG called the relevant person to confirm that they had received the consultation information and to check if they wanted to discuss the project. the relevant person informed CGG that the email address CGG has is a mailbox that doesn't go anywhere. However, they did forward it at the time to

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										the relevant person. NIAA asked if CGG has anyone based in Broome, and CGG stated that they are based in Perth but have someone visiting mid-late August and can organise a meet up. NIAA representative stated they will forward the information to a number of personnel who are based in Broome with the dates of the August trip. Stated that the role of NIAA is mostly to provide funding to the KLC and others, but that its good for them to know what's happening.
National Indigenous Australians Agency (NIAA)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
National Indigenous Australians Agency (NIAA)	15/08/2023	03:28 PM	Follow up	Phone	NA	Phone	Confirmed has received the most recent email update. Asked if CGG had contacted the local volunteer sea rescue group. Stated would forward the relevant person notification to the volunteer sea rescue group.	No objections or claims.	NA	Advised that CGG are in Broome until next Friday. Advised that have not consulted with the volunteer sea rescue as the operational area is far distant from their normal area of operations, but would contact them if they are interested in the survey.
National Indigenous Australians Agency (NIAA)	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
National Indigenous Australians Agency (NIAA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
National Indigenous Australians Agency	24/06/2025	5:48PM	E021	Email	NA	NA	NA	NA	NA	NA
National Indigenous Australians Agency	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
National Native Title Tribunal (NNTT)	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:30PM	Email	Autoreply noting the receipt of the email and stating that an appropriate team at the NNTT will respond.	No objections or claims.	NA	NA
National Native Title Tribunal (NNTT)	31/07/2023	03:22 PM	Follow up	Phone	NA	Phone	The relevant person will resend the information to the correct person.	No objections or claims.	NA	CGG called the relevant person to confirm that they had received the consultation information and to check if they wanted to discuss the project. the relevant person informed CGG that the person who would normally respond is on leave and so they will follow up with the acting personal. Stated that normally the NNTT replies to things like this within a week.
National Native Title Tribunal (NNTT)	1/08/2023	06:04 PM	Follow up	Email	1/8/2023 8:26AM	Email	The NNTT emailed CGG to state that they have no comment to make on this seismic survey. Noted that if CGG would like the NNTT to conduct a survey of native title matters please complete a geospatial search request form.	No objections or claims.	NA	CGG responded to thank NNTT for their response.
National Native Title Tribunal (NNTT)	14/08/2023	02:10 PM	E011	Email	14/7/2023 2:11PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
National Native Title Tribunal (NNTT)	11/01/2024	8:10PM	E017	Email	11/01/23 8:10PM	Email	Autoreply and acknowledgement of receipt. Another autoreply from an additional contact email stated that that representative was no longer working for the NNTT.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
National Native Title Tribunal (NNTT)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Automatic reply: Email will be forwarded to most appropriate team	No objections or claims.	NA	No response
National Native Title Tribunal (NNTT)	24/06/2025	3:08PM	E020	Email	24/06/2024 1:08PM	Email	Automatic reply: email will be forwarded to most appropriate team	No objections or claims.	NA	No response
National Native Title Tribunal (NNTT)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Automatic reply: email will be forwarded to most appropriate team	No objections or claims.	NA	No response
National Offshore Petroleum Safety Environment Management	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Authority (NOPSEMA)										
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
NEWBEACH NOMINEES PTY LTD; NEWBEACH NOMINEES PTY LTD & SAKAN PTY LTD; SAKAN PTY LTD; SAKAN PTY LTD & NEWBEACH NOMINEES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Ngarluma Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Ngarluma Aboriginal Corporation RNTBC	16/06/2023	12:45 PM	Initial phone call	Phone	NA	Phone	NA	NA	NA	CGG to call, no answer and no voicemail machine
Ngarluma Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Ngarluma Aboriginal	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation RNTBC										and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Ngarluma Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Ngarluma Aboriginal Corporation RNTBC	24/06/2025	5:50PM	E021	Email	NA	NA	NA	NA	NA	NA
Ngarluma Aboriginal Corporation RNTBC	9/07/2025	4:25PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the office contact number for Ngarluma AC, with no answer. A pre-recorded message plays and then hangs up. No voicemail option so couldn't leave a message.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Ngarluma Aboriginal Corporation RNTBC	26/08/2025	3:45PM	E024	Email	NA	NA	NA	NA	NA	NA
Ngarluma Aboriginal Corporation RNTBC	27/08/2025	4:32PM	Response	Email	26/8/2025 5:07PM	Email	NAC expressed interest in arranging an informational presentation by a NOPSEMA representative for the NAC Board and Ngarluma Elders to better understand marine seismic surveys. This aims to support Ngarluma in making informed decisions about cultural heritage values potentially affected by offshore seismic activities. The primary concerns include impacts on animal migration routes and habitats of totemic species due to seismic noise and possible hydrocarbon spills. Additionally, NAC requested that CGG engage Ngarluma Elders in an ethnographic ecological consultation to provide detailed information on environmental impacts and to review project area maps.	The following claims are merited: 1) Primary NAC concerns include impacts on animal migration routes and habitats of totemic species due to seismic noise and possible hydrocarbon spills. NAC also provided guidance and made several requests regarding how to consult with them.	No additional control measures adopted in response to this consultation with the NAC as the controls already adopted are considered adequate to reduce impacts to ALARP and acceptable. 1) EP includes a risk assessment of potential impacts on marine fauna species, including marine mammals, turtles and fish, that has been informed by underwater noise and oil spill modelling. EP specifies a range of management measures to mitigate potential impacts from underwater noise and possible hydrocarbon spills. CGG is adopting NACs advice regarding how best to consult with them and this will be carried forward in ongoing consultation.	CGG thanked the NAC heritage team for their response and suggested that they reach out to NOPSEMA directly to discuss the possibility of a representative from the NOPSEMA delivering an informational presentation about marine seismic surveys to the NAC Board and Ngarluma Elders reference group. CGG provided NOPSEMA email and telephone contact details. CGG expressed that they are happy to pursue options for an ethnographic ecological consultation with the Ngarluma Elders. One option is an online presentation/meeting whereby representatives from CGG present detailed information on the survey and the potential impacts to marine animals and habitats, and maps of the project area can be reviewed and discussed. CGG asked if this was an appropriate method with which to consult the Ngarluma Elders. CGG offered to call and discuss further.
Ngarluma Aboriginal Corporation RNTBC	25/09/2025	2:54PM	Follow up	Email	16/09/2025 1:38PM	Email	NAC thanked CGG for their response and expressed that their preference would be for CGG to present in person, to allow the attending Ngarluma representatives an opportunity to ask questions and receive feedback directly. The NAC contact enquired about CGG's availability for a consultation in October or November at the NAC office in Karratha, and they can provide an agenda with key queries for CGG to prepare in advance.	No objections or claims.	NA	CGG thanked the NAC contact for their response and confirmed that a representative from CGG can travel to the NAC office and present in person, supported by a consultant via MS Teams. CGG requested some suggested times in October or November 2025 in order to plan the trip. CGG requested that the NAC representative contact them if they have any questions in the meantime.
Ngarluma Aboriginal Corporation RNTBC	30/10/2025	1:25PM	Follow up	Email	30/10/2025 1:25PM	Email	Automatic reply noting that one of the recipients was out of office and providing an alternative email address. CGG had already CC'd the alternative email address in the original	NA	NA	CGG followed up on the previous email to note that as mentioned, they are happy to travel to the NAC office in person to discuss the Sauropod seismic survey. If this is still of

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							email - no action required. No further response received.			interest, please feel free to suggest some dates that might fit, and CGG can work around that.
Nimanburr Aboriginal Corporation	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nimanburr Aboriginal Corporation	8/06/2023	04:41 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nimanburr Aboriginal Corporation	3/08/2023	04:18 PM	Follow up	Phone	NA	Phone	The KLC phone number is the contact number for the AC so CGG called the KLC and asked whether they were able to speak to a representative of the Nimanburr AC. The KLC said the representative person is busy but provided their email address.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. The KLC phone number is the contact number for the AC so CGG called the KLC and asked whether they were able to speak to a representative of the Nimanburr AC. The KLC said the representative person is busy but provided their email address.
Nimanburr Aboriginal Corporation	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Nimanburr Aboriginal Corporation	14/08/2023	04:10 PM	E011	Email	NA	NA	NA	NA	NA	CGG sent the consultation information to the new email address along with details of the current August trip to Broome.
Nimanburr Aboriginal Corporation	17/08/2023	11:09 AM	Follow up	Phone	NA	Phone	NA	NA	NA	See records for KLC
Nimanburr Aboriginal Corporation	17/08/2023	11:09 AM	Follow up	Phone	NA	Phone	NA	NA	NA	See record in KLC
Nimanburr Aboriginal Corporation	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Nimanburr Aboriginal Corporation	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Nimanburr Aboriginal Corporation	19/04/2024	8:30AM	E018	Email						
Nimanburr Aboriginal Corporation	24/06/2025	5:52PM	E021	Email	NA	NA	NA	NA	NA	NA
Nimanburr Aboriginal Corporation	14/07/2025	6:13PM	Initial phone call	Phone call	NA	Phone	While speaking to the KLC receptionist, CGG asked if they were able to forward me through to a relevant contact for the Nimanburr Aboriginal Corporation as they have the KLC number listed. They said the relevant contact works at the KLC and would try get in contact with them. CGG agreed to be put through to their voicemail.	No objections or claims.	NA	While speaking to the KLC receptionist, CGG asked if they were able to forward me through to a relevant contact for the Nimanburr Aboriginal Corporation as they have the KLC number listed. They said the relevant contact works at the KLC and would try get in contact with them. CGG agreed to be put through to their voicemail. CGG left a message explaining the project, and to check if they had received the consultation information and if this was still the most appropriate way to consult with the Nimanburr Aboriginal Corporation. CGG requested a

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										call or email back if they have any concerns or queries about the project.
Nimanburr Aboriginal Corporation	26/08/2025	4:51PM	E024	Email	NA	NA	NA	NA	NA	NA
North Star Cruises Australia Pty Ltd True North Adventure Cruise	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
North Star Cruises Australia Pty Ltd True North Adventure Cruise	8/06/2023	02:50 PM	Inquiry of availability	Phone	NA	Phone	They have received the letter, True North are not anywhere near the Rowley's between January and May, has no concerns, but would still like to receive email updates in case plans change. Does not want to meet up while CGG are in town.	No objections or claims.	CGG will continue to send activity updates to this relevant person.	Described the proposed activity and asked if received the consultation letter sent last week. CGG will continue to send activity updates to this relevant person.
North Star Cruises Australia Pty Ltd True North Adventure Cruise	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
North Star Cruises Australia Pty Ltd True North Adventure Cruise	18/08/2023	03:22 PM	Follow up	In person	NA	In person	Operations team have received email, not available to chat now.	No objections or claims.	NA	Enquired if the operations team were available discuss the proposed survey. Gave card and said in town till next week.
North Star Cruises Australia Pty Ltd True North Adventure Cruise	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
North Star Cruises Australia Pty Ltd True North Adventure Cruise	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
North Star Cruises Australia Pty Ltd True North Adventure Cruise	19/04/2024	8:30AM	E018	Email						
North Star Cruises Australia Pty Ltd True North Adventure Cruise	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
North Star Cruises Australia Pty Ltd True North Adventure Cruise	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	31/07/2023	03:38 PM	Follow up	Phone	NA	Phone	The relevant person confirmed that they had received the information but does not as yet have anything to say about it.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. the relevant person confirmed that they received the information, although provided a more updated email address. Stated that they have been forwarding on to the appropriate people but that if they haven't responded then they likely don't have anything to say.
NORTHERN WILDCATCH	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD										
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES	19/04/2024	8:30AM	E018	Email						

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
HOLDING COMPANY PTY LTD										
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	29/07/2025	3:15PM	Initial phone call	Phone call	NA	Phone	The receptionist confirmed the consultation information was forwarded to the director, who is the most appropriate contact person to discuss any questions or concerns about the project.	No objections or claims.	NA	CGG called the listed contact number and a receptionist answered, who confirmed they had received the consultation information and had forwarded it on to the director. CGG asked if they had any concerns or queries and were informed the director was the most appropriate contact person. CGG requested the receptionist inform the director of the call, and that CGG can be contacted via any of the means listed in the consultation letter.
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
NORTHERN WILDCATCH SEAFOOD AUSTRALIA PTY LTD; NDSF LICENCES HOLDING COMPANY PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Nyangumarta Karajarri Aboriginal	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation RNTBC										
Nyangumarta Karajarri Aboriginal Corporation RNTBC	8/06/2023	04:41 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Karajarri Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Karajarri Aboriginal Corporation RNTBC	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Nyangumarta Karajarri Aboriginal Corporation RNTBC	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Nyangumarta Karajarri Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email	2/05/2024	Email	Confirmation of reciept and confirmation of contact details.	No objections or claims	NA	Thank you for the confirmation
Nyangumarta Karajarri Aboriginal Corporation RNTBC	24/06/2025	5:54PM	E021	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Karajarri Aboriginal Corporation RNTBC	7/07/2025	8:31PM	Response	Email	7/07/2025 13:53PM	Email	The contact person for the Nyangumarta Karajarri AC (the Legal Secretary of the KLC) responded to CGG to confirm that they are the correct contact person for the corporation. They have forwarded the email to the directors of the corporation, and trust them to respond if/when in a position to do so. Responses can be delayed as the corporation does not employ any staff and has no office.	No objections or claims	NA	CGG replied to thank them for the update and for noting that further responses from the corporation could be delayed. CGG reiterated that if they have any questions or would like further information to please get in touch.
Nyangumarta Karajarri Aboriginal Corporation RNTBC	14/07/2025	5:55PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG left a voicemail for the KLC legal secretary, who is the contact for the NWAC provided by the KLC. The voicemail explainined the project and inquired whether the contact person had received the information and if this was still the appropriate consultation contact. CGG requested feedback on any concerns or queries regarding the project and asked for a callback or email response.
Nyangumarta Karajarri Aboriginal Corporation RNTBC	26/08/2025	5:12PM	E024	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Karajarri Aboriginal Corporation RNTBC	27/08/2025	3:52PM	Response	Email	27/8/2025 12:52PM	Email	The NKAC contact informed CGG that the recent E024 consultation email had been misdirected to the KLC's executive assistant, who had then forwarded the email to them. The contact person requested that CGG update their records to reflect that they	Request for contact details to be updated only.	CGG updated contact details for NKAC's current contact person.	CGG thanked the NKAC contact for confirming they have passed the consultation email onto the directors. CGG confirmed they will update their contact records to reflect the NKAC contact as the current contact person. CGG confirmed they will wait for

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							are the current contact person. The NKAC contact confirmed that they had have discharged their contact person duties by forwarding the consultation email to the directors, following which it is beyond their power to influence the timeframe of the response or actions and trust that the corporation will get back to CGG if and when in a position to do so. Note responses can be delayed given this corporation does not employ any staff and does not have an office. In addition, there may be limited access to emails/phones and other factors contributing to delay. Patience and understanding is appreciated.			a response from the directors and keep them updated as the survey continues to go through the planning and permitting process. CGG invited the contact to get in touch if they have any questions or require further information.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Warrarn Aboriginal Corporation RNTBC	16/06/2023	12:38 PM	Initial phone call	Phone	NA	Phone	The contact number was that of YMAC, so the YMAC staff member attempted to put CGG through to the General Manager of the Nyangumarta Warrarn AC. There was no answer so the YMAC staff member said they would pass on the information of the project and of the trip to Broome/Port Hedland and request that he call CGG.	No objections or claims.	NA	CGG called the Nyangumarta Warrarn AC to provide details of the project and of the trip to Broome/Port Hedland.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	3/08/2023	04:26 PM	Follow up	Phone	NA	Phone	The relevant person confirmed that they had received the information, and that they would get in touch with the CEO and Board.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. CGG spoke with the General manager, who said they had seen the information but asked CGG to elaborate. CGG explained the nature and location of the project. CGG asked if they would be interested in meeting up while CGG have a representative in Broome, and they stated that possibly the CEO and Board would be interested but they are based in Perth. CGG agreed to resend the consultation material along with the dates of the trip.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Nyangumarta Warrarn Aboriginal Corporation RNTBC	4/08/2023	05:13 PM	Follow up	Email	NA	NA	NA	NA	NA	CGG sent the consultation information to the new email address along with an invitation to talk with the Nyangumarta Warrarn Aboriginal Corporation in a way that suits them, including face to face in Broome or Perth or via a Teams/Zoom meeting.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Warrarn Aboriginal Corporation RNTBC	9/10/2023	04:03 PM	Follow up	Email	10/10/2023 8:11AM	Email	The relevant person responded to ask if there would be an information session happening during the visit.	No objections or claims.	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	10/10/2023	NA	Follow up	Phone	NA	Phone	NA	NA	NA	CGG called the relevant person to explain and discuss the project. CGG explained that they were not doing a public session, could meet one on one to explain the survey and answer any questions . The relevent person explained they were unable to meet on Tuesday afternoon or wednesday, so a face-to-face meeting wasn't possible. CGG directed them to the project website and sent them the latest stakeholder letter for information. CGG offered that once they had had a chance to review the information and talk further with the boss, CGG could arrange a Teams call to answer any remaining questions.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	10/10/2023	NA	Follow up	Email	NA	NA	NA	NA	NA	CGG sent a follow up email to thank them for their time on the phone and to send updated consultation information.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	10/10/2023	10:09: AM	NA	NA	10/10/2023	Voicemail	Can you please give me a call back?	No objections or claims.	NA	CGG will call the number provided.
Nyangumarta Warrarn Aboriginal	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation RNTBC										assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Nyangumarta Warrarn Aboriginal Corporation RNTBC	24/06/2025	6:00PM	E021	Email	24/06/2025 6:01PM	Email	Automatic reply stating that the email address is no longer in use and providing a new email address.	No objections or claims.	NA	CGG updated the email address in the contact register
Nyangumarta Warrarn Aboriginal Corporation RNTBC	24/06/2025	6:05PM	E021	Email	NA	NA	NA	NA	NA	CGG emailed the E021 consultation information to the alternate NWAC contact address provided.
Nyangumarta Warrarn	14/07/2025	5:40PM	Initial phone call	Phone call	NA	Phone	The YMAC contact transferred CGG to a contact for	No objections or claims.	NA	CGG called the listed contact for Nyangumarta Warrarn

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Aboriginal Corporation RNTBC							Nyangumarta Warrarn Aboriginal Corporation. CGG left a voicemail with this contact.			Aboriginal Corporation (a YMAC number), and asked to be transferred to a NWAC contact. CGG left a voicemail with the contact provided explaining the project and requesting a call back.
Nyangumarta Warrarn Aboriginal Corporation RNTBC	26/08/2025	5:16PM	E024	Email	NA	NA	NA	NA	NA	NA
Nyul Nyul PBC Aboriginal Corporation	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nyul Nyul PBC Aboriginal Corporation	8/06/2023	04:41 PM	E010	Email	NA	NA	NA	NA	NA	NA
Nyul Nyul PBC Aboriginal Corporation	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Nyul Nyul PBC Aboriginal Corporation	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
Nyul Nyul PBC Aboriginal Corporation	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Nyul Nyul PBC Aboriginal Corporation	19/04/2024	8:30AM	E018	Email	30/04/2024	Email	Please use an alternate email address for further communications, this email has been forwarded to the other email address.	No objections or claims, request to update contact details.	NA	Thank you, will update the contact list as advised.
Nyul Nyul PBC Aboriginal Corporation	24/06/2025	6:02PM	E021	Email	NA	NA	NA	NA	NA	NA
Nyul Nyul PBC Aboriginal Corporation	14/07/2025	4:29PM	Initial phone call	Phone call	NA	Phone	The listed contact confirmed they were the correct contact person for the Nyul Nyul AC. They confirmed they had recieved the stakeholder letter, and that they have a board meeting tomorrow and it will be tabled as part of the received correspondence. CGG summarised the project over the phone, and noted that the only thing that is changing is the survey timing, and asked them to pass that on to the board tomorrow. CGG asked if there were any queries or concerns, to which the contact responded not yet but if there was any raised at the board meeting they would inform CGG.	No objections or claims.	NA	CGG called the listed contact to confirm they are the correct contact person for the Nyul Nyul AC and to check if they received the consultation information regarding the project, noting the change in the survey timing. The contact person confirmed receipt of the stakeholder letter and said the matter would be discussed at an upcoming board meeting tomorrow. CGG summarised the project over the phone, emphasizing the timing change, and asked the contact to relay this to the board. The contact person had no current concerns but agreed to inform CGG if any arise after the board meeting.
Nyul Nyul PBC Aboriginal Corporation	18/07/2025	3:10PM	Follow up call	Phone call	NA	Phone	NA	NA	NA	CGG called the contact person and left brief voicemail (10 second restriction) to check how the board meeting went and if there were any questions or concerns about the project.
Nyul Nyul PBC Aboriginal Corporation	26/08/2025	4:54PM	E024	Email	NA	NA	NA	NA	NA	NA
Ocean Dream Charters	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Ocean Dream Charters	31/07/2023	03:32 PM	Follow up	Phone	NA	Phone	The relevant person confirmed that they did receive the information, but the appropriate person is on leave so please call when they return, but did confirm that they operate mostly in Kimberleys but also west coast and Rowley shoals at start and end of the season.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. They said the appropriate person is on leave so please call when they return, but did confirm that they operate mostly in Kimberleys but also west coast and Rowley shoals at start and end of the season.
Ocean Dream Charters	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Ocean Dream Charters	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will be managed as per the process outlined in the EP.
Ocean Dream Charters	19/04/2024	8:30AM	E018	Email						
Ocean Dream Charters	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Ocean Dream Charters	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD	31/07/2023	03:38 PM	Follow up	Phone	NA	Phone	The relevant person stated that they're not that interested. Say they get lots of things come in from companies like CGG and are not interested in talking to CGG. States that what they would like is compensation for the destruction that oil and gas companies do up there. CGG informed them that there are avenues for compensation if they'd like to talk to us about it. The relevant person stated that they believe the strategies are to bog them down in consultation and they are not interested in doing that. CGG asked if they would like to be taken off the list of Relevant Persons and they requested to be kept on.	The relevant persons claims are merited: 1) Request for compensation 2) Consultation fatigue	CGG addressed each of the merited claims: 1) CGG has determined that compensation for commercial fishers is an appropriate control for the Sauropod 3D MSS and will implement the NERA (2021 – Revision 1) CSEP Commercial Fishing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing stakeholders for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities. 2) CGG offered to remove the relevant person from the consultation list, however beyond this option CGG cannot reduce the larger consultation load on relevant persons as they must meet the consultation requirements outlined by NOPSEMA in regards to the extent and frequency of their consultation.	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. The relevant person stated that they're not that interested. Say they get lots of things come in from companies like CGG and are not interested in talking to CGG. States that what they would like is compensation for the destruction that oil and gas companies do up there. CGG informed them that there are avenues for compensation if they'd like to talk to us about it. The relevant person stated that they believe the strategies are to bog them down in consultation and they are not interested in doing that. CGG asked if they would like to be taken off the list of Relevant Persons and they requested to be kept on.
OLD BROWN DOG PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
OLD BROWN DOG PTY LTD	19/04/2024	8:30AM	E018	Email						
OLD BROWN DOG PTY LTD; Brown Dog Fishing Pty Ltd	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD; Brown Dog Fishing Pty Ltd	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD; Brown Dog Fishing Pty Ltd	29/07/2025	3:15PM	Initial phone call	Phone call	NA	Phone	Contact person responded by stating that they have received numerous consultation materials over the years and are not willing to move their fishing vessel for the seismic survey. They requested that if the seismic vessel is going to cross paths with their fishing vessel, CGG should send an email asking them to move, and they will seek compensation for displacement. They acknowledged that the survey area is right over their fishing zone and they do fish there, and expressed concern about the cumulative effects of seismic surveys over time.	Request that an email be sent to the contact person if survey and fishing vessels cross paths during the survey is not merited due to the following reasons: 1) Email correspondence would be too slow under the circumstance which require an immediate response. 2) Stakeholder newsletters describe how guard vessels will be present during the survey to engage and communicate with other marine users through more suitable means (eg marine radio). 3) All marine users, including both seismic and fishing vessels are exoected to abide by navigation 'rules of the road'. 4) Stakeholder newsletters describe how notification of	No additional controls or mitigation measures adopted. The EP includes several control measures to avoid disruption/interference with other marine users, including commercial fishers, such as COLREGS, Notice to Mariners, pre-sruvey notifications to fisheries relevant persons indicating location and expected timing, and conducting acquisition outside key fishing seasons. See Section 7.4 of the draft EP for more details. The EP includes implementation of the NERA (2021 Revision 1) CSEP Commercial FIshing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial	CGG called the listed contact to explain the project and ask if they had recieved the consultation materials and if they have any concerns or queries about the project. CGG also explained that measures are in place to communicate the seismic vessel's movements to minimize collision risk and that compensation plans exist for loss of catch. CGG thanked the contact for their feedback and asked them to inform CGG if they have any more concernes or queries.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
								survey activities will be provided to marine users and fishers via NtM in advance so that they may manage their own activities accordingly. 5) Stakeholder newsletters describe the compensation process through which fishers may seek compensation for potential impacts resulting from the seismic survey. 6) Concern regarding cumulative effects is noted and addressed in the Stakeholder newsletters and in Section7.2 of the EP.	fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities. See Section 7.1, 7.2, 7.4 for more details. The EP includes a risk assessment of potential cumulative impacts of marine seismic surveys on marine fauna species that has been informed by underwater noise modelling. EP specifies a range of management measures to mitigate potential impacts. See Section 7.2 of the draft EP.	
OLD BROWN DOG PTY LTD; Brown Dog Fishing Pty Ltd	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
OLD BROWN DOG PTY LTD; Brown Dog Fishing Pty Ltd	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Pathfinder Energy Pty Ltd	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Pathfinder Energy Pty Ltd	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
Pathfinder Energy Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Pathfinder Energy Pty Ltd	19/04/2024	8:30AM	E018	Email						
Pathfinder Energy Pty Ltd	19/04/2024	8:30AM	E018	Email						
Pathfinder Energy Pty Ltd	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Pathfinder Energy Pty Ltd	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Pearl Producers Association of WA (PPA)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Pearl Producers Association of WA (PPA)	31/07/2023	03:38 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project.
Pearl Producers Association of WA (PPA)	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Pearl Producers Association of WA (PPA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Pearl Producers Association of WA (PPA) represents/point of contact for: • Pearl Oyster Managed Fishery	19/04/2024	8:30AM	E018	Email						
Pearl Producers Association of WA (PPA)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Pearl Producers Association of WA (PPA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Pelican Charters	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Pelican Charters	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
PGS Australia Pty Ltd	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
PGS Australia Pty Ltd	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
PGS Australia Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
PGS Australia Pty Ltd	19/04/2024	8:30AM	E018	Email						
Pirate Enterprises NT Pty Ltd	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
Pirate Enterprises NT Pty Ltd	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
RAPTIS FISHING LICENCES PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
RAPTIS FISHING LICENCES PTY LTD	31/07/2023	03:46 PM	Follow up	Phone	NA	Phone	the relevant person confirmed that they had received the information and that they do not fish in the area.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. The receptionist confirmed that the owner would have received the information, but that they do not fish in the north west area, only the GAB. CGG informed the relevant person that they can get in contact if they would like to be removed from the relevant list of Relevant Persons, otherwise CGG will continue to send updates and information through.
RAPTIS FISHING LICENCES PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
RAPTIS FISHING LICENCES PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
RAPTIS FISHING LICENCES PTY LTD	19/04/2024	8:30AM	E018	Email						
RAPTIS FISHING LICENCES PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
RAPTIS FISHING LICENCES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
RAPTIS FISHING LICENCES PTY LTD	29/07/2025	3:13PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the listed contact and left a voicemail message asking whether they had received the consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										material and to find out if they had any concerns or queries about the project. CGG requested a return call.
RAPTIS FISHING LICENCES PTY LTD	26/08/2025	3:15PM	E023	Email	NA	NA	NA	NA	NA	NA
RAPTIS FISHING LICENCES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
RecfishWest	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply noting receipt of the email and that they are on leave until 31 May	No objections or claims.	NA	NA
RecfishWest	9/06/2023	03:25 PM	Response to E010	Email	9/6/2023 12:25PM	Email	RecfishWest reiterated feedback given in previous consultation that while the planned activities are located well offshore, they are still infrequently visited by recreational fishers. The northern border of the operational area is also located less than 50km south of the Rowley Shoals, which are fished regularly by charter vessels and infrequently by private vessels. Therefore, it remains important for RecfishWest to be kept informed as activity dates are confirmed so that they are able to communicate relevant details with the recreational fishing community.	No objections or claims.	CGG will continue to send activity updates to this relevant person.	CGG responded to thank RecfishWest for the feedback and to confirm that they would continue to provide them with updates.
RecfishWest	14/08/2023	02:10 PM	E012	Email	31/08/2023 1:47PM	Email	RecfishWest thanked CGG for their email and stated that based on the information provided, RecfishWest has no further comments to add to their previous feedback.	No objections or claims.	NA	NA
RecfishWest	31/08/2023	6:34PM	Follow up	Email	NA	NA	NA	NA	NA	CGG thanked RecfishWest for their email, and confirmed that they would continue to keep them updated as they move forward with all aspects of survey planning.
Recfishwest	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Recfishwest	19/04/2024	8:30AM	E018	Email						
Recfishwest	19/04/2024	8:30AM	E018	Email						
Recfishwest	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Recfishwest	8/07/2025	12:47PM	Response	Email	7/07/2025 16:55PM	Email	RecfishWest reiterated feedback given in previous consultation that recreational fishing is underaken at the Rowley Shoals and while primarily limited to charter operations and larger vessels it is considered an iconic destination. Stated that seismic surveys and their impacts are a concern for recreational fishers, but that it is positive to see that CGG takes a measured approach to the survey including several mitigative measures to reduce impacts. However, it would be useful to better understand the actual range of potential impacts of the proposed activities, especially in realtion to Rowley Shoals. They noted that the EMBA appears to be focussed on spills, and asked if there is a	The following claims are merited: 1) Request for additional information on the extent of underwater noise impacts particularly in relation to Rowley Shoals. 2) Query about the range of potential impacts of proposed activities in relation to the Rowley Shoals. 2) Note that the EMBA appears to be focussed on hydrocarbon spills, and enquired if there is a similar model for seismic surveys.	No new controls or mitigation measures adopted. 1) CGG provided additional information and highlighted the relevant sections of the EP. 2 & 3) CGG have assessed the range of impacts for all MSS activities, and while routine vessel discharges cause only localised, minor, and temporary effects, more significant impacts like seismic noise and potential oil spills have been modelled in detail. For oil spills, CGG ran 300 simulations across different seasons and conditions to define the impact boundary or EMBA. See Section 4 of the draft EP for more details. Regarding seismic noise, CGG	CGG thanked RecfishWest for their response and acknowledged their concerns about the potential impacts of seismic surveys on recreational fishing at the Rowley Shoals. In response CGG advised they have assessed the range of impacts for all MSS activities. While routine vessel discharges cause only localised, minor, and temporary effects, more significant impacts like seismic noise and potential oil spills have been modelled in detail. For oil spills, we ran 300 simulations across different seasons and conditions to define the impact boundary. Regarding seismic noise, we conducted sound propagation modelling at multiple sites to evaluate effects on marine life and socio-economic factors. Our

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							similar model for seismic surveys.		conducted sound propagation modelling at multiple sites to evaluate effects on marine life and socio-economic factors. Findings show injury-level noise affecting fish up to 190 meters from the source and behavioural changes extending to 2.8 kilometres, which is well within the 60-kilometre distance to the Rowley Shoals Marine Park boundary. Since many target fish are mobile, they are likely to move away from harmful noise, and mitigation measures like gradual ramping up of seismic activity are designed to support this. See Sections 7.1.3, 7.1.5.4 and Appendix D of the draft EP for more details.	findings show injury-level noise affecting fish up to 190 meters from the source and behavioural changes extending to 2.8 kilometres, which is well within the 60-kilometre distance to the Rowley Shoals Marine Park boundary. Since many target fish are mobile, they are likely to move away from harmful noise, and mitigation measures like gradual ramping up of seismic activity are designed to support this. CGG requested RecfishWest to reach out if they have any further questions.
Recfishwest	10/07/2025	11:47AM	Response	Email	09/07/2025 16:26PM	Email	RecfishWest thanked CGG for providing the additional information and for highlighting the relevant sections of the EP.	No objections or claims.	NA	CGG acknowledged RecfishWest's response and asked them to let CGG know if they need anything else.
Recfishwest	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
SABEA FISHING CO PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
SABEA FISHING CO PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
SABEA FISHING CO PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SABEA FISHING CO PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
SABEA FISHING CO PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SABEA FISHING CO PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
SAGACITY PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
SAGACITY PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
SAGACITY PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SAGACITY PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
SAGACITY PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SAGACITY PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Santos WA Northwest Pty Ltd	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Santos WA Northwest Pty Ltd	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
Santos WA Northwest Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Santos WA Northwest Pty Ltd	19/04/2024	8:30AM	E018	Email						
Santos WA Northwest Pty Ltd	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Santos WA Northwest Pty Ltd	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Save Our Songlines	22/09/2023	3:07PM	E012	Email	NA	NA	NA	NA	NA	NA
Save Our Songlines	10/01/2024	10:14 AM	Follow up	Email	NA	NA	NA	NA	NA	Provided E012 with minor intorductory text updates to make specifically directed to the relevant person. Indicated that feedback would be required by 19/1/2024.
Save Our Songlines	30/01/2024	04:00 PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Save Our Songlines	19/04/2024	8:30AM	E018	Email						
Save Our Songlines	24/06/2025	6:07PM	E021	Email	NA	NA	NA	NA	NA	NA
Save Our Songlines	26/08/2025	4:56PM	E024	Email	NA	NA	NA	NA	NA	NA
SEA HARVEST FISHING COMPANY PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
SEA HARVEST FISHING COMPANY PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
SEA HARVEST FISHING COMPANY PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SEA HARVEST FISHING COMPANY PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SEA HARVEST FISHING COMPANY PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	19/04/2024	8:30AM	E018	Email						
SEAFRESH HOLDINGS PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD & FABRON HOLDINGS PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD & FABRON HOLDINGS PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
SEAFRESH HOLDINGS PTY LTD & FABRON HOLDINGS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD & FABRON HOLDINGS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SEAFRESH HOLDINGS PTY LTD & FABRON HOLDINGS PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SEAFRESH HOLDINGS PTY LTD & FABRON	19/04/2024	8:30AM	E018	Email						

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
HOLDINGS PTY LTD										
Searcher Seismic	19/04/2023	NA	NA	NA	19/04/2023 7:12PM	Email	Searcher sent CGG an EP update for their Possum EP. Document titled “F007-Invitation for Consultation Update” Flyer. The update includes their proposed survey window of between December and April.	No objections or claims.	NA	CGG requested clarification on the EP validity window (until July 2023) given the survey is planned for December 2023 to April 2024.
Searcher Seismic	26/04/2023	NA	Response to Searcher consultation email	Email	NA	NA	Searcher responded to say that the current EP has validity until end of July 2023 but due to delays caused by the new consultation process it is most likely that once the EP is submitted they will apply for an extension that would extend the validity until the end of July 2025.	No objections or claims.	NA	NA
Searcher Seismic	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Searcher Seismic	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
Searcher Seismic	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA’s review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Searcher Seismic	19/04/2024	8:30AM	E018	Email						
SHARK BAY NOMINEES PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
SHARK BAY NOMINEES PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SHARK BAY NOMINEES PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will be managed as per the process outlined in the EP.
SHARK BAY NOMINEES PTY LTD	19/04/2024	8:30AM	E018	Email						
SHARK BAY NOMINEES PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
SHARK BAY NOMINEES PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SHARK BAY NOMINEES PTY LTD	26/08/2025	3:20PM	E023	Email	NA	NA	NA	NA	NA	NA
SHARK BAY NOMINEES PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
SHARK BAY SEAFOODS PTY LTD	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
SHARK BAY SEAFOODS PTY LTD	31/07/2023	03:49 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. No answer, CGG left a voice message.
SHARK BAY SEAFOODS PTY LTD	14/08/2023	02:10 PM	E013	Email	NA	NA	NA	NA	NA	NA
SHARK BAY SEAFOODS PTY LTD	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SHARK BAY SEAFOODS PTY LTD	19/04/2024	8:30AM	E018	Email						
SHARK BAY SEAFOODS PTY LTD	24/06/2025	3:02PM	E019	Email	NA	NA	NA	NA	NA	NA
SHARK BAY SEAFOODS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SHARK BAY SEAFOODS PTY LTD	29/07/2025	3:12PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the listed contact and left a voicemail message asking whether they had received the consultation material and to find out if they had any concerns or queries about the project. CGG requested a return call.
Shell Australia	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA
Shell Australia	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
SPANIARD FISHING PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
SPANIARD FISHING PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
SPANIARD FISHING PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
SPANIARD FISHING PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
SPANIARD FISHING PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
SPANIARD FISHING PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Terrafirma Offshore Pty Ltd	2/06/2023	03:28 PM	E010	Email	3/6/2023 9:42AM	Email	Terrafirma replied with information on their chase boat capacities and enquired if CGG could pass them on to their procurement department.	No objections or claims.	NA	NA
Terrafirma Offshore Pty Ltd	6/06/2023	03:28 PM	Response to provision of vessel information	Email	NA	NA	NA	NA	NA	CGG responded to Terrafirma noting that they will pass on the vessel specifications to the operations team.
Terrafirma Offshore Pty Ltd	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Terrafirma Offshore Pty Ltd	18/08/2023	NA	NA	NA	14/08/2023 12:38PM	NA	Terrafirma called CGG and left a voicemail requesting a call back	No objections or claims.	NA	CGG returned the call. Terrafirma explained that they were calling to follow up on their offer of chase vessels for the seismic survey. CGG stated that they would get in touch with the appropriate team members and follow up with Terrafirma.
Terrafirma Offshore Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Terrafirma Offshore Pty Ltd	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA
Terrafirma Offshore Pty Ltd	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Terrafirma Offshore Pty Ltd	30/06/2025	2:15PM	Follow up	Email	29/06/2025 9:11AM	Email	The company remains interested in providing scout boat services for this scope and requests to be connected with the appropriate contact to express their interest.	No objections or claims.	NA	CGG expressed appreciation for the message and confirmed that it had been forwarded to their Operations team, who would reach out closer to the acquisition start if needed to discuss further opportunities; in the meantime, CGG offered assistance with any questions or requests for additional information.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Terrafirma Offshore Pty Ltd	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
TGS-NOPEC Geophysical Company Pty Ltd	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
TGS-NOPEC Geophysical Company Pty Ltd	14/08/2023	02:10 PM	E014	Email	NA	NA	NA	NA	NA	NA
TGS-NOPEC Geophysical Company Pty Ltd	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
TGS-NOPEC Geophysical Company Pty Ltd	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Congratulations on acceptance of the EP	No objections or claims.	NA	
The Great Escape Charter Company	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
The Great Escape Charter Company	8/06/2023	02:55 PM	Inquiry of availability	Phone	NA	Phone	Can't find the email from Friday, please resend, the email used is correct. Will let skippers know about possibility of meeting with CGG in the week of the 19th, they will look at the letter and get in touch if they want to meet. Recommend contacting the Kimberly Marine Tourism Association. We frequent the Rowley's Oct-Dec, on the Kimberley coast March-Oct.	No objections or claims.	NA	CGG will resend the email from Friday.
The Great Escape Charter Company	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
The Great Escape Charter Company	16/08/2023	10:45 AM	Inquiry of availability	Phone	NA	Phone	No answer	NA	NA	Left a message for office manager, to check if got email, informing that CGG will be in Broome on 2nd and 23d of next week if interested to meet and call back if any questions.
The Great Escape Charter Company	18/08/2023	03:31 PM	Follow up	In person	NA	In person	Office manager is overseas, will be back to work on Monday.	No objections or claims.	NA	Asked if could speak to manager about the proposed survey. Will come back next week when the manager is back in.
The Great Escape Charter Company	22/08/2023	10:48 AM	Follow up	In person	NA	In person	Office manager is still not available, there is no way to make an appointment, come back on Wednesday afternoon.	No objections or claims.	NA	Asked if the office manager is available, or if there was any way to make an appointment.
The Great Escape Charter Company	23/08/2023	03:24 PM	Follow up	Phone	NA	Phone	NA	NA	NA	No answer, left a message. Unable to come by this afternoon, can the office manager please call to set a time to meet.
The Great Escape Charter Company	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
The Great Escape Charter Company	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
The Great Escape Charter Company	19/04/2024	8:30AM	E018	Email						
The Great Escape Charter Company	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
The Great Escape Charter Company	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
The Trustee for Diversity Charters Unit Trust	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
The Trustee for Diversity Charters Unit Trust	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
The Trustee for Diversity Charters Unit Trust	16/08/2023	10:45 AM	Inquiry of availability	Phone	NA	Phone	Will pass a message on the director to call back.	No objections or claims.	NA	Asked to speak to someone about the survey. Will wait for the callback and will drop in when on the consultation trip.
The Trustee for Diversity Charters Unit Trust	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey. Please get in touch if you would like to arrange a meeting with us.
The Trustee for Diversity Charters Unit Trust	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
The Trustee for Diversity Charters Unit Trust	19/04/2024	8:30AM	E018	Email						
The Trustee for Diversity Charters Unit Trust	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
The Trustee for Diversity Charters Unit Trust	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
The Trustee for Wilderness Safari Unit Trust	2/06/2023	03:28 PM	E010	Email	2/6/2023 3:29PM	Email	Autoreply acknowledging receipt of email and providing the email address for the office manager.	No objections or claims.	NA	CGG to send E010 to the generic email address provided
The Trustee for Wilderness Safari Unit Trust	2/06/2023	04:08 PM	E010	Email	NA	NA	NA	NA	NA	CGG sent activity information to the alternative email address provided

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
The Trustee for Wilderness Safari Unit Trust	31/07/2023	03:52 PM	Follow up	Phone	NA	Phone	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. They confirmed that although they haven't operated in the Rowley Shoals yet, they are planning to in the coming years. However, didn't think the survey would overlap with their activities but provided the phone number of the skipper for CGG to confirm.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. They confirmed that although they haven't operated in the Rowley Shoals yet, they are planning to in the coming years. However, didn't think the survey would overlap with their activities but provided the phone number of the skipper for CGG to confirm.
The Trustee for Wilderness Safari Unit Trust	31/07/2023	03:54 PM	Follow up	Phone	NA	Phone	CGG called the skipper to confirm the vessels movements and any potential overlap. The skipper stated that they did not expect any overlap. CGG stated that they can get in contact if anything changes.	No objections or claims.	NA	CGG called the skipper to confirm the vessels movements and any potential overlap. The skipper stated that they did not expect any overlap. CGG stated that they can get in contact if anything changes.
The Trustee for Wilderness Safari Unit Trust	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
The Trustee for Wilderness Safari Unit Trust	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
The Trustee for Wilderness Safari Unit Trust	19/04/2024	8:30AM	E018	Email						
Tourism Western Australia	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Tourism Western Australia	31/07/2023	04:00 PM	Follow up	Phone	NA	Phone	The relevant person provided a new email address and stated that they will share the information with the appropriate team.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. Tourism WA provided a more accurate email address to contact them with. They will share the information with the appropriate team.
Tourism Western Australia	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Tourism Western Australia	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Tourism Western Australia	19/04/2024	8:30AM	E018	Email						
Tourism Western Australia	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Tourism Western Australia	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Tuna Australia	2/06/2023	03:28 PM	E010 - Tuna Australia specific	Email	5/6/2023 6:21AM	Email	Tuna Australia provided CGG with their Industry Position Statement and noted which fisheries they represent in the consultation process. Stated that due to an increase in consultation requests, Tuna Australia will consult with members and provide submissions reflecting the views of the fishery in response to proposals. Stated that after CGG has reviewed the industry position statement and they can continue the process of entering a services agreement with Tuna Australia .	No claims or objections. Request to enter a services agreement.	CGG to respond to Tuna Australia to state that CGG does not believe it necessary to enter into a service agreement with Tuna Australia as the survey will not impact fishers operating in the Western Tuna and Billfish fishery.	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines and a request that if this is incorrect, that CGG should be notified.
Tuna Australia	5/07/2023	08:50 PM	Discussion	Email	27/6/23 8:53AM	Email	Tuna Australia emailed CGG to note that a new representative had taken over. They also provided a new industry position statement. They expressed that their position remains that they are happy to engage with CGG via a signed services agreement.	No claims or objections. Request to enter a services agreement.	CGG does not believe it necessary to enter into a service agreement with Tuna Australia as the survey will not impact fishers operating in the Western Tuna and Billfish fishery.	CGG responded to Tuna Australia to inform them that CGGs review of Commonwealth fisheries data indicates that whilst the survey area overlaps with the management area of the Western Tuna and Billfish fishery it is located a considerable distance from the actively fished area of this fishery. Thus, CGG does not believe the survey will impact fishers operating in the Western Tuna and Billfish fishery, and therefore it is not necessary to enter into a service agreement with Tuna Australia.
Tuna Australia	10/07/2023	03:41 PM	Discussion	Email	6/7/2023 9:47AM	Email	Tuna Australia responded to CGG, stating that they think the project should consider not just the current fishing activity in	Tuna Australia's objections and claims below are merited due to their position as an industry body for the fishery:	No new controls adopted. 1) CGGs assessment of relevance of a fishery using parameters such as recent	CGG responds to Tuna Australia to expand on their assessment regarding impact on commonwealth fisheries in

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							WTB. State that the activity also the SBTF and the Australian Skipjack Fishery. They provide the offer again of entering into a service agreement to help CGG meet the consultation requirements.	1) CGG should consider more than just current fishing activity 2) the activity also overlaps SBTF and the Australian Skipjack Fisheries 3) Believes that CGG should enter into a services agreement in order to consult with concession holders of all Tuna fisheries represented by Tuna Australia	fishing activity has been deemed as appropriate by NOPSEMA in previously accepted EPs. 2) CGG already considers the SBTF and the ASF in the Existing Environment and impact assessment of the EP. 3) CGG is already consulting with Tuna Australia who is a relevant person given their position as an industry body. However, CGG does not consider the concession holders of the WTB or ASF as relevant persons under their extensive assessment undertaken of Commonwealth and Western Australian managed fisheries and fishing effort. As such, does not believe it necessary to enter into a service agreement with Tuna Australia.	relation to the additional fisheries. CGG notes that they did not initially address the SBTF and the ASF because the Tuna Australia industry position statement indicates that companies should liaise separately with the SBT Industry Association, and it doesn't mention the Skipjack Fishery. CGG notes that they have however considered these fisheries in the impact assessment. CGG outlines the conclusions of this impact assessment to Tuna Australia.
Tuna Australia	28/07/2023	05:01 PM	Discussion	Email	14/7/2023 7:33PM	Email	Tuna Australia responded to note that Tuna Australia is a relevant person under NOPSEMA's consultation guidelines, and to offer again to enter into a service agreement.	Tuna Australia's claim that they are a relevant person is merited.	CGG is already in consultation with Tuna Australia.	CGG thanked Tuna Australia for their email, and agreed that Tuna Australia is a relevant person because of the overlap between the proposed seismic survey and management areas for fisheries that Tuna Australia represent. Noted that in this capacity CGG will continue to consult with Tuna Australia as representative of that body and the fishers it represents CGG noted that additional consultation with fishers within these tuna-based fisheries has not previously been required because they are not active anywhere near the area of the proposed seismic survey or larger EMBA, with CGGs latest review of fisheries data showing that this remains the case. As such, CGG does not see a necessity to enter into an agreement with Tuna Australia to consult with fishers in these fisheries. CGG stated that if Tuna Australia believe this assessment is incorrect and that fishers represented by Tuna Australia may be impacted by the proposed survey then CGG would certainly be interested in understanding that impact.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Tuna Australia	4/08/2023	12:00 PM	Discussion	Email (pt 1)	1/8/2023 10:49AM	Email (pt 1)	Tuna Australia responded to CGG. Tuna Australia expressed the following: 1) Expressed an ongoing opinion that they believe CGG should enter into a service agreement with Tuna Australia. 2) They believe concession holders in these fisheries will be concerned about this proposal. 3) Tuna Australia believes CGG has not addressed some factors of the OPGGS Act 2006. Particularly, the impact to larval spawn, new recruits, migration, and food web chain impacts and cumulative impacts of seismic surveys have not been addressed. 4) Tuna Australia suggests that future fishing activity (set to occur from late 2023), including the work Tuna Australia is doing to reinvigorate the fishery using specialised freezer fishing vessels, should also be considered. Fishing is also heavily influenced by ocean currents, eddy formation, climate change, seasonal changes etc are all interseason factors which influence where fish will be and their availability to catch. (continued in next row)	Tuna Australia's objections and claims below are merited due to their position as an industry body for the fishery: 1) CGG should enter into a service agreement with Tuna Australia. 2) concession holders in these fisheries will be concerned about this proposal 3) CGG has not addressed some factors of the OPGGS Act 2006 relating to conservation of the seabed – impacts to larval spawn, new recruits, migration, and food web chain impacts and cumulative impacts of seismic surveys have not been addressed 4) future fishing activity (set to occur from late 2023), including the work Tuna Australia is doing to reinvigorate the fishery using specialised freezer fishing vessels, should also be considered	No new controls or measures adopted. 1) CGG does not believe it necessary to enter into a service agreement with Tuna Australia as the survey will not impact fishers operating in the Western Tuna and Billfish fishery or Australian Skipjack Fishery. 2) CGG considers there to be no potential for interaction within the overlapping areas of the Western Tuna and Billfish Fishery (WTBF) and Western sector of the Australian Skipjack Fishery. 3) It is CGG's view that the potential impacts of acquisition of the Sauropod 3D MSS are comprehensively and adequately assessed in the Environment Plan (EP) Sections 7 and 8. CGG believes that the activity will be conducted in a manner that does not result in unacceptable impacts to the sustainability of commercial fisheries, including spawning activity. CGG's evaluation of the potential for cumulative impacts on the sustainability of commercial fish stocks, using recently published scientific literature, and the control measures adopted by CGG to manage the activity, demonstrate that the potential impacts to spawning fish will not result in serious or long-term effects to populations of key commercial species. 4) CGGs assessment of relevance of a fishery using parameters including recent fishing activity is deemed appropriate. CGG agrees that Tuna Australia is a relevant person because of the overlap between the proposed seismic survey and management areas for fisheries that Tuna Australia represent. CGGs approach to consultation with commercial fishers is consistent with AFMA advice.	With respect to the OPPGS Act requirement of the conservation of the resources of the sea and seabed – it is CGG's view that the potential impacts of acquisition of the Sauropod 3D MSS on "larval spawn, new recruits, migration patterns, and food web chain impacts from phytoplankton to apex predator" were comprehensively and adequately assessed in the Environment Plan (EP), which NOPSEMA accepted on 16th February 2022. As stated by NOPSEMA: "…NOPSEMA has concluded that the activity will be conducted in a manner that does not result in unacceptable impacts to the sustainability of commercial fisheries, including spawning activity." Similarly, with respect to potential cumulative or additive effects from other MSS activity in the same general area, NOPSEMA concluded in the Key Matters Report that: "NOPSEMA is reasonably satisfied, after taking into consideration CGG's evaluation of the potential for cumulative impacts on the sustainability of commercial fish stocks, recently published scientific literature and the control measures adopted by CGG to manage the activity, that the potential impacts to spawning fish will not result in serious or long-term effects to populations of key commercial species." Note that there is no planned direct interaction with the seabed as part of the proposed activities. As previously stated, CGG agrees that Tuna... (continues in next row)
Tuna Australia	4/08/2023	12:00 PM	Discussion	Email (pt 2)	1/8/2023 10:49AM	Email (pt 2)	6) States that concession holders have grave concerns about the impact of marine	(continued from above) 6) concession holders have grave concerns about the	5) It is CGG's view that the potential impacts of acquisition of the Sauropod 3D MSS are	... Australia is a relevant person because of the overlap between the proposed seismic survey

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							seismic testing on larval spawn, new recruits, migration patterns, and food web chain impacts from phytoplankton to apex predator. 7) To compound this, we have already received several requests to consult on other MSS activity in the same general area, so the cumulative impacts of these surveys need to be considered, deconflicted, and mitigated.	impact of marine seismic testing on larval spawn, new recruits, migration patterns, and food web chain impacts from phytoplankton to apex predator. 7) the cumulative impacts of these surveys need to be considered, deconflicted, and mitigated.	comprehensively and adequately assessed in the Environment Plan (EP) Sections 7 and 8. The EP demonstrates that potential impacts of the seismic survey to spawning fish will not result in serious or long-term effects to populations of key commercial species. 6) CGG's evaluation of the potential for cumulative impacts on the sustainability of commercial fish stocks, recently published scientific literature and the control measures adopted by CGG to manage the activity demonstrates that the potential impacts to spawning fish will not result in serious or long-term effects to populations of key commercial species.	and management areas for fisheries that Tuna Australia represent. Accordingly, we have consulted with Tuna Australia as part of the relevant person engagement process for the Sauropod 3D MSS EP. We acknowledge that the fishery management areas for the Western Tuna and Billfish Fishery (WTBF) and Western sector of the Australian Skipjack Fishery, both of which Tuna Australia represents, overlap the acquisition and operational areas and the EMBA for the Sauropod 3D MSS. However, CGG considers there to be no potential for interaction within these areas. CGGs approach to consultation with commercial fishers is consistent with AFMA advice that it expects all Commonwealth fishers who have entitlements to fish within the proposed area to be consulted, which can be through the relevant fishing industry associations. The level of feedback provided by an organisation, if any, is at the person or organisation's discretion. CGG does not have an expectation that organisations will provide a report or engage a consultant to engage in consultation or provide feedback on their behalf. That is not the purpose of the consultation process as required under the OPGGS (Environment) Regulations.
Tuna Australia	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Tuna Australia	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Tuna Australia	19/04/2024	8:30AM	E018	Email						
Tuna Australia	19/04/2024	8:30AM	E018	Email						
Tuna Australia	24/06/2025	4:35PM	E020 - Tuna Australia specific	Email	NA	NA	NA	NA	NA	NA
Tuna Australia	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Tuna Australia	NA	NA	NA	NA	29/8/2025 3:27PM	Email	The Tuna Australia contact informed CGG that they have sent out the stakeholder update newsletter for the Sauropod Marine Seismic Survey to the tuna fishing community. The contact attached a PDF copy of the email sent to the tuna fishing community. The attached PDF of the email sent by Tuna Australia to the tuna fishing community requests that they see the Sauropod Marine Seismic Survey stakeholder update via a link to the E020 (Tuna Australia specific) newsletter. The email explains that the activity was supposed to take placein 2024–	Notification that the consultation newsletter has been passed on to the tuna fishing community only. No objections or claims.	NA	No response

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							2025 but has been delayed until 2026–2027, and to please reach out to CGG if they have any questions.			
University of Western Australia (UWA)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
University of Western Australia (UWA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
University of Western Australia (UWA)	19/04/2024	8:30AM	E018	Email						
University of Western Australia (UWA)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
University of Western Australia (UWA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
VIENCY PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
VIENCY PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
VIENCY PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
VIENCY PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
VIENCY PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
VIENCY PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
WA Department of Transport - Marine (DoT WA)	2/06/2023	03:28 PM	E010 - DoT specific	Email	2/6/2023 3:55PM	Email	Autoreply from MEER Unit of DoT noted the receipt of the email and stated that it would be actioned as soon as possible by the relevant officer.	No objections or claims.	NA	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation guidelines and a request that if this is incorrect, that CGG should be notified.
WA Department of Transport - Marine (DoT WA)	6/06/2023	NA	NA	NA	6/6/2023 11:11AM	Email	MEER emailed CGG to inform them that If there are any changes in the risk to State waters from the previously provided Oil Pollution Emergency Plan (OPEP) (Sauropod 3D Marine Seismic Survey OPEP, Rev B which was submitted in 2021) please consult with them. However, if there are no changes they do not need any further consultation on the OPEP itself.	No objections or claims.	CGG will continue to provide MEER DoT with any updates to the activity or changes to the OPEP	NA
WA Department of Transport - Marine (DoT WA)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
WA Department of Transport - Marine (DoT WA)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
WA Department of Transport - Marine (DoT WA)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply from MEER Unit of DoT noted the receipt of the email and stated that it would be actioned as soon as possible by the relevant officer.	No objections or claims.	NA	
WA Department of Transport - Marine (DoT WA)	24/06/2025	4:32PM	E020 - DoT specific	Email	24/06/2025 4:33PM	Email	Autoreply from MEER Unit of DoT noted the receipt of the email and stated that it would be actioned as soon as possible by the relevant officer.	No objections or claims.	NA	No response
WA Department of Transport - Marine (DoT WA)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Autoreply from MEER Unit of DoT noted the receipt of the email and stated that it would be actioned as soon as possible by the relevant officer.	No objections or claims.	NA	No response
Wanparta Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Wanparta Aboriginal Corporation RNTBC	13/06/2023	10:32 AM	E010	Email	13/6/2023 2:01PM	Email	The Wanparta AC contact person responded to say that the information had been received and passed on to the Wanparta Directors, and that they would advise if there were any queries.	No objections or claims.	NA	CGG sent consultation material to a newly found contact email for the Wanparta AC, noting that they are aware that the Wanparta Aboriginal Corporation is the RNTBC of the Ngarla People native title areas, which lie along the coastline adjacent to the proposed project area, and that they jointly manage the 80 Mile Beach marine park and are connected to the Ngarla Ranges. Also provided the dates of the Broome/Port Hedland visit.
Wanparta Aboriginal Corporation RNTBC	16/06/2023	12:48 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG called Wanparta to confirm they had received the information and to inform them of the dates of the upcoming July Port Hedland/Broome trip. Left a voice message with the details.
Wanparta Aboriginal Corporation RNTBC	19/06/2023	NA	Visit to Jinparinya Community	In person	NA	In person	CGG visited the Jinparinya Community, near the Ngarla Coastal Ngamal Community. The Wanparta Aboriginal	No objections or claims. Identified a potentially relevant party that CGG should consult with.	CGG is already in consultation with the Nyangumarta Warrarn and Nyangumarta Karajarri AC.	CGG visited the Jinparinya Community, near the Ngarla Coastal Ngamal Community. The Wanparta Aboriginal

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							Corporation RNTBC is the registered PBC that holds native title rights and interests on trust for the Ngarla People. CGG spoke with a member of the community who is of the Ngarla people. They did not have any concerns or queries about the survey, and did not identify any coastal or marine values or sensitivities to CGG. They explained that they had limited connection with the sea. They said that CGG should speak to the Nyangumarta people whose Country extends along 80 Mile Beach, and that they come under the YMAC.			Corporation RNTBC is the registered PBC that holds native title rights and interests on trust for the Ngarla People. CGG spoke with a member of the community who is of the Ngarla people. CGG explained they survey and showed them a map. CGG asked whether they had any concerns or questions relating to the survey. CGG asked whether there were any coastal values or sensitivities that they would like to identify to CGG. CGG asked whether they were aware of any other potentially relevant parties that CGG should consult with.
Wanparta Aboriginal Corporation RNTBC	22/06/2023	08:41 AM	Follow up	Email	21/06/2023	Email	The Wanparta AC legal representative contacted CGG noting that a member of the Wanparta AC had requested they contact CGG. They requested some context from CGG, noting that they had received the previously sent out information.	No objections or claims. Request for further information.	CGG to provide additional context to the survey.	CGG responded to provide further background on the project. CGG stated they have been talking in particular to Traditional Owners, and that they would be happy to meet in person to discuss the project.
Wanparta Aboriginal Corporation RNTBC	4/08/2023	09:22 AM	Meeting arrangements	Email	2/8/2023 3:46PM	Email	The Wanparta AC legal representative emailed CGG to inform them of the opportunity to present at an upcoming Directors Meeting. They would have 1-2 hours to present and take questions. Requested that CGG advice if this is possible at their earliest convenience.	No objections or claims.	NA	CGG responded to accept the opportunity to present at their Directors Meeting.
Wanparta Aboriginal Corporation RNTBC	4/08/2023	12:47 PM	Meeting arrangements	Email	4/8/2023 10:35AM	Email	The Wanparta AC legal representative thanked CGG for their response. and informed them that unfortunately all time slots have been booked for 16 August 2023. Wanparta will have availability in September, however at this stage they cannot confirm the dates. They will contact CGG as soon as they have confirmed the dates.	No objections or claims.	NA	CGG confirmed that they would be happy to present at the September meeting and look forward to confirmation of the timing of the meeting.
Wanparta Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Wanparta Aboriginal Corporation RNTBC	14/08/2023	03:37 PM	Meeting arrangements	Email	14/8/2023 12:47PM	Email	The Wanparta AC legal representative provided the schedule and costs of CGG attending the Directors Meeting on the 16th August.	No objections or claims.	NA	CGG thanked Wanparta AC for the offer of a place at the 16th August meeting. CGG said they would have to look into the possibility of personnel and flights and will confirm as soon as possible. CGG enquired as to

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										whether attending this meeting is the only way for CGG to consult with the Wanparta AC on the Sauropod activity, or whether there are any other acceptable ways. CGG also requested some clarification on the fees for the meeting.
Wanparta Aboriginal Corporation RNTBC	14/08/2023	NA	Meeting arrangements	NA	14/8/2023 11:25AM	Phone	The Wanparta AC legal representative called CGG to offer them a place at their meeting that Wednesday in Port Hedland (i.e. in two days time). CGG would have an hour from 2.15-3.15pm.	No objections or claims.	NA	NA
Wanparta Aboriginal Corporation RNTBC	14/08/2023	1:37PM	NA	NA	14/8/2023 11:25AM	Email	The Wanparta AC legal representative sent a follow up email to outline their offer of a place at the upcoming Directors meeting and to send a draft agenda.	No objections or claims.	NA	CGG responded to say they are looking into the possibility of securing flights at short notice, and will confirm their attendance as soon as possible. CGG enquired as to whether and in person meeting was the only method by which CGG can consult with the Wanparta AC.
Wanparta Aboriginal Corporation RNTBC	14/08/2023	5:53PM	NA	NA	14/8/2023 1:58PM	Email	The Wanparta AC legal representative confirmed with CGG that Wanparta requires proponents to meet with the Board and Ngarla elders in person as Wanparta is a self-managed small Registered Native Title Body Corporate with limited resources. Wanparta further requires proponents to attend in-person for consultation, noting the complexities of the subject matter. They also provided more clarity on the fees for attending the meeting.	No objections or claims.	NA	CGG thanked Wanparta AC for the clarifications and stated that they were close to being able to confirm attendance.
Wanparta Aboriginal Corporation RNTBC	15/08/2023	5:51PM	NA	NA	15/8/2023 10:01AM	Email	The Wanparta AC legal representative sent through the general meeting agenda and the CGG specific agenda.	No objections or claims.	NA	CGG sent through their presentation and enquired as to whether an additional CGG representative could attend remotely via Teams.
Wanparta Aboriginal Corporation RNTBC	15/08/2023	9:32AM	NA	NA	14/8/2023 5:56PM	Email	The Wanparta AC legal representative stated that they would email CGG tomorrow regarding the agenda specific to CGG's meeting slot and attendees once they receive CGGs confirmation.	No objections or claims.	NA	CGG confirmed they had been able to secure flights and could attend the meeting.
Wanparta Aboriginal Corporation RNTBC	16/08/2023	3:15PM	Meeting	In person	NA	In person	CGG attended the Board of Directors meeting on the WAC. WAC queried: 1) what sort of data was obtained from seismic surveys 2) what the impacts to whales	No objections or claims, request for additional information only. Provided information on values and sensitivities.	NA	CGG attended the Board of Directors meeting on the WAC. CGG described the activity to the board and discussed their concerns. CGG answered WAC's queries:

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							are 3) whether there will be opportunities for First Nations people to be involved e.g. as marine fauna observers. 4) CGG informed the WAC that what CGG would appreciate finding out is what concerns the Ngarla peoples and the WAC may have (cultural and otherwise), bearing in mind the nature and scale of the activity, so that they can be addressed. The legal representative indicated that they would deliver these within a fortnight.			1) CGG explained the nature of seismic survey data 2) CGG sfummarised the impact assessment on whales outlined in the EP including describing the controls that will be used, and noting that the impact on whales has been reduced to ALARP 3) CGG noted that they would consider what opportunities for First Nations people to be involved there may be. 4) CGG informed the WAC that what CGG would appreciate finding out is what concerns the Ngarla peoples and the WAC may have (cultural and otherwise), bearing in mind the nature and scale of the activity, so that they can be addressed. The legal representative indicated that they would deliver these within a fortnight.
Wanparta Aboriginal Corporation RNTBC	30/08/2023	1:57PM	Follow up	Email	26/08/2023 12:53PM	Email	The WAC legal representative provided CGG with the correspondence of the meeting. During the Meeting, the Board advised that: 1) the Ngarla People's have a deep spiritual connection to sea country. This includes the importance of the Ngarla People's totem species - the octopus, stingray, spiny bream fish and kestrel. 2) the protection and management of marine life plays a significant role in the Ngarla People's practise of lore, culture and customs. 3) the Ngarla People exercising their native title rights and interests is contingent on a healthy and well managed Sea Country. 4) the WAC is satisfied with the consultation on 16 August 2023 and do not presently have concerns to the Project as detailed in the Consultation Correspondence. 5) Wanparta requires CGG to consult further, should the parameters of the Project change from those set out in Consultation Correspondence, and or if the timing of the Project	All of the WAC claims are merited. The WAC also provided information on values and sensitivities.	1) CGG has incorporated the value of Sea Country to Ngarla People's and the identified totem species into the Existing Environment of the EP (see Section 4.4.8.3.3) and considered these values and sensitivities in the impact assessment. 2) CGG has noted the role of protection and management of marine life to the Ngarla People's in the Existing Environment of the EP (see Section 4.4.8.3.3). 3) CGG has noted the importance of a healthy and well managed Sea Country to the Ngarla People's ability to exercise their native title rights in the Existing Environment of the EP (see Section 4.4.8.3.3). 5) CGG will follow all consultation and notification controls and measures adopted in the EP, including notifications of EP updates. CGG has also adopted an additional measure to engage with First Nations groups, including IPA managers, in the unlikely event of an oil spill to seek input into spill response planning (see Section 4.4.8 of the OPEP).	CGG responded to the WAC legal representative to thank them for arranging the meeting in Port Hedland and the subsequent letter. Noted that they would keep WAC updated as the EP and project move forward, but that they would reach out if they have any further questions.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							will impact the migration of whales, dugongs or other marine mammals.			
Wanparta Aboriginal Corporation RNTBC	11/01/2024	8:10PM	E017	Email	11/01/23 8:10PM	Email	Autoreply noting the holiday closure period for the Wanparta AC office (20 Dec 23 to 17 Jan 24). Autoreply from the Wanparta AC legal representative stating that they are out of office and will return on the 17 January.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Wanparta Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Wanparta Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Wanparta Aboriginal	24/06/2025	6:09PM	E021	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation RNTBC										
Wanparta Aboriginal Corporation RNTBC	14/07/2025	4:41PM	Initial phone call	Phone call	NA	Phone	CGG called Wanparta AC and spoke to a receptionist from McClean Legal, asking to speak with the listed contact person for Wanparta AC. The receptionist said the listed contact person was out of the office but offered to have her call CGG back. CGG mentioned that they had already emailed information about the survey and this call was a follow-up to confirm receipt and address any concerns. The receptionist agreed to have the listed contact person return the call or respond to the email. The receptionist called back a few minutes later to report they had sopken to the listed contact person, and they couldn't find CGG's email in their inbox. The receptionist requested CGG re-send the information to their specific email address, which they will then forward to the listed contact person.	No objections or claims.	NA	CGG contacted Wanparta AC by phone and spoke with a receptionist from McClean Legal to reach the designated contact person. Although the contact was unavailable, CGG informed the receptionist that they had previously emailed survey information and were following up to confirm receipt and address any concerns. The receptionist agreed to have the contact person respond either by returning the call or replying to the email. Shortly after, the receptionist called back to report that the contact person could not find CGG's original email. As requested, CGG resent the survey information to a specific email address, which would then be forwarded to the correct contact person.
Wanparta Aboriginal Corporation RNTBC	14/07/2025	5:15PM	E021	Email	NA	NA	NA	NA	NA	As requested by the contact person from McLean Legal, CGG emailed the E021 consultation information to a specific email address for them to forward on to the correct contact person at Wanparta AC.
Wanparta Aboriginal Corporation RNTBC	26/08/2025	4:48PM	E024	Email	NA	NA	NA	NA	NA	NA
Wanparta Aboriginal Corporation RNTBC	NA	NA	NA	Email	24/09/2025 2:20PM	Email	The Wanparta contact person email to say that the Wanparta Chairperson had confirmed that Wanparta has no further comments and does not require a meeting with CGG for the resubmission of the Environmental Plan, noting the only amendment to the Environmental Plan is to the survey dates.	No objections or claims.	NA	NA
WEST COAST CRABS PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
WEST COAST CRABS PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
WEST COAST CRABS PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
WEST COAST CRABS PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
WEST COAST CRABS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
WEST COAST CRABS PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Western Australian Fishing Industry Council (WAFIC)	2/06/2023	03:28 PM	E010 - WAFIC specific	Email	NA	NA	NA	NA	NA	CGG sent the relevant person consultation information. The letter includes a description and acknowledgement of how the relevant person has stated that they would like to be consulted in their published consultation

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										guidelines and a request that if this is incorrect, that CGG should be notified.
Western Australian Fishing Industry Council (WAFIC)	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Western Australian Fishing Industry Council (WAFIC)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Western Australian Fishing Industry Council (WAFIC)	19/04/2024	8:30AM	E018	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Western Australian Fishing Industry Council (WAFIC)	24/06/2025	4:37PM	E020 - WAFIC specific	Email	24/06/2025	Email	Bounceback from one of the contact emails providing an alternative contact email	NA	CGG to send information to alternative contact email.	NA
Western Australian Fishing Industry Council (WAFIC)	24/06/2025	4:43PM	E020 - WAFIC specific	Email	NA	NA	NA	NA	NA	NA
Western Australian Fishing Industry Council (WAFIC)	26/06/2025	12:41PM	Follow up	Email	25/06/2025 10:20AM	Email	WAFIC thanked CGG for the information. Stated that WAFIC and commercial fishers have significant concerns about the potential impacts of seismic surveys on the fishing industry. Noted that in the stakeholder letter CGG have identified four WA State managed fisheries that have historically had catch effort within the Operational or Acquisition Areas (MMF, PTMF, PFTIMF and NDSMF). Asked whether CGG has distributed this consultation information to relevant licence holders that may be affected? Noted that before WAFIC provides specific feedback on this EP, a further understanding of CGG approach to consultation would be appreciated. WAFIC sent through their Oil and Gas Consultation Framework, which outlines best-practice engagement with the commercial fishing industry regarding seismic surveys. Also noted that they offers fee-for-service to assist titleholders in consultation with the fishing industry. As part of this service, WAFIC advises the best way to consult with individual licence holders that benefits both industries. Noted that titleholders who choose not to use this service are still obligated to consult with the potentially impacted fishers, independently of WAFIC.	The following claims are merited: 1) concerns about the potential impacts of seismic surveys on the fishing industry, specifically those four WA state managed fisheries with historical effort within the OA or acquisition area. 2) Query if CGG has distributed this consultation information to relevant licence holders that may be affected	No new controls or mitigation measures adopted for the following reasons: 1) The EP includes several control measures to avoid disruption/interference with other marine users, including commercial fishers, such as COLREGS, Notice to Mariners, pre-sruvey notifications to fisheries relevant persons indicating location and expected timing, and conducting acquisition outside key fishing seasons. See Section 7.4 of the draft EP for more details. The EP includes implementation of the NERA (2021 Revision 1) CSEP Commercial FIshing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities. See Section 7.1, 7.2, 7.4 for more details. The EP includes a risk assessment of potential cumulative impacts of marine seismic surveys on marine fauna species that has been informed by underwater noise modelling. EP specifies a range of management measures to mitigate potential impacts. See Section 7.2 of the draft EP. 2) CGG are undertaking a completely new identification exercise and consultation with relevant persons, including individual licence holders within the four WA state with hostorical effort within the OA and acquisition area. Fishery specific consultation letters have been	CGG responded to acknowledge the concerns potential impacts of seismic surveys to fishers, and hence they had considerable correspondence with WAFIC during development of the previously accepted EP for the proposed Sauropod seismic survey. A key outcome of this consultation was, as a specific management measure, the implementation of the NERA (2021) CSEP Commercial Fishing Industry Adjustment Protocol (NERA Protocol) to formally manage claims by commercial fishing relevant persons for loss of catch, displacement and lost or damaged fishing gear as a consequence of survey activities during the survey. CGG summarised their consultation process for WAFIC, including the process for identifying relevant persons such as fishers and describing the consultation material that has been sent out to fishers as part of this round of consultation. CGG provided a summary of the consultation process as an attachment, and a copt of the CGG 'EP Ongoing Stakeholder Consultation Procedure'. CGG noted that they would update references in the EP to the latest WAFIC consultation framework, and that given the small footprint and short-duration of the proposed survey and well-developed consultation process they do not believe it necessary to make use of WAFICs fee for service at this point. Thanked WAFIC and said to please get in touch if they wish to discuss the proposed survey further.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
									distributed to relevant persons. Section 5 of the EP describes the consultation methods.	
Western Australian Fishing Industry Council (WAFIC)	4/07/2025	2:51PM	Follow up	Email	4/07/2025 12:00PM	Email	WAFIC acknowledges CGG's clarification regarding their previous involvement and confirms that, since the EP details and acquisition window remain unchanged, they stand by their original feedback from June 2021 and have no further comments.	No objections or claims.	NA	CGG thanked WAFIC for the update and noted that if they have any questions in the future or require further information to please let CGG know.
Western Australian Fishing Industry Council (WAFIC)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Western Australian Game Fishing Association	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Western Australian Game Fishing Association	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Western Australian Game Fishing Association (WAGFA)	19/04/2024	8:30AM	E018	Email						
Western Australian Game Fishing Association (WAGFA)	24/06/2025	03:08 PM	E020	Email	NA	NA	NA	NA	NA	NA
Western Australian Game Fishing Association (WAGFA)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Western Australian Marine Science Institution (WAMSI)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Western Australian Marine Science Institution (WAMSI)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Western Australian Marine Science Institution (WAMSI)	19/04/2024	8:30AM	E018	Email						
Western Australian Marine Science Institution (WAMSI)	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Western Australian Marine Science Institution (WAMSI)	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
WESTERN WILD FISHERIES HOLDINGS PTY LTD	2/06/2023	NA	E010	Post	NA	NA	NA	NA	NA	NA
WESTERN WILD FISHERIES HOLDINGS PTY LTD	14/08/2023	11:00 AM	E013	Registered Post	NA	NA	NA	NA	NA	NA
WESTERN WILD FISHERIES HOLDINGS PTY LTD	11/01/2024	8:10PM	E017	Registered Post	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
WESTERN WILD FISHERIES HOLDINGS PTY LTD	18/04/2024	3:55 PM	E018	Registered Post						
WESTERN WILD FISHERIES HOLDINGS PTY LTD	17/06/2025		E019	Registered Post	NA	NA	NA	NA	NA	NA
WESTERN WILD FISHERIES HOLDINGS PTY LTD	28/08/2025		E023	Registered Post	NA	NA	NA	NA	NA	NA
Whale Shark Swim Dive	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Whale Shark Swim Dive	31/07/2023	04:08 PM	Follow up	Phone	NA	Phone	the relevant person confirmed that they had received the information, and that they haven't had a chance to look at it yet but will respond when they do.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. the relevant person confirmed that they had received the information, and that they haven't had a chance to look at it yet but will respond when they do.
Whale Shark Swim Dive	14/08/2023	02:10 PM	E012	Email	NA	NA	NA	NA	NA	NA
Whale Shark Swim Dive	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Whale Shark Swim Dive	19/04/2024	8:30AM	E018	Email						
Whale Shark Swim Dive	24/06/2025	3:08PM	E020	Email	NA	NA	NA	NA	NA	NA
Whale Shark Swim Dive	26/08/2025	3:15PM	E022	Email	NA	NA	NA	NA	NA	NA
Wilderness Society	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Wilderness Society	31/07/2023	04:10 PM	Follow up	Phone	NA	Phone	the relevant person confirmed they had received the information but requested it be resent so they can send to the appropriate staff member.	No objections or claims.	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. the relevant person noted that they had received the information but there had been a change of staff member around that time and so they hadn't been able to respond. Requested that CGG resend the consultation information and the new staff member will respond.
Wilderness Society	1/08/2023	10:22 AM	Follow up	Email	1/8/23 1:33PM	Email	the relevant person confirmed receipt of the information and said it has been passed on to	No objections or claims.	NA	CGG resent the consultation information to the new email address

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							their Corporates Campaign Manager for a response.			
Wilderness Society	14/08/2023	02:10 PM	E011	Email	14/7/2023 2:11PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	NA
Wilderness Society	11/01/2024	8:10PM	E017	Email	11/01/24 8:10PM	Email	Autoreply and acknowledgement of receipt.	No objections or claims.	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Wilderness Society	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	No response
Wilderness Society	24/06/2025	3:08PM	E020	Email	24/06/2024 3:08PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	No response
Wilderness Society	26/08/2025	3:15PM	E022	Email	26///2025 3:15PM	Email	Autoreply acknowledging receipt of CGG's email	No objections or claims.	NA	No response
World Wildlife Fund for Nature (WWF)	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
World Wildlife Fund for Nature (WWF)	31/07/2023	04:12 PM	Follow up	Phone	NA	Phone	No answer	NA	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. No answer.
World Wildlife Fund for Nature (WWF)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
World Wildlife Fund for Nature (WWF)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
World Wildlife Fund for Nature (WWF)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	Autoreply	No objections or claims	NA	

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
World Wildlife Fund for Nature (WWF)	20/04/2024	12:01 PM	NA	NA	20/04/2024	Email	Response stating enquiry with WWF has been resolved.	No objections or claims.	NA	NA
World Wildlife Fund for Nature (WWF)	24/06/2025	3:08PM	E020	Email	24/06/2024	Email	Autoreply acknowledging receipt of CGG's email (ticket number: 236495)	No objections or claims.	NA	No response
World Wildlife Fund for Nature (WWF)	26/08/2025	3:15PM	E022	Email	26/8/2025 3:16PM	Email	Autoreply acknowledging receipt of CGG's email (ticket number: 243706)	No objections or claims.	NA	No response
World Wildlife Fund for Nature (WWF)	NA	NA	NA	NA	28/8/2025 7:01PM	Email	Automatic email informing CGG that their enquiry (#243706) with WWF-Australia has now been resolved.	No objections or claims.	NA	No response
Yamatji Marlpa Aboriginal Corporation (YMAC)	2/06/2023	03:28 PM	E010	Email	6/6/2023 10:12AM	Email	A member of the YMAC responded stating that they work with the Nyangumarta Rangers whose country includes 80 Mile beach and expressed an interest in meeting with CGG when they visit Broome on the week of the 12th June	No objections or claims.	NA	CGG to follow up with YMAC to coordinate a meeting
Yamatji Marlpa Aboriginal Corporation (YMAC)	6/06/2023	10:38 AM	Inquiry of availability	Phone	6/06/2023 10:38am	Phone	No answer.	NA	NA	CGG called the Port Hedland YMAC office, no response.
Yamatji Marlpa Aboriginal Corporation (YMAC)	6/06/2023	10:38 AM	Inquiry of availability	Phone	6/06/2023 10:38am	Phone	YMAC Perth tried to connect CGG to the Port Hedland Office, with no success. Informed CGG that they would pass on their details to the Port Hedland Project Officer who is the person that would likely want to meet with them. Informed CGG that he is currently in Perth but would be back in Port Hedland next week.	No objections or claims.	NA	CGG called the Perth YMAC office. CGG will wait for the Port Hedland office to contact, and will conduct a follow up call the following day.
Yamatji Marlpa Aboriginal Corporation (YMAC)	8/06/2023	12:30 PM	Inquiry of availability	Phone	NA	Phone	No answer.	NA	NA	CGG called to organise a meeting with Jacob Loughridge, no answer. Left a message with the new visit dates (19-23rd) and requested he call back when possible to organise a meeting.
Yamatji Marlpa Aboriginal Corporation (YMAC)	8/06/2023	12:36 PM	Inquiry of availability	Phone	NA	Phone	No answer.	NA	NA	CGG tried to call the Port Hedland office
Yamatji Marlpa Aboriginal Corporation (YMAC)	12/06/2023	03:44 PM	E010	Email	12/6/2023 4:28PM	Email	The YMAC communications manager responded confirming that they did receive the original consultation material (on the 2nd June) and that this was forwarded to the Land and Sea Management Team and the Nyungumarta Warrarn Aboriginal Corporation at the time.	No objections or claims.	NA	CGG sent a follow up email to the Port Hedland Office Manager. Provided the consultation letter and the dates of the Port Hedland/Broome trip. Requested information on the availability of the Regional Manager for a meeting.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Yamatji Marlpa Aboriginal Corporation (YMAC)	12/06/2023	04:47 PM	E010	Email	13/6/2023 8:49AM	Email	The YMAC Land and Sea Management Program Manager stated that there is no link between Wanparta AC and YMAC.	No objections or claims.	NA	CGG requested clarification as to whether YMAC was linked to Wanparta Aboriginal Corporation, the Ngarla People and the Ngarla Rangers. Asked given the native title area linked to these groups falls within the YMAC RATSIB.
Yamatji Marlpa Aboriginal Corporation (YMAC)	12/06/2023	01:48 PM	Inquiry of availability	Phone	NA	Phone	The Perth office gave CGG the email of the Port Hedland office manager. Also noted that the Karajarri ranger that CGG had been in contact with was often out of range.	No objections or claims.	NA	CGG tried to call the Port Hedland office with no answer so called the Perth office.
Yamatji Marlpa Aboriginal Corporation (YMAC)	12/06/2023	02:01 PM	Inquiry of availability	Phone	NA	Phone	The Nyangumarta IPA Coordinator (Land & Sea Management) noted that he is based between Broome and Bidyadanga and so can not be certain of his movements in advance, but is interested in meeting if he is in Broome.	No objections or claims.	NA	CGG called the Nyangumarta IPA Coordinator (Land & Sea Management) and provided a brief update. Based on his email to CGG wanting to meet up, CGG provided him with updated dates of the visit to Broome.
Yamatji Marlpa Aboriginal Corporation (YMAC)	12/06/2023	03:10 PM	Inquiry of availability	Phone	NA	Phone	The Port Hedland office manager called CGG, following up on a request from the Perth office to reach out to CGG. YMAC noted that the PH office is very small, only the office manager and the regional manager, and so the only person they may want to meet with there would be the regional manager.	No objections or claims.	NA	CGG briefed them on the project, and explained the planned visit and dates.
Yamatji Marlpa Aboriginal Corporation (YMAC)	19/06/2023	NA	Phone call	Phone	NA	Phone	No answer	NA	NA	CGG called the Perth office of YMAC and they tried to transfer to the Port Hedland office but there was no answer.
Yamatji Marlpa Aboriginal Corporation (YMAC)	19/06/2023	NA	Visit to Port Hedland Office	In person	NA	In person	Not available.	NA	NA	CGG attempted to visit the Port Hedland YMAC office twice throughout the day of the 19th June but the gates were shut. CGG left a message on the mobile number shown on the sign.
Yamatji Marlpa Aboriginal Corporation (YMAC)	20/06/2023	02:00 PM	Discussion	In-person	NA	In-person	In person meeting with two members of the YMAC Port Hedland office. CGG discussed the following points with YMAC: 1) YMAC noted the potential value of Sea Country with Dreamtime stories in the coastline area adjacent to the EMBA but the representative could not provide any specific information as their experience and focus was land-based. 2) YMAC provided the contact details for the Program Manager	YMACs claims are merited: 1) The potential value of Sea Country and Dreamtime stories in the coastline area adjacent to the EMBA. 2) YMAC identified additional potentially relevant persons.	1) The potential existence of Sea Country and Dreamtime stories in the marine and coastal environment of the Yamatji Marlpa area has been included in the Existing Environment description in the EP (see Section 4.4.8.3.3). CGG has also adopted an additional measure to engage with First Nations groups, including IPA managers, in the unlikely event of an oil spill to seek input into spill response planning (see	CGG attended a meeting with two YMAC representatives at the Port Hedland office. CGG presented a map of the survey area, and left the information brochure and flyer with them. CGG discussed the following points with YMAC: 1) CGG asked if they have any information they wish to provide on cultural features and/or heritage values within the activity area. 2) CGG asked if either of them

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							for Land and Sea Management with the Yamatji Marlpa and who had set up the Ranger Program. YMAC also indicated that CGG should also talk to Ngarla and Nyangumarta Peoples.		Section 4.4.8 of the OPEP). 2) CGG has contacted and consulted with the YMAC Program Manager for Land and Sea Management, and is already in consultation with the Ngarla and Nyangumarta Peoples via the Wanparta AC, Nyangumarta Warrarn AC and Nyangumarta Karajarri AC.	were aware of any other relevant parties who may be affected by the survey, or aware of any people, who in accordance with Indigenous tradition, that may have spiritual and cultural connections to the environment that may be affected by the activity that have not yet been afforded the opportunity to provide information that may inform the management of the activity.
Yamatji Marlpa Aboriginal Corporation (YMAC)	20/06/2023	PM	Discussion	In-person	NA	In-person	Discussion with the Program Manager of the Land and Sea Management Program. They acknowledged that they had already been in contact with CGG via email. 1) They noted that they do not personally hold any cultural knowledge, but that the Nyangumarta IPA Management Plan and 80 Mile Beach Management Plan provide details of the importance of Sea Country. 2) They suggested that CGG speak with the IPA coordinator for YMAC.	YMACs claims are merited: 1) The IPA Management Plan (Nyangumarta Warrarn AC & YMAC 2022) and 80 Mile Beach Management Plan (DBCA 2014) provide details on Sea Country 2) Suggested CGG speak with the IPA coordinator of YMAC.	1) CGG has incorporated details of Sea Country from the two Management Plans referenced here into the Existing Environment description in the EP (see Table 4-16 and Table 4-17) and considered these values and sensitivities in the impact assessment. 2) CGG is already in discussion with the IPA coordinator.	CGG spoke with the YMAC Program Manager of the Land and Sea Management Program. 1) CGG asked whether they had any information the wish to provide on cultural features and/or heritage values within the activity area. 2) CGG asked if they were aware of any other relevant parties who may be affected by the survey.
Yamatji Marlpa Aboriginal Corporation (YMAC)	21/06/2023	AM	Availability enquiry	Text messages	NA	NA	IPA coordinator agreed to meeting with CGG	No objections or claims.	NA	CGG texted the IPA coordinator to arrange a meeting. Meeting organised for 1:30PM Friday 23rd June
Yamatji Marlpa Aboriginal Corporation (YMAC)	23/06/2023	01:30 PM	Meeting	In-person	NA	In-person	CGG visited the YMAC Land and Sea Coordinator/Nyangumata IPA manager for the pre-arranged meeting. 1) The YMAC representative did not express any concerns or comments relating to the survey. 2) The YMAC representative did not identify any specific features, and noted that unlike the KTLA they don't have a sea country claim yet. 3) YMAC were interested in whether the survey may find evidence of ancient coastline inhabitance. 4) YMAC noted that CGG had covered all impacts and didn't see any issue with the survey. 5) YMAC accepted CGG's offer to send an email with a short description and a request for a teams meeting.	No objection or claim made. Advice / request for further information only. The YMAC expressed an interest in the potential for the survey data to help identify evidence of ancient coastline inhabitance.	CGG considered whether the seismic data could be provided in order to contribute to future underwater heritage surveys but it was found to be commercially unfeasible to release confidential data.	CGG visited the YMAC Land and Sea Coordinator/Nyangumata IPA manager for the pre-arranged meeting. CGG provided the representative with the stakeholder slide pdf and explained the details of how the survey would be undertaken and the potential impacts from the survey on FN cultural and spiritual values/features. 1) CGG stated that they were interested in understanding whether the Nyangumarta people may have any concerns or comments on the survey at any point during the consultation period. 2) CGG stated that they were interested in whether there were any cultural or spiritual values/features associated with the ancient coastline where the

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										survey would occur or waters closer to the 80 Mile Beach and Broome area where the EMBA might overlap. 3) CGG explained that the data output was focussed on deeper layers of the seabed but whilst the surface detail was more limited it may provide evidence of old rivers and coastlines. CGG stated that they would check the possibility of providing information from the survey to YMAC. No further request from YMAC was made on this topic. 4) CGG asked Jacob if there was anything other information they required or if they had any further comments including thoughts on cultural features/values. 5) CGG offered to send an email with a short description and a request for a teams meeting, which YMAC agreed to.
Yamatji Marlpa Aboriginal Corporation (YMAC)	5/07/2023	10:10 AM	Follow up email	Email	5/7/2023 10:14AM	Email	An out of office email was received for one of the members of YMAC	No objections or claims.	NA	CGG contacted the YMAC to request that the survey be formally considered by the YMAC and any concerns provided to CGG. CGG also proposed a teams meeting with the executive team. CGG provided the consultation material.
Yamatji Marlpa Aboriginal Corporation (YMAC)	10/07/2023	09:57 AM	Follow up email	Email	10/7/2023 9:19AM	Email	One of the members of YMAC responded to state that the best person to speak to was currently away, and that they would respond when they return.	No objections or claims.	NA	CGG thanked the YMAC member for their response and stated that they were looking forward to hearing from the recommended staff member when they return.
Yamatji Marlpa Aboriginal Corporation (YMAC)	25/07/2023	12:20 PM	Follow up	Email	17/7/2023 10:01AM	Email	The Program Manager for Land and Sea Management provided CGG with the details of the NWAC General Manager and requested they be included in future conversations as they will be able to advise a time to suit a NWAC board discussion.	Requested to include the NWAC General Manager in future discussions and communication.	CGG to include the NWAC General Manager in future discussions and communication.	CGG thanked the YMAC for the introduction, and noted that at the appropriate time, we would welcome the opportunity to discuss our survey further with the board. In the meantime, if YMAC have any questions, or require any further information, please let CGG know.
Yamatji Marlpa Aboriginal Corporation (YMAC)	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Yamatji Marlpa Aboriginal Corporation (YMAC)	9/10/2023	04:03 PM	Follow up	Email	NA	NA	NA	NA	NA	The CGG team will be in Broome on 10th and 11th October 2023 and will be available to discuss the proposed Sauropod survey.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										Please get in touch if you would like to arrange a meeting with us.
Yamatji Marlpa Aboriginal Corporation (YMAC)	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Yamatji Marlpa Aboriginal Corporation (YMAC)	19/02/2024	3:08 PM	Follow up	Email	19/02/2024 10:47 AM	Email	Can you please advise who else in YMAC is subscribed to this email group? Can you tell me whose Country you are working on?	No objections or claims, request for information only.	NA	We have the following YMAC contacts and associated email addresses registered to the CGG Sauropod mailing list. Please let us know if there are any additional relevant persons or contact details that you think CGG should be sending project updates to. In regard to whose country we

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										will be working on, the Sauropod MSS will be occurring in the offshore marine environment. The figure below shows the location of the seismic survey in relation to adjacent Native Title Claims and Determinations. The Operational Area of this project does not directly overlap any active Native Title claims or IPAs. However, it does occur adjacent to the lands of a number of First Nations Peoples. Adjacent groups that are connected to YMAC include the Karajarri Traditional Lands Association, Yindjibarndi AC, Kariyarra AC and Ngarluma AC.
Yamatji Marlpa Aboriginal Corporation (YMAC)	19/04/2024	8:30AM	E018	Email	19/04/2024	Email	An out of office email was received for one of the members of YMAC	No objections or claims.	NA	
Yamatji Marlpa Aboriginal Corporation (YMAC)	24/06/2025	6:11PM	E021	Email	24/06/2025 6:11PM	Email	Automatic reply from the admin personel stating that they are out of the office and providing the phone number of an alternative contact for if the matter is urgent.	No objections or claims.	NA	CGG added the phone number to the existing contact details and will call if no response is received from YMAC.
Yamatji Marlpa Aboriginal Corporation (YMAC)	14/07/2025		Initial phone call	Phone call	NA	Phone	CGG spoke with the contact person and explained the project and inform them that community consultation was being conducted again, and asked if they had received the consultation letter. The relevant person acknowledged that CGG had already included the heritage and research team in the initial email, and noted that one of the listed contacts no longer works at YMAC. The relevant person said they would forward the initial email again, noting that CGG had called and could they please call CGG back or respond via email.	No objections or claims.	NA	CGG spoke with a contact at YMAC to explain the project and inform them about the ongoing community consultation, inquiring if they had received the consultation letter. The contact person confirmed that CGG had already included the heritage and research team in the initial email but mentioned that one listed contact no longer works at YMAC. They agreed to resend the initial email and requested CGG to return the call or reply via email.
Yamatji Marlpa Aboriginal Corporation (YMAC)	26/08/2025	5:18PM	E024	Email	NA	NA	NA	NA	NA	NA
Yawuru Native Title Holders Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Yawuru Native Title Holders	16/06/2023	02:18 PM	Follow up call	Phone	NA	Phone	Yawuru AC said that the normal staff were still not available, but	No objections or claims.	NA	CGG called back the Yawuru AC.

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Aboriginal Corporation RNTBC							provided the email of the Executive Assistant.			
Yawuru Native Title Holders Aboriginal Corporation RNTBC	16/06/2023	02:35 PM	Follow up email	Email	NA	NA	No answer.	NA	NA	CGG provided the consultation material to the Executive Assistant and provided the dates of the trip to Broome and Port Hedland.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	16/06/2023	12:33 PM	Initial phone call	Phone	NA	Phone	Yawuru AC said that the normal staff were not available, but that the Land & Sea Management team would be the members of the AC that would likely be interested.	No objections or claims.	NA	CGG called Yawuru AC, who said that the normal staff were out of office and to please call back in the afternoon.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	22/06/2023	09:00 AM	Discussion	In-person	NA	In-person	The executive officer agreed to discuss the project with the CEO and would inform the rangers about the drop in session later that day. Noted that everyone was busy today but possibly had time tomorrow.	No objections or claims.	NA	CGG visited the Yawuru AC Broome office.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	5/07/2023	10:30 PM	Follow up email	Email	NA	NA	NA	NA	NA	CGG emailed the relevant person to thank them for the talk in Port Hedland, to request that the survey be formally considered by the relevant person and any concerns provided to CGG. CGG also proposed a teams meeting to discuss their concerns. CGG provided the consultation material.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	13/07/2023	02:05 PM	Meeting arrangements	Email	11/7/2023 1:45PM	Email	the relevant person provided a written response to CGGs recent consultation enquiries in which they noted that the Yawuru PBC is the appropriate body for CGG to engage with to reach the Yawuru community, and they noted when the next quarterly meeting was scheduled and asked if CGG would be available to present during the meeting.	No objections or claims.	NA	CGG responded to inform the relevant person that they would be available and willing to present at the upcoming meeting. CGG requested further details re the time and format.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	24/07/2023	NA	Meeting arrangements	Email	20/07/2023	Email	Yawuru AC emailed CGG to inform them that the agenda for the August board meeting is already full but they could potentially offer them a slot at the following meeting on 11 October.	No objections or claims.	NA	CGG stated that they would be happy to present at the next meeting on 11 October. Noted that they are mindful of the Committee's time and will ensure our presentation is delivered promptly at the meeting.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Yawuru Native Title Holders Aboriginal Corporation RNTBC	19/09/2023	4:09PM	Meeting arrangements	Email	19/09/2023 4:24PM	Email	Yawuru AC emailed the Teams link to the meeting through	No objections or claims.	NA	CGG replied to confirm that they will attend the board meeting in person, and checking whether it was possible to have another colleague attend via Teams. Noted that they are finalising their presentation and will send over shortly.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	19/09/2023	NA	NA	NA	19/09/2023 11:57	Email	Yawuru AC emailed CGG to confirm that CGG are scheduled to present at the PBC Board Meeting on 11 October at 1pm; and requested a copy of CGG's presentation	No objections or claims.	NA	NA
Yawuru Native Title Holders Aboriginal Corporation RNTBC	20/09/2023	5:26PM	Meeting arrangements	Email	19/09/2023 4:24PM	Email	Yawuru AC agreed that an open discussion as opposed to a long presentation would be a better approach.	No objections or claims.	NA	CGG provided a copy of the presentation. CGG offered to have more of an open discussion during the meeting itself.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	2/10/2023	05:44 AM	Meeting arrangements	Email	NA	NA	NA	NA	NA	CGG thanked Yawuru AC for the clarification and noted that they will facilitate a discussion.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	11/10/2023	1:00PM	Meeting	In person	NA	In-person	CGG attended the Board of Directors meeting in Broome to present on the Sauropod project and its potential impacts. The relevant person enquired on the following topics: 1) do you have measures to protect whales. 2) Can you explain airgun 3) Has the EP been submitted 4) Will it lead to drilling 5) Who is CGG 6) Who is CGGs client? 7) How long will the survey go for 8) Will vessels come into port 9) Will they be notified when the survey start/finish 10) This is likely the start of more activity, thus what opportunities are there for FN people moving forward.	No objections or claims, only requests for more information. 9) The query as to whether they be notified when the survey starts and finishes is merited 10) The query regarding opportunities for FN people is considered merited.	CGG answered each of the relevant persons enquiries and will send additional information after the meeting. 9) The Sauropod MSS EP includes control measure relating to notifying relevant persons at the start and end of the seismic survey. See Section 9.12 of the EP for more detail. 10) If and when the Sauropod MSS EP is accepted, CGG will communicate with Yawuru regarding the opportunity to provide training.	CGG attended the Board of Directors meeting in Broome to present on the Sauropod project and its potential impacts. CGG discussed each of the relevant persons queries with them: 1) CGG explained that they had a number of measures to protect whales in the EP controls. These included the proposed timing window of the survey being chosen to avoid the Humpback whale migration and to limit overlap with the Pygmy Blue Whale migration periods, 'soft starts' and the use of marine fauna observers (MFOs). 2) CGG explained to the Board how an airgun works. 3) CGG explained the process of submitting an EP and the history of this particular EP, including the fact that it had previously been submitted, but that this particular update had not been submitted yet. 4) CGG explained that they could not confirm whether conducting this seismic MSS would lead to drilling as this will depend on the results of the survey and numerous other factors. They also noted that if drilling was of interest to any

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										companies it would be the subject of a completely new EP that would be assessed on its own merits, and that the Yawuru AC would be provided an opportunity to consult on that. 5) CGG explained the background and history of their company. 6) CGG is the document holder for the EP and will undertake the seismic survey, but 3D Oil are the titleholders. 7) CGG explained that the MSS is planned to occur within the window of early January to the end of May in either 2024 or 2025 with acquisition taking a maximum of 60 days. 8) Vessels will be cleared to coastal status before the survey, and during the survey the seismic vessel will not enter Port. However, there is potential for support vessels to enter Port. 9) CGG confirmed that they would be notified prior to the start of the survey and upon completion. 10) CGG noted that there is potential for MMO training.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	12/10/2023	5:00PM	Follow up	Email	NA	NA	NA	NA	NA	CGG sent a follow up email to the Yawuru AC after the meeting to thank them for their time. CGG noted that they appreciated the interest of the Yawuru AC, and would be grateful if they could detail any further concerns or comments for CGG to consider. CGG provided the link to the EP and the NOPSEMA public comment portal.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Yawuru Native Title Holders Aboriginal Corporation RNTBC	24/06/2025	6:14PM	E021	Email	NA	NA	NA	NA	NA	NA
Yawuru Native Title Holders Aboriginal Corporation RNTBC	16/06/2025	12:24PM	Initial phone call	Phone call	NA	Phone	CGG called the listed contact for the Yawuru AC and enquired if they have reached the Yawuru AC. The person who answered replied no and that CGG must have the wrong number, explaining they were Juluwarlu not Yawuru.	No objections or claims.	NA	CGG called the listed contact for the Yawuru AC but was informed by the person who answered that they had reached the wrong number, as the respondent was from Juluwarlu, not Yawuru.
Yawuru Native Title Holders Aboriginal Corporation RNTBC	24/07/2025	4:33PM	E021	Email	NA	NA	NA	NA	NA	CGG sent the E021 consultation letter to another contact for the Yawuru AC, explaining the project and asking them to get in contact with CGG if they have any questions or comments.
Yawuru Native Title Holders Aboriginal	26/08/2025	5:01PM	E024	Email	NA	NA	NA	NA	NA	NA

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
Corporation RNTBC										
Yindjibarndi Aboriginal Corporation RNTBC	2/06/2023	03:28 PM	E010	Email	NA	NA	NA	NA	NA	NA
Yindjibarndi Aboriginal Corporation RNTBC	16/06/2023	12:29 PM	Initial phone call	Phone	NA	Phone	No answer.	NA	NA	CGG attempted to call, no answer so CGG left a voice message with details of the project
Yindjibarndi Aboriginal Corporation RNTBC	3/08/2023	04:48 PM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG called the relevant person to check that they had received the consultation information and to check if they wanted to discuss the project. No answer.
Yindjibarndi Aboriginal Corporation RNTBC	14/08/2023	02:10 PM	E011	Email	NA	NA	NA	NA	NA	NA
Yindjibarndi Aboriginal Corporation RNTBC	17/08/2023	11:36 AM	Follow up	Phone	NA	Phone	No answer.	NA	NA	CGG attempted to call, no answer so CGG left a voice message with details of the project
Yindjibarndi Aboriginal Corporation RNTBC	11/01/2024	8:10PM	E017	Email	NA	NA	NA	NA	NA	CGG has provided all relevant persons sufficient information and a reasonable period of time to make an informed assessment of potential impacts and risks of the activity on their functions, interests or activities. CGG has also provided sufficient time for relevant persons to provide feedback to CGG on any objections or claims about the seismic survey. Feedback provided to CGG included in the EP. CGG has discharged its duty under regulation 11A and considers that consultation under regulation 11A is complete. Consultation continues throughout the EP assessment stage, so please contact the CGG team should you require any further information or have any questions. If the EP is accepted by NOPSEMA, CGG will continue to consult with relevant persons under Regulation 14(9). CGG will also continue to identify relevant persons during NOPSEMA's review of the EP and after acceptance of the EP. If you are aware of anyone who could be a relevant person that

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
										we have not yet contacted, please ask them to contact us. If new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims raised will be managed as per the process outlined in the EP.
Yindjibarndi Aboriginal Corporation RNTBC	19/04/2024	8:30AM	E018	Email						
Yindjibarndi Aboriginal Corporation RNTBC	24/06/2025	6:16PM	E021	Email	NA	NA	NA	NA	NA	NA
Yindjibarndi Aboriginal Corporation RNTBC	14/07/2025	3:18PM	Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the listed contact for Yindjibarndi AC, leaving a voicemail explaining the project and requesting a call back.
Yindjibarndi Aboriginal Corporation RNTBC	26/08/2025	5:02PM	E024	Email	NA	NA	NA	NA	NA	NA
YMAC - Land & Sea Management	19/04/2024	8:30AM	E018	Email						
YMAC - Land & Sea Management	24/06/2025	6:18PM	E021	Email	NA	NA	NA	NA	NA	NA
YMAC - Land & Sea Management	14/07/2025		Initial phone call	Phone call	NA	Phone	NA	NA	NA	CGG called the mobile of a listed contact at YMAC. CGG left a voicemail stating some consultation information was sent via email a few weeks ago, and were calling to check they had received it and if they had any concerns or queries about the project. CGG requested a call back.
Yamatji Marlpa Aboriginal Corporation (YMAC) - Land and Sea Management	26/08/2025	5:05PM	E024	Email	NA	NA	NA	NA	NA	NA
Yamatji Marlpa Aboriginal Corporation (YMAC) - Land and Sea Management	16/09/2025	12:19PM	Response	Email	27/8/2025 9:33AM	Email	YMAC land and sea management contact thanked CGG for sending the consultation newsletter. The contact asked 'would any of this seismic survey result in detailed ocean floor mapping and can this be shared with Traditional Owner groups? Our ranger team is currently expanding out to include sea country management and as a result we	No objections or claims. YMAC made several requests regarding information provision and training opportunities.	No new controls or mitigation measures adopted. CGG responded to queries relating to training opportunities and information requests. Information requested will be provided as part of ongoing consultation.	CGG thanked the YMAC land and sea contact for their response and clarified that the Sauropod survey aims to image geological horizons more than 1,000 meters below the seabed, resulting in seabed images that primarily highlight bathymetric changes rather than detailed features. As such, the image is not particularly detailed. CGG included an example image from

Relevant Person Code / Organisation	Date from CGG	Time	Document from CGG	Mode from CGG	Date from Relevant Person	Mode from Relevant Person	Relevant Person Response Summary	Assessment of the Merited Objections and Claims	Controls/ measures adopted or proposed to adopt	Summary of Titleholders Response, or proposed response
							have several rangers and staff who will have completed the coursework component of Coxswain Grade II, would there be scope for rangers or staff to participate in the survey either on the large or support vessel? This would assist the rangers fulfilling the sea time component of the qualification and provide a great opportunity to experience marine survey techniques.'			a different survey and offered to share a similar image from the Sauropod survey if desired. CGG also explained that it is challenging to have ranger team members or staff onboard during the survey due to mandatory offshore training requirements, including BOSIET safety training and comprehensive medical assessments, which are prerequisites for working offshore. CGG emphasised that accommodating additional personnel is not simply a matter of space on the vessel. CGG invited YMAC to reach out if they have any further questions.

Appendix D: Underwater Sound Modelling

3D Oil Sauropod 3-D Marine Seismic Survey

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

Submitted to:

Jared Davidson
Environmental Resources Management

Authors:

Jorge Quijano
Craig McPherson

11 June 2020

P001483-002
Document 01781
Version 1.1

JASCO Applied Sciences (Australia) Pty Ltd.
Unit 1, 14 Hook Street
Capalaba, Queensland, 4157
Tel: +61 7 3823 2620
www.jasco.com



Disclaimer:

The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

Suggested citation:

Quijano, J.E. and C.R. McPherson. 2020. *3D Oil Sauropod 3-D Marine Seismic Survey: Acoustic Modelling for Assessing Marine Fauna Sound Exposures*. Document 01781, Version 1.1. Technical report by JASCO Applied Sciences for Environmental Resources Management.

Contents

EXECUTIVE SUMMARY 1
1. INTRODUCTION 4
2. MODELLING SCENARIOS 5
3. NOISE EFFECT CRITERIA 6
3.1. Cetaceans 7
3.1.1. Behavioural response 7
3.1.2. Injury and hearing sensitivity changes 7
3.2. Fish, Turtles, Fish Eggs, and Fish Larvae 8
3.2.1. Turtles 9
3.3. Benthic Invertebrates (Crustaceans and Bivalves) 10
4. METHODS 11
4.1. Acoustic Source Model 11
4.2. Sound Propagation Models 11
4.3. Parameter Overview 11
4.4. Accumulated SEL 12
4.5. Geometry and Modelled Regions 12
5. RESULTS 13
5.1. Acoustic Source Levels and Directivity 13
5.2. Per-pulse Sound Fields 14
5.2.1. Tabulated results 14
5.2.2. Sound field maps and graphs 16
5.2.3. Particle motion 23
5.3. Multiple Pulse Sound Fields 24
6. DISCUSSION 26
6.1. Overview and Source Levels 26
6.2. Per-Pulse Sound Fields 26
6.3. Particle Motion 26
6.4. Multiple Pulse Sound Fields 27
6.5. Summary 27
GLOSSARY 30
LITERATURE CITED 34
APPENDIX A. ACOUSTIC METRICS A-1
APPENDIX B. ACOUSTIC SOURCE MODEL B-1
APPENDIX C. SOUND PROPAGATION MODELS C-1
APPENDIX D. METHODS AND PARAMETERS D-1
APPENDIX E. ADDITIONAL RESULTS E-1

Figures

Figure 1. Overview of the modelling sites, acquisition lines, and features for the 3-DSauropod 3-D MSS modelling. 5
Figure 2. *Site 1, per-pulse SEL:* Sound level contour map showing unweighted maximum-over-depth results. 16
Figure 3. *Site 1, SPL:* Sound level contour map showing unweighted maximum-over-depth results..... 17
Figure 4. *Site 2, per-pulse SEL:* Sound level contour map showing unweighted maximum-over-depth results. 17
Figure 5. *Site 2, SPL:* Sound level contour map showing unweighted maximum-over-depth results..... 18
Figure 6. *Site 3, per-pulse SEL*: Sound level contour map showing unweighted maximum-over-depth results. 18
Figure 7. *Site 3, SPL:* Sound level contour map showing unweighted maximum-over-depth results..... 19
Figure 8. *Site 4, per-pulse SEL*: Sound level contour map showing unweighted maximum-over-depth results. 19
Figure 9. *Site 4, SPL:* Sound level contour map showing unweighted maximum-over-depth results..... 20
Figure 10. *Site 1, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. 20
Figure 11. *Site 2, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. 21
Figure 12. *Site 3, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. 21
Figure 13. *Site 4, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. 22
Figure 14. Site 1: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions. 23
Figure 15. Sound level contour map showing maximum-over-depth SEL_{24h} results. 25
Figure 16. Sound level contour map showing seafloor SEL_{24h} results. 25

Figure A-1. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2018). A-4
Figure B-1. Predicted source level details for the 3090 in^3 array at a 6 m towed depth. B-2
Figure B-2. Directionality of the predicted horizontal source levels for the 3090 in^3 seismic source array, 10 Hz to 2 kHz. B-3
Figure C-1. The N×2-D and maximum-over-depth modelling approach used by MONM. C-1
Figure C-2. PK and SPL and per-pulse SEL versus range from a 20 in^3 seismic source. C-2
Figure D-1. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two different scenarios. D-1
Figure D-2. Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. D-2
Figure D-3. Bathymetry map of the modelling area. D-3
Figure D-4. The final sound speed profile (May) used for the modelling showing the entire water column (left) and the top 300 m within the profile (right). D-4
Figure D-5. Layout of the modelled 3090 in^3 seismic source array. D-5
Figure E-1. Site 2: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions. E-1
Figure E-2. Site 3: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions. E-2

Figure E-3. Site 4: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions. E-3

Tables

Table 1. Summary of maximum cetacean PTS onset distances for 24-h SEL modelled scenarios..... 1
Table 2. Distances to turtle behavioural response criteria. 2
Table 3. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios 2
Table 4. Location details for the modelling sites. 5
Table 5. Unweighted SPL, SEL_{24h}, and PK thresholds for acoustic effects on cetaceans. 7
Table 6. Criteria for seismic noise exposure for fish and turtles 9
Table 7. Far-field source level specifications for the 3090 in^3 array, for a 6 m tow depth. 13
Table 8. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3090 in^3 array to modelled maximum-over-depth unweighted per-pulse SEL isopleths from the four modelled single impulse sites. 14
Table 9. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3090 in^3 array to modelled maximum-over-depth SPL isopleths from the four modelled single impulse sites. 14
Table 10. Maximum (R_{max}) horizontal distances (km) from the 3090 in3 array to modelled maximum-over-depth peak pressure level (PK) thresholds 15
Table 11. Maximum (R_{max}) horizontal distances (in km) from the 3090 in^3 array to modelled maximum-over-depth peak-peak pressure level threshold (178 dB re 1µPa, PK-PK) 15
Table 12. Maximum (R_{max}) horizontal distances (in m) from the 3090 in^3 array to modelled seafloor peak pressure level thresholds (PK) from four single-impulse modelling sites (Table 4). 15
Table 13. Maximum (R_{max}) horizontal distances (in m) from the 3090 in^3 array to modelled seafloor peak-peak pressure level thresholds (PK-PK) from four modelling sites (Table 4). 16
Table 14. Maximum-over-depth distances to SEL_{24h} based marine mammal PTS and TTS thresholds (NMFS 2018). 24
Table 15. Distances to SEL_{24h} based fish criteria. 24
Table 16. Summary of maximum cetacean PTS onset distances for SEL_{24h} modelled scenarios (PK values from Table 10 and SEL_{24h} values from Table 14) 28
Table 17. Distances to turtle behavioural response criteria (from Table 9). 28
Table 18. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios 29

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2018). A-3
Table D-1. Geoacoustic profile for all sites in this study. D-4
Table D-2. Layout of the modelled 3090 in^3 seismic source array. D-5

Executive Summary

JASCO Applied Sciences performed a numerical estimation study of underwater sound levels associated with the planned 3D Oil Sauropod 3-D Marine Seismic Survey (MSS) to assist in understanding the potential acoustic impact on key regional receptors including fish, cetaceans, turtles, benthic invertebrates, and plankton. Modelling considered a 3090 in^3 seismic source in a flip-flap-flop configuration, towed at a 6 m depth behind a single vessel.

A specialised airgun array source model was used to predict the acoustic signature of the seismic source, and complementary underwater acoustic propagation models were used in conjunction with the modelled array signature to estimate sound levels over a large area around the source. Single-impulse sound fields were predicted at defined locations within the Acquisition Area, and accumulated sound exposure fields were predicted for one representative scenario for likely survey operations over 24 hours.

The modelling methodology considered source directivity and range-dependent environmental properties in each of the areas assessed. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. Particle motion metrics were predicted at four modelled sites. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied to all modelling.

The analysis considered the distances away from the seismic source at which several effects criteria or relevant sound levels were reached. The results are summarised below for the representative single-impulse sites and accumulated SEL scenarios.

Cetacean injury and behaviour

- The maximum distance where the NMFS (2014) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) could be exceeded varied between 6.47 and 8.36 km (Site 2 and Site 1, water depths of 125 66 m respectively).
- The results for the criteria applied for marine mammal Permanent Threshold Shift (PTS), NMFS (2018), consider both metrics within the criteria (PK and SEL_{24h}). The longest distance associated with either metric is required to be applied. The table below summarises the maximum distances for PTS, along with the relevant metric.
- The 24-h SEL is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours considering that an animal is consistently exposed to such noise levels at a fixed position. The corresponding 24-h SEL radii for low-frequency cetaceans were larger than those for peak pressure criteria, but they represent an unlikely worst-case scenario. More realistically, marine mammals (and fish) would not stay in the same location for 24 hours. Therefore, a reported radius for 24-h SEL criteria does not mean that marine fauna travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with injury (either PTS or TTS) if it remained in that location for 24 hours.

Table 1. Summary of maximum cetacean PTS onset distances for 24-h SEL modelled scenarios.

Relevant hearing group	Metric associated with longest distance to PTS onset	R_{max} (km)
Low-frequency cetaceans	SEL_{24h}†	0.63
Mid-frequency cetaceans	PK	<0.02
High-frequency cetaceans	PK	0.23

† The model does not account for shutdowns.

Turtles

- The PK turtle injury criteria of 232 dB re 1 µPa for PTS and 226 dB re 1 µPa for TTS from Finneran et al. (2017) was not exceeded at a distance greater than 20 m from the centre of the

array. Because the array is not a point source (approximately 14 × 8 m), the actual ranges from the edge of the airgun array is small.

- The distances to where the NMFS criterion (NSF 2011) for behavioural effects in turtles of turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b) could be exceeded are summarised in Table 2.

Table 2. Distances to turtle behavioural response criteria.

SPL (L_p; dB re 1 µPa)	Distance (km)	
	Min	Max
175†	1.00	1.20
166‡	3.28	5.10

† Threshold for turtle behavioural response to impulsive noise (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b).
‡ Threshold for turtle behavioural response to impulsive noise (NSF 2011).

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK and SEL_{24h} metrics associated with mortality and potential mortal injury and impairment in the following groups:
  - Fish without a swim bladder (also appropriate for sharks in the absence of other information)
  - Fish with a swim bladder that do not use it for hearing
  - Fish that use their swim bladders for hearing
  - Fish eggs and fish larvae
- Table 3 summarises the distances to injury criteria for fish, fish eggs, and fish larvae along with the relevant metric.

Table 3. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios.

Relevant hearing group	Injury criteria	Water column		Seafloor	
		Metric associated with longest distance to injury criteria	R_{max} (km)	Metric associated with longest distance to injury criteria	R_{max} (km)
Fish: No swim bladder	Injury	PK	0.06	PK	0.08
	TTS	SEL_{24h}	2.81	SEL_{24h}	2.79
Fish: Swim bladder not involved in hearing Swim bladder involved in hearing	Injury	PK	0.13	PK	0.19
	TTS	SEL_{24h}	2.81	SEL_{24h}	2.79
Fish eggs, and larvae	Injury	PK	0.13	PK	0.19

Crustaceans and Bivalves, Sponges and Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following have been determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) was considered; it was reached at ranges between 468 and 709 m depending on the modelled site.
- Bivalves: the distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). The maximum horizontal distance to this particle acceleration level was 9.1 m.
- Sponges and coral: The PK sound level at the seafloor directly underneath the seismic source was estimated at all modelling sites considered for seafloor fish receptors and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was found that the level was not reached at any of the four considered sites.
- Plankton: The distance to the sound level of 178 dB re 1 µPa PK-PK from McCauley et al. (2017) was estimated at two modelling sites through full-waveform modelling using FWRAM; the results ranged from 5.32 km to 7.93 km.

1. Introduction

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the planned 3D Oil Sauropod 3-D Marine Seismic Survey (MSS) in permit WA-527-P to assist in understanding the potential acoustic impact on key regional receptors including fish, cetaceans, benthic invertebrates, plankton, and turtles. Modelling considered a 3090 in^3 seismic source in a flip-flap-flop configuration, towed at a 6 m depth behind a single vessel.

JASCO's specialised Airgun Array Source Model (AASM) was used to predict the acoustic signature of the array. AASM accounts for individual airgun volumes and array geometry. Complementary underwater acoustic propagation models were used in conjunction with the modelled array signature to estimate sound levels over a large area around the source. Single-impulse sound fields were predicted at defined locations within the Acquisition Area, and accumulated sound exposure fields were predicted for one representative scenario for likely survey operations over 24 h. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied at each of the modelling locations.

The modelling methodology considered source directivity and range-dependent environmental properties. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. Particle motion metrics were predicted at the modelled locations along the broadside directions associated with the highest levels.

2. Modelling Scenarios

Four standalone single impulse sites and one likely scenario for survey operations over 24 hours to assess accumulated SEL were defined. The locations of all modelling sites are provided in Table 4, with all sites and the acquisition lines shown in Figure 1 along with the survey boundaries. The modelling assumed that the survey vessel sailed along the survey lines at ~4.4 knots, with an impulse interval of 12.5 m. The considered survey acquisition lines took ~10.18 h (each) to traverse with ~5.2 h of turn time required between the lines, accounted for 13280 impulses. During line turns the seismic source was not in operation.

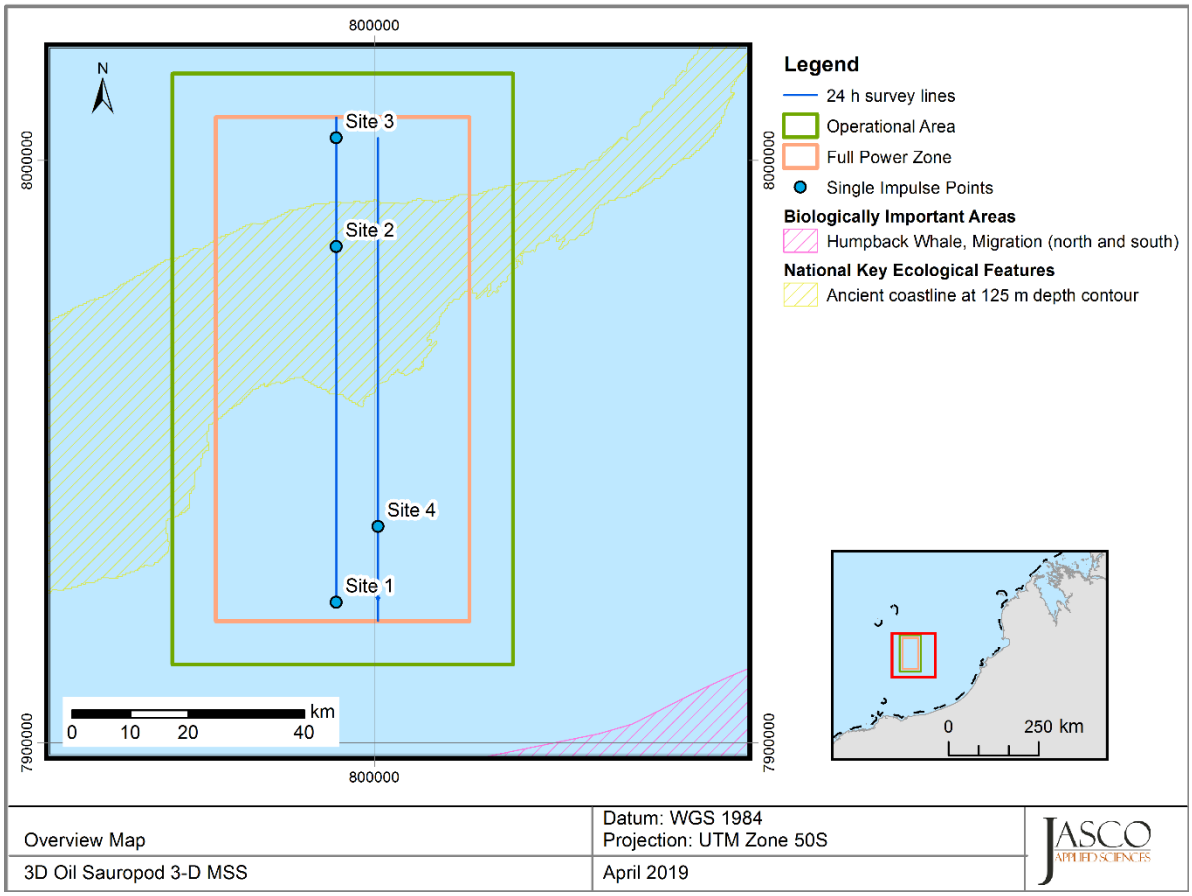


Figure 1. Overview of the modelling sites, acquisition lines, and features for the 3-DSauropod 3-D MSS modelling.

Table 4. Location details for the modelling sites.

Site	Latitude (S)	Longitude (E)	UTM (WGS1984) Zone 50S		Water depth (m)	Representative tow direction (°)
			X (m)	*Y* (m)		
1	18° 45' 14.3694"	119° 46' 58.6168"	793425	7924100	66	0 & 180
2	18° 12' 08.6755"	119° 46' 26.6060"	793425	7985200	125	
3	18° 02' 00.9264"	119° 46' 17.0335"	793425	8003900	161	
4	18° 38' 07.1558"	119° 50' 57.1375"	800625	7937133	107	

3. Noise Effect Criteria

The perceived loudness of sound, especially impulsive noise such as from seismic airguns, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content. Several sound level metrics, such as PK, SPL, and SEL, are commonly used to evaluate noise and its effects on marine life (Appendix A). The period of accumulation associated with SEL is defined, with this report referencing either a "per pulse" assessment or over 24 h. Appropriate subscripts indicate any applied frequency weighting; unweighted SEL is defined as required. The acoustic metrics in this report reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405.2:2017 (2017b).

Whether acoustic exposure levels might injure or disturb marine mammals is an active research topic. Since 2007, several expert groups have investigated an SEL-based assessment approach for injury, with a handful of key papers published on the topic. The number of studies that investigated the level of disturbance to marine animals by underwater noise has also increased substantially.

We chose the following noise criteria and sound levels for this study because they include standard thresholds, thresholds suggested by the best available science, and sound levels presented in literature for species with no suggested thresholds (Sections 3.1–3.2 and Appendix A):

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from the U.S. National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of Permanent Threshold Shift (PTS) in marine mammals.
2. Marine mammal behavioural threshold based on the current interim U.S. National Marine Fisheries Service (NMFS) (2014) of 160 dB re 1 µPa SPL (L_p) for impulsive sound sources.
3. Sound exposure guidelines for fish, fish eggs and larvae, and turtles (Popper et al. 2014).
4. A threshold for turtle PTS of 232 dB re 1 µPa (PK) (Finneran et al. 2017), and a behavioural response of 166 dB re 1 µPa SPL (L_p) (NSF 2011), as applied by the U. S. NMFS, along with a sound level associated with an increased level of response 175 dB re 1 µPa (SPL) (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b, NSF 2011).
5. A sound level 178 dB re 1 µPa PK-PK in the water column, reported for comparison to the results in McCauley et al. (2017) for plankton.
6. Peak-peak pressure levels (PK-PK; L_{pk-pk}) and particle acceleration at the seafloor to help assess effects of noise on crustaceans and bivalves, through comparing to results in Day et al. (2016a) and Payne et al. (2008).
7. A sound level of 226 dB re 1 µPa PK (L_{pk}) reported for comparing to Heyward et al. (2018) for sponges and corals.

Additionally, to assess the size of the low-power zone required under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1, Department of the Environment, Water, Heritage and the Arts (DEWHA 2008), the distance to an unweighted per-pulse SEL of 160 dB re 1 $\mu Pa^2 \cdot s$ is reported.

The following section expands on the thresholds and sound levels for cetaceans, fish, turtles, fish eggs, and fish larvae and benthic invertebrates.

3.1. Cetaceans

The criteria applied in this study to assess possible effects of airgun noise on cetaceans are summarised in Table 5 and detailed in Sections 3.1.1 and 3.1.2, with frequency weighting explained in Appendix A.3.

Table 5. Unweighted SPL, SEL_{24h}, and PK thresholds for acoustic effects on cetaceans.

Hearing group	NMFS (2014)	NMFS (2018)			
	Behaviour	PTS onset thresholds* (received level)		TTS onset thresholds* (received level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)	PK (L_{pk}; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)	PK (L_{pk}; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
L_p–denotes sound pressure level period and has a reference value of 1 µPa.
L_{pk}, flat–peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E - denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 µPa^{2}s.
Subscripts indicate the designated marine mammal auditory weighting.

3.1.1. Behavioural response

Southall et al. (2007) extensively reviewed marine mammal behavioural responses to sounds. Their review found that most marine mammals exhibited varying responses between 140 and 180 dB re 1 µPa SPL, but inconsistent results between studies makes choosing a single behavioural threshold difficult. Studies varied in their lack of control groups, imprecise measurements, inconsistent metrics, and that animal responses depended on study context, which included the animal's activity state. To create meaningful quantitative data from the collected information, Southall et al. (2007) proposed a severity scale that increased with increasing sound levels.

NMFS has historically used a relatively simple sound level criterion for potentially disturbing a marine mammal. For impulsive sounds, this threshold is 160 dB re 1 µPa SPL for cetaceans (NMFS 2014) which has been applied for this report.

3.1.2. Injury and hearing sensitivity changes

There are two categories of auditory threshold shifts or hearing loss: permanent threshold shift (PTS), a physical injury to an animal's hearing organs and Temporary Threshold Shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued.

To assist in assessing the potential for impairment in cetaceans, this report applies the criteria recommended by NMFS (2018), considering both PTS and TTS. Appendix A.2 provides more information about the NMFS (2018) criteria.

3.2. Fish, Turtles, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Turtles was formed to continue developing noise exposure criteria for fish and turtles, work begun by a panel convened by NOAA two years earlier. The resulting guidelines included specific thresholds for different levels of effects and for different groups of species (Popper et al. 2014). These guidelines defined quantitative thresholds for three types of immediate effects:

- Mortality, including injury leading to death.
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma.
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. These effects are not assessed in this report. Because the presence or absence of a swim bladder has a role in hearing, fish's susceptibility to injury from noise exposure varies depending on the species and the presence and possible role of a swim bladder in hearing. Thus, different thresholds were proposed for fish without a swim bladder (also appropriate for sharks and applied to whale sharks in the absence of other information), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Turtles, fish eggs, and fish larvae are considered separately.

Table 6 lists relevant effects thresholds from Popper et al. (2014). In general, any adverse effects of seismic sound on fish behaviour depends on the species, the state of the individuals exposed, and other factors. We note that, despite mortality being a possibility for fish exposed to airgun sounds, Popper et al. (2014) do not reference an actual occurrence of this effect. Since the publication of that work, newer studies have further examined the question of possible mortality. Popper et al. (2016) adds further information to the possible levels of impulsive seismic airgun sound to which adult fish can be exposed without immediate mortality. They found that the two fish species in their study, with body masses in the range 200–400 g, exposed to a single-impulse of a maximum received level of either 231 dB re 1 µPa (PK) or 205 dB re 1 $\mu Pa^2 \cdot s$ (SEL), remained alive for 7 days after exposure and that the probability of mortal injury did not differ between exposed and control fish.

The SEL metric integrates noise intensity over some period of exposure. Because the period of integration for regulatory assessments is not well defined for sounds that do not have a clear start or end time, or for very long-lasting exposures, it is required to define a time. Popper et al. (2014) recommend a standard period should be applied, where this is either defined as a justified fixed period or the duration of the activity, however also include caveats about how long the fish will be exposed because they can move (or remain in location) and so can the source. Popper et al. (2014) summarises that in all TTS studies considered, fish that showed TTS recovered to normal hearing levels within 18–24 hours. Due to this, a period of accumulation of 24 hours has been applied in this study for SEL, which is similar to that applied for marine mammals in NMFS (2016, 2018).

In the discussion of the criteria, Popper et al. (2014) discuss the complications in determining a relevant period of mobile seismic surveys, as the received levels at the fish change between impulses due to the mobile source, and that in reality a revised guideline based on the closest PK or the per-pulse SEL might be more useful than one based on accumulated SEL. This is because exposures at the closest point of approach are the primary exposures contributing to a receiver's accumulated level (Gedamke et al. 2011). Additionally, several important factors determine the likelihood and duration a receiver is expected to be in close proximity to a sound source (i.e., overlap in space and time between the source and receiver). For example, accumulation time for fast moving (relative to the receiver) mobile sources is driven primarily by the characteristics of source (i.e., speed, duty cycle; NMFS 2016, 2018).

Table 6. Criteria for seismic noise exposure for fish and turtles, adapted from Popper et al. (2014).

Type of animal	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	>219 dB SEL_{24h} or >213 dB PK	>216 dB SEL_{24h} or >213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL_{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: Peak sound level (PK) dB re 1 µPa; SEL_{24h} dB re 1µPa^2·s. All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist. Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

3.2.1. Turtles

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. For turtle injury, a PTS of 232 dB re 1 µPa (PK), and TTS of 226 dB re 1 µPa (PK) from Finneran et al. (2017) has been applied as it represents updated information compared to the information in Popper et al. (2014).

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. McCauley et al. (2000a) observed the behavioural response of caged turtles—green (*Chelonia mydas*) and loggerhead (*Caretta caretta*)—to an approaching seismic airgun. For received levels above 166 dB re 1 µPa (SPL), the turtles increased their swimming activity and above 175 dB re 1 µPa they began to behave erratically, which was interpreted as an agitated state. The 166 dB re 1 µPa level has been used as the threshold level for a behavioural disturbance response by NMFS and applied in the Arctic Programmatic Environment Impact Statement (PEIS) (NSF 2011). At that time, and in the absence of any data from which to determine the sound levels that could injure an animal, TTS or PTS onset were considered possible at an SPL of 180 dB re 1 µPa (NSF 2011). Some additional data suggest that behavioural responses occur closer to an SPL of 175 dB re 1 µPa, and TTS or PTS at even higher levels (Moein et al. 1995), but the received levels were unknown and the NSF (2011) PEIS maintained the earlier NMFS criteria levels of 166 and 180 dB re 1 µPa (SPL) for behavioural response and injury, respectively. Popper et al. (2014) suggested injury to turtles could occur for sound exposures above 207 dB re 1 µPa (PK) or above 210 dB re 1 µPa^2·s (SEL_{24h}) (Table 6). Sound levels defined by Popper et al. (2014) show that animals are very likely to exhibit a behavioural response when they are near an airgun (tens of metres), a moderate response if they encounter the source at intermediate ranges (hundreds of metres), and a low response if they are far (thousands of meters) from the airgun. The NMFS criterion for behavioural disturbance (SPL of 166 dB re 1 µPa), and a criterion for behavioural disturbance (SPL of 175 dB re 1 µPa) (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b)_ENREF_62 criterion for behavioural disturbance (SPL of 175 dB re 1 µPa) have been included in this analysis.

3.3. Benthic Invertebrates (Crustaceans and Bivalves)

Research is ongoing into the relationship between sound and its effects on crustaceans, including the relevant metrics for both effect and impact. Available literature suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. Water depth, seabed material and seismic source size are related to the particle motion levels at the seafloor, with larger arrays and shallower water being related to higher particle motion levels, more likely relevant to effects on crustaceans and bivalves.

At the seafloor interface, crustaceans and bivalves are subject to particle motion stimuli from several acoustic or acoustically induced waves. These include the particle motion associated with an impinging sound pressure wave in the water column (the incident, reflected, and transmitted portions), substrate acoustic waves, and interface waves of the Scholte type. However, it is unclear which aspect(s) of these waves is/are most relevant to the animals, either when they normally sense the environment or their physiological responses to loud sounds so there is not enough information to establish similar criteria and thresholds as done for marine mammals and fish. Including recent research, such as Day et al. (2016a), current literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for an assessment. This includes the consideration of what particle motion levels lead to a behavioural response, or mortality. Therefore, at this stage, we cannot propose authoritative thresholds to inform the impact assessment. However, levels can be determined for pressure metrics presented in literature to assist the assessment.

For crustaceans, a PK-PK sound level of 202 dB re 1 µPa (Payne et al. 2008) is considered to be associated with no impact, and therefore applied in the assessment. Additionally for context, the PK-PK sound levels determined for crustaceans in Day et al. (2016a), 209–212 dB re 1 µPa, are also included.

For bivalves, literature does not present a sound level associated with no impact, and as particle motion is the more relevant metric, particle acceleration from the seismic source has been presented for comparing the results in Table 7 and Day et al. (2016a). The maximum particle acceleration assessed for scallops was 37.57 ms^{-2}.

4. Methods

4.1. Acoustic Source Model

The pressure signature of the individual airguns and the composite 1/3-octave-band point-source equivalent directional levels (i.e., source levels) of the 3090 in^3 seismic source were modelled with JASCO's Airgun Array Source Model (AASM). Although AASM accounts for notional pressure signatures of each seismic source with respect to the effects of surface-reflected signals on bubble oscillations and inter-bubble interactions, the surface-reflected signal (known as surface ghost) is not included in the far-field source signatures. The acoustic propagation models account for those surface reflections, which are a property of the propagating medium rather than the source.

AASM considers:

- Array layout.
- Volume, tow depth, and firing pressure of each airgun.
- Interactions between different airguns in the array.

The array was modelled over AASM's full frequency range, up to 25 kHz. Appendix B details this model.

4.2. Sound Propagation Models

Three sound propagation models were used to predict the acoustic field around the seismic source:

- Combined range-dependent parabolic equation and Gaussian beam acoustic ray-trace model (MONM-BELLHOP, 10 Hz to 25 kHz).
- Full Waveform Range-dependent Acoustic Model (FWRAM, 0.5 Hz to 1024 Hz).
- Wavenumber integration model (VSTACK, 10 Hz to 2048 Hz).

The models were used in combination to characterise the acoustic fields at short and long ranges in terms of SEL, SPL, PK, and PK-PK. Appendix C details each model. MONM was used to calculate SEL of a 360° area around each source location. VSTACK was used to calculate close range PK, PK-PK, and SEL along transects at the seafloor from the broadside direction of the seismic source. VSTACK was also used to compute estimates of particle acceleration and velocity at all modelling sites.

4.3. Parameter Overview

The specifications of the seismic source and the environmental parameters used in the propagation models are described in detail in Appendix D. Three 3090 in^3 seismic source arrays consisting of two strings each were modelled in a flip-flop-flap configuration. The three arrays considered were towed at a depth of 6 m, and the lateral distance between the arrays was 25 m. A single sound speed profile for May was considered in the modelling; this was identified as the seasonal period that would provide the greatest propagation (Appendix D.3.2). Sediment in the area was modelled as a succession from soft to hard sediments (silty carbonate sand to calcarenites) (Table D-1).

4.4. Accumulated SEL

During a seismic survey, new sound energy is introduced into the environment with each pulse from the seismic source. While some impact criteria are based on the per-pulse energy released, others, such as the cetacean and fish SEL criteria used in this report (Sections 3.1 and 3.2) account for the total acoustic energy marine fauna is subjected to over a specified period of time, defined in this report as 24 h. An accurate assessment of the accumulated sound energy depends not only on the parameters of each seismic pulse impulse, but also on the number of impulses delivered in a period and the relative positions of the impulses.

When there are many seismic pulses, it becomes computationally prohibitive to perform sound propagation modelling for every single event. The distance between the consecutive seismic impulses is small enough, however, that the environmental parameters that influence sound propagation are virtually the same for many impulse points. The acoustic fields can, therefore, be modelled for a subset of seismic pulses and estimated at several adjacent ones. After sound fields from representative impulse locations are calculated, they are adjusted to account for the source position for nearby impulses.

Although estimating the cumulative sound field with the described approach is not as precise as modelling sound propagation at every impulse location, small-scale, site-specific sound propagation features tend to blur and become less relevant when sound fields from adjacent impulses are summed. Larger scale sound propagation features, primarily dependent on water depth, dominate the cumulative field. The accuracy of the present method acceptably reflects those large-scale features, thus providing a meaningful estimate of a wide area SEL field in a computationally feasible framework.

To produce the map of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum-over-depth level was calculated at each sampling point within the modelled region. The radial grids of maximum-over-depth and seafloor sound levels for each impulse were then resampled (by linear triangulation) to produce a regular Cartesian grid. The sound field grids from all impulses were summed (Equation A-5) to produce the cumulative sound field grid with cell sizes of 20 m. The contours and threshold ranges were calculated from these flat Cartesian projections of the modelled acoustic fields. The single-impulse SEL fields were computed over model grids 200 × 200 km in range, which encompasses the full area of the cumulative grid (the entire survey area).

The unweighted (fish) and frequency-weighted SEL_{24h} results were rendered as contour maps, including contours that focus on the relevant criteria-based thresholds.

4.5. Geometry and Modelled Regions

To assess sound levels with MONM-BELLHOP, the sound field modelling calculated propagation losses up to distances at least 100 km from the source, with a horizontal separation of 20 m between receiver points along the modelled radials. The sound fields were modelled with a horizontal angular resolution of $\Delta\theta$ = 2.5° for a total of N = 144 radial planes. Receiver depths were chosen to span the entire water column over the modelled areas, from 2 m to a maximum of 3000 m, with step sizes that increased with depth. To supplement the MONM results, high-frequency results for propagation loss were modelled using Bellhop for frequencies from 2.5 to 25 kHz. The MONM and Bellhop results were combined to produce results for the full frequency range of interest.

FWRAM was run to 100 km, but along only four radials (fore and aft endfire, and port and starboard broadside) for computational efficiency, from 5 to 1024 Hz in 0.5 Hz steps. This was done to compute SEL-to-SPL conversions (Appendix D.2) but also to quantify water column PK and PK-PK. The horizontal range step is dependent on frequency and ranges from 50 m at lower frequencies to 10 m above 800 Hz.

The maximum modelled range for VSTACK was 1500 m and a variable receiver range increment that increased away from the source was used. The increment increased from 5 to 50 m. Received levels were computed for receivers at seafloor.

5. Results

5.1. Acoustic Source Levels and Directivity

AASM (Section 4.1) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic source, with results provided in Appendix B.2 along with the horizontal directivity plots.

Table 7 shows the PK and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions. The vertical source level that accounts for the "surface ghost" (the out of phase reflected pulse from the water surface) is also presented to make it easier to compare the output of other seismic source models.

Figure B-1 shows the broadside, endfire, and vertical overpressure signature and corresponding power spectrum levels for the array. The signature consists of a strong primary peak, related to the initial release of high-pressure air, followed by a series of pulses associated with bubble oscillations. Most energy was produced at frequencies below 600 Hz. Frequency-dependent peaks and nulls in the spectrum result from interference among airguns in the array and correspond with the volumes and relative locations of the airguns to each other.

Table 7. Far-field source level specifications for the 3090 in^3 array, for a 6 m tow depth. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Direction	Peak source pressure level ($L_{S,pk}$) (dB re 1 µPa·m)	Per-pulse source SEL ($L_{S,E}$) (dB 1 μPa^2m^2s)	
		10–2000 Hz	2000–25000 Hz
Broadside	249.4	225.1	184.5
Endfire	245.7	223.2	187.8
Vertical	255.0	228.2	195.0
Vertical (surface affected source level)	255.0	230.6	198.0

5.2. Per-pulse Sound Fields

5.2.1. Tabulated results

Per-pulse results for the 3090 in³ seismic source towed at 6 m are presented for SPL, SEL, PK, and PK-PK, including seafloor PK and PK-PK. Tables 8–11 list the estimated ranges for the various applicable maximum-over-depth per-pulse effects criteria and isopleths of interest. Tables 12 and 13 list the estimated ranges for seafloor per-pulse effects criteria and isopleths of interest.

5.2.1.1. Entire water column

Table 8. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3090 in³ array to modelled maximum-over-depth unweighted per-pulse SEL isopleths from the four modelled single impulse sites.

Per-pulse SEL (L_E; dB re 1 µPa²·s)	Site 1 (66 m)		Site 2 (125 m)		Site 3 (161 m)		Site 4 (107 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
190	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
180	0.16	0.14	0.16	0.14	0.16	0.13	0.16	0.14
170	0.72	0.59	0.74	0.67	0.78	0.69	0.70	0.63
160†	3.10	2.35	2.44	1.99	2.24	1.76	2.42	2.00
150	9.27	7.82	7.90	6.43	7.95	6.42	7.45	6.26
140	25.2	19.2	18.2	14.9	19.1	16.0	17.1	14.0
130	50.5	40.7	36.1	30.9	37.8	32.1	33.7	27.8
120	86.3	71.2	73.4	60.0	67.2	59.1	61.1	51.3

† Low power zone assessment criteria DEWHA (2008).

Table 9. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3090 in³ array to modelled maximum-over-depth SPL isopleths from the four modelled single impulse sites.

SPL (L_p; dB re 1 µPa)	Site 1 (66 m)		Site 2 (125 m)		Site 3 (161 m)		Site 4 (107 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
190	0.14	0.12	0.13	0.12	0.12	0.12	0.13	0.12
180	0.58	0.50	0.70	0.62	0.54	0.48	0.66	0.60
175#	1.20	0.99	1.01	0.85	1.00	0.84	1.14	0.85
170	2.48	2.09	2.04	1.66	1.80	1.49	2.02	1.72
166†	5.10	3.60	3.32	2.85	3.28	2.68	3.64	2.87
160‡	8.36	6.76	6.47	5.58	6.58	5.65	7.18	5.50
150	20.5	16.3	15.7	13.1	16.5	13.8	14.7	12.2
140	43.6	34.9	30.9	26.2	32.9	27.7	28.5	23.9
130	78.5	64.6	64.5	52.0	60.8	51.0	53.5	44.9

Threshold for turtle behavioural response to impulsive noise (Moein et al. 1995).
† Threshold for turtle behavioural response to impulsive noise (NSF 2011).
‡ Marine mammal behavioural threshold for impulsive sound sources (NMFS 2014).

Table 10. Maximum (R_{max}) horizontal distances (km) from the 3090 in3 array to modelled maximum-over-depth peak pressure level (PK) thresholds based on the NOAA Technical Guidance (NMFS 2018) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for turtles, at the modelling sites (Table 4).

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)			
		Site 1 (66 m)	Site 2 (125 m)	Site 3 (161 m)	Site 4 (107 m)
Low-frequency cetaceans (PTS)	219	0.03	0.03	0.03	0.03
Low-frequency cetaceans (TTS)	213	0.06	0.06	0.06	0.06
Mid-frequency cetaceans (PTS)	230	<0.02	<0.02	<0.02	<0.02
Mid-frequency cetaceans (TTS)	224	<0.02	<0.02	<0.02	<0.02
High-frequency cetaceans (PTS)	202	0.21	0.21	0.22	0.23
High-frequency cetaceans (TTS)	196	0.68	0.41	0.6	0.7
Fish: No swim bladder (also applied to sharks)	213	0.06	0.06	0.06	0.06
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	0.11	0.12	0.13	0.12
Turtles (PTS)	232	<0.02	<0.02	<0.02	<0.02
Turtles (TTS)	226	<0.02	<0.02	<0.02	<0.02

Table 11. Maximum (R_{max}) horizontal distances (in km) from the 3090 in^3 array to modelled maximum-over-depth peak-peak pressure level threshold (178 dB re 1µPa, PK-PK), assessed along the four FWRAM modelling transects (maximum presented) at two of the modelling sites (Table 4).

PK-PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (km)			
	Site 1 (66 m)	Site 2 (125 m)	Site 3 (161 m)	Site 4 (107 m)
178	7.93	5.76	6.38	5.32

5.2.1.2. Seafloor

Table 12. Maximum (R_{max}) horizontal distances (in m) from the 3090 in^3 array to modelled seafloor peak pressure level thresholds (PK) from four single-impulse modelling sites (Table 4).

Hearing group/animal type	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (m)			
		Site 1 (66 m)	Site 2 (125 m)	Site 3 (161 m)	Site 4 (107 m)
Sound levels for sponges and corals†	226	—	—	—	—
Fish: No swim bladder (also applied to sharks)	213	80	52	32	60
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	187	158	145	150

† Heyward et al. (2018)
A dash indicates the level was not reached.

Table 13. Maximum (R_{max}) horizontal distances (in m) from the 3090 in^3 array to modelled seafloor peak-peak pressure level thresholds (PK-PK) from four modelling sites (Table 4). Results included in relation to benthic invertebrates (Section 3.3).

PK-PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m)			
	Site 1 (66 m)	Site 2 (125 m)	Site 3 (161 m)	Site 4 (107 m)
213	156	150	130	146
212	179	165	156	164
211	204	182	186	188
210	234	209	210	215
209	260	240	229	247
202	468	635	709	591

5.2.2. Sound field maps and graphs

5.2.2.1. Sound level contour maps

Maps of the estimated sound fields, threshold contours, and isopleths of interest for the per-pulse SEL and SPL sound fields have been presented at all modelling sites (Table 4), shown in Figures 2–09.

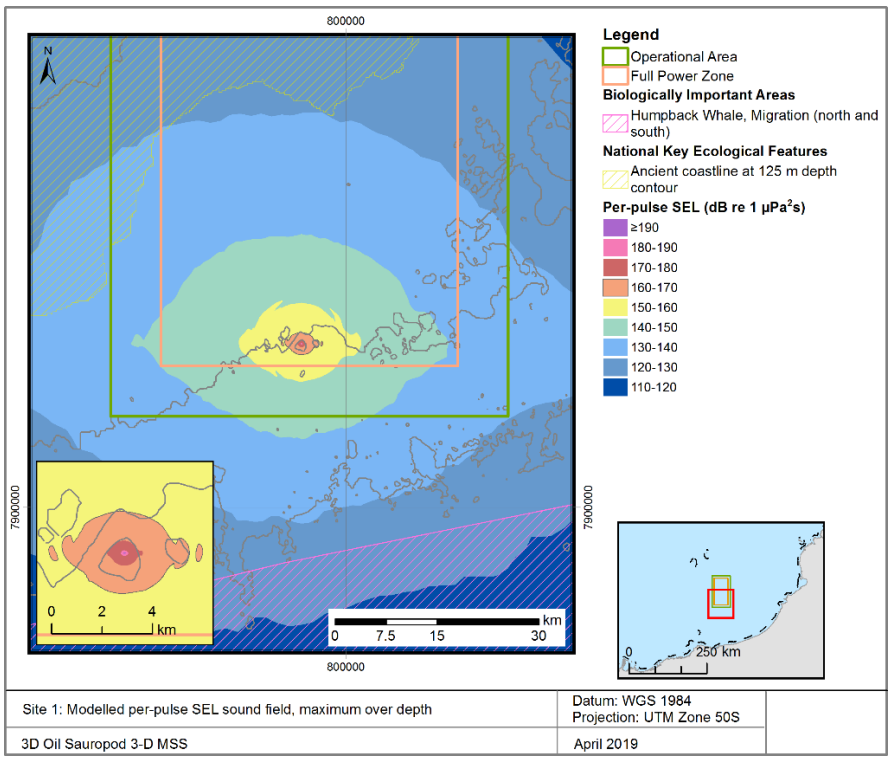


Figure 2. *Site 1, per-pulse SEL:* Sound level contour map showing unweighted maximum-over-depth results.

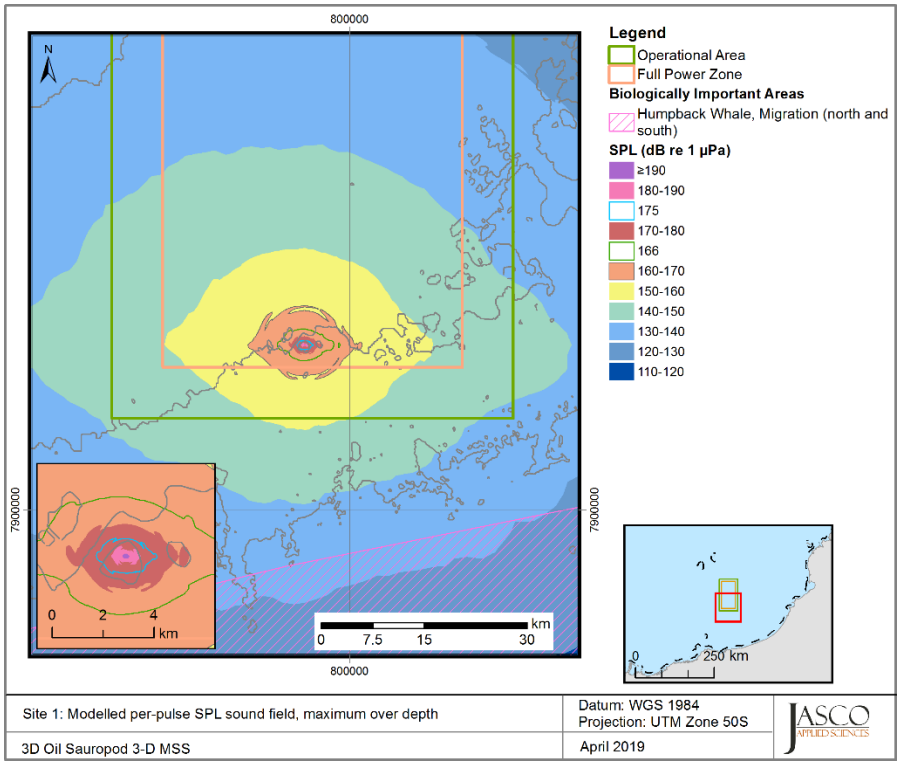


Figure 3. *Site 1, SPL:* Sound level contour map showing unweighted maximum-over-depth results.

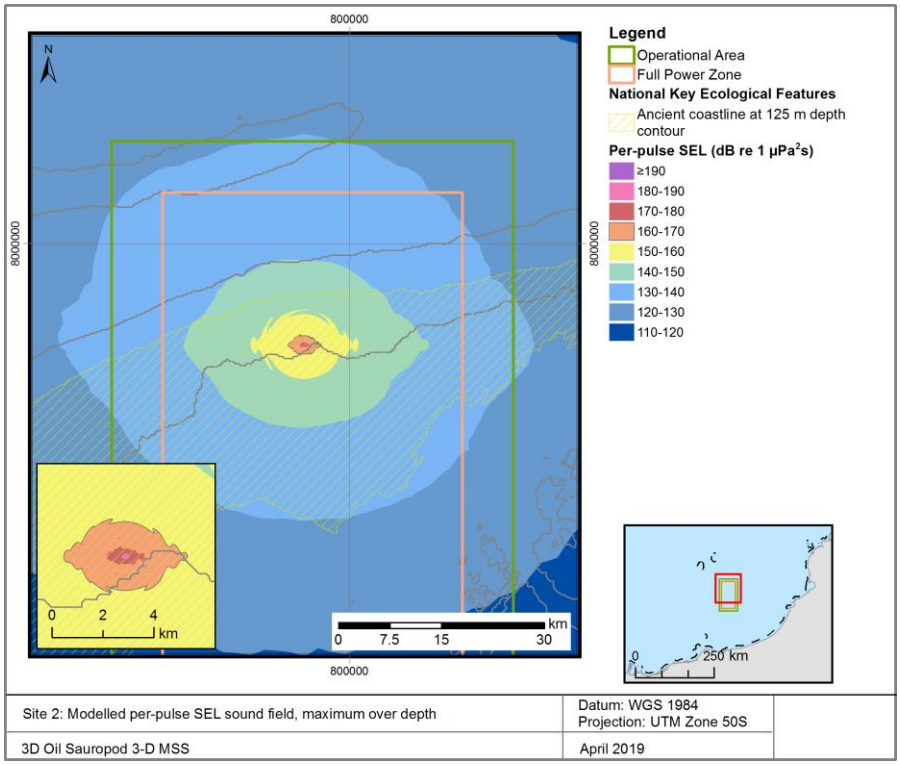


Figure 4. *Site 2, per-pulse SEL:* Sound level contour map showing unweighted maximum-over-depth results.

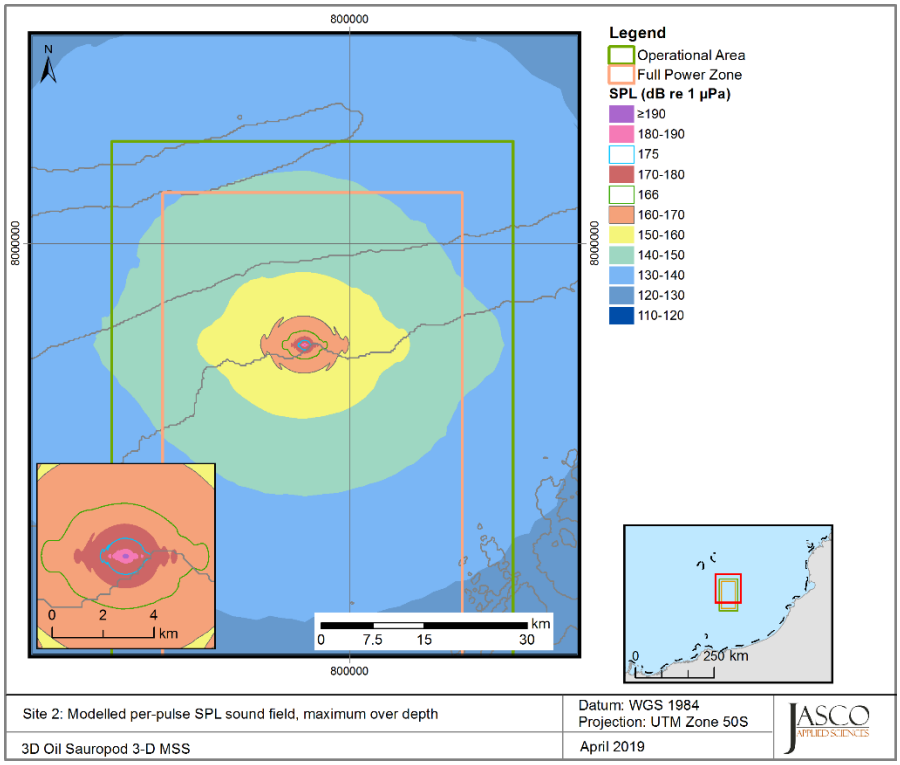


Figure 5. *Site 2, SPL:* Sound level contour map showing unweighted maximum-over-depth results.

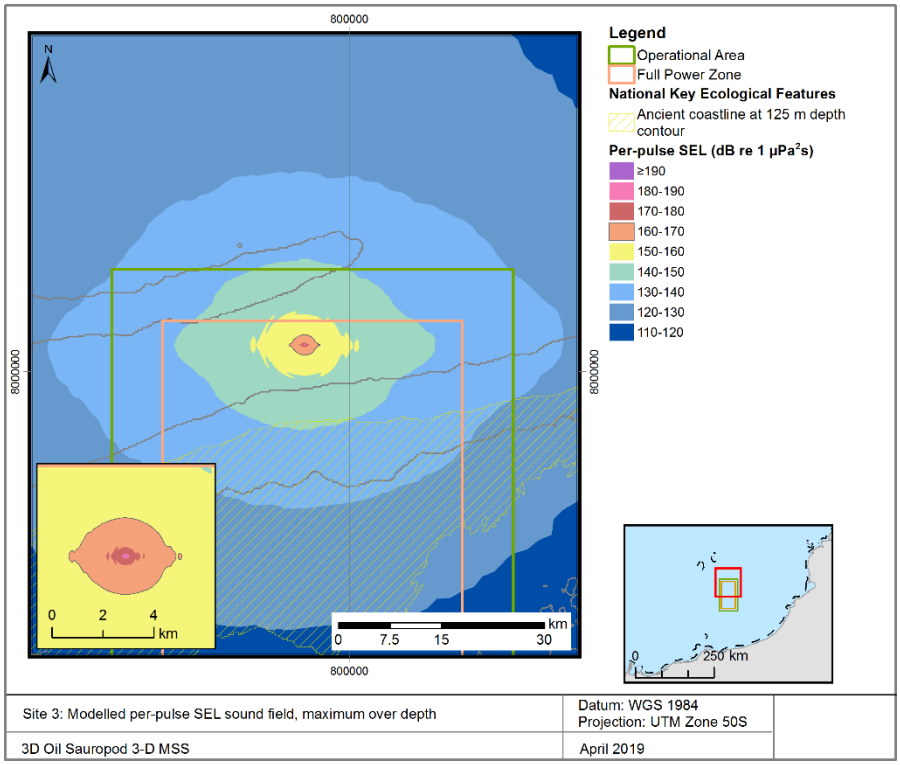


Figure 6. *Site 3, per-pulse SEL*: Sound level contour map showing unweighted maximum-over-depth results.

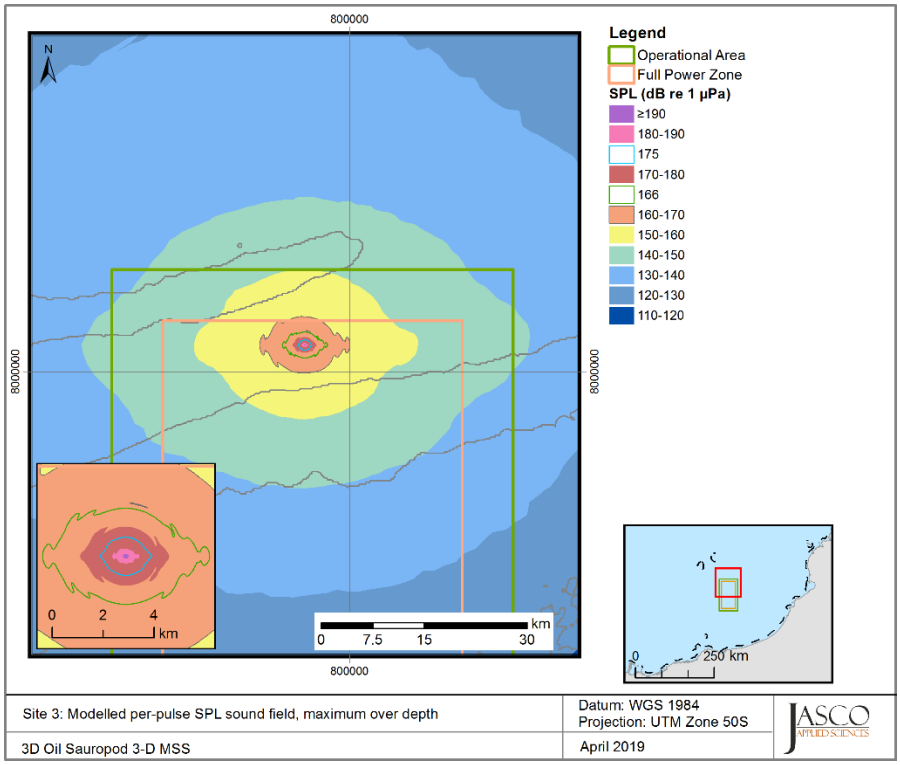


Figure 7. *Site 3, SPL:* Sound level contour map showing unweighted maximum-over-depth results.

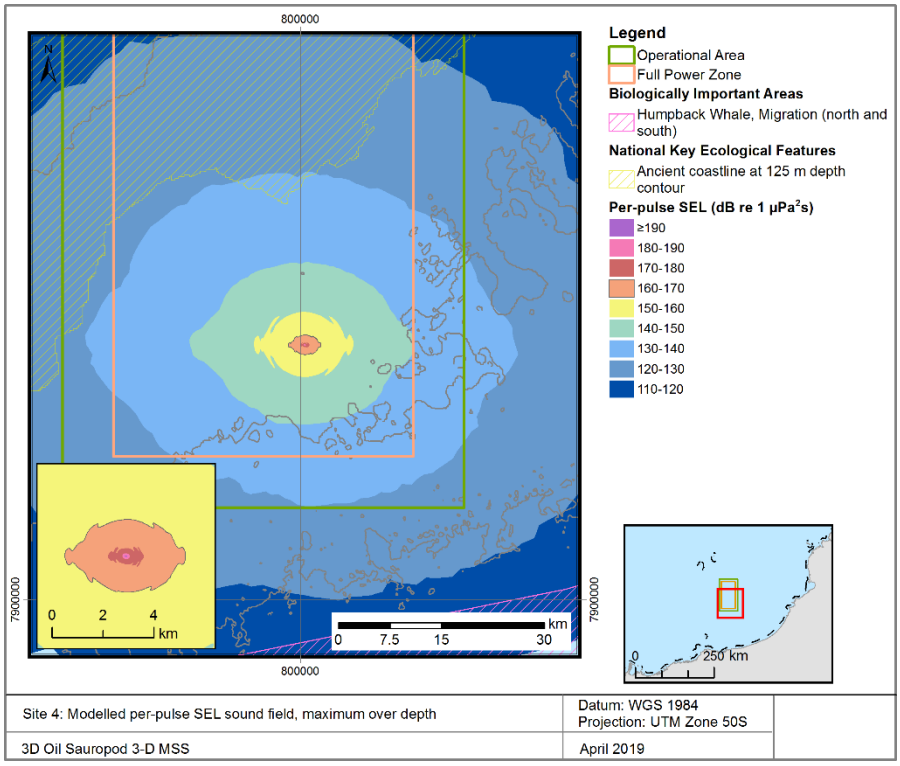


Figure 8. *Site 4, per-pulse SEL*: Sound level contour map showing unweighted maximum-over-depth results.

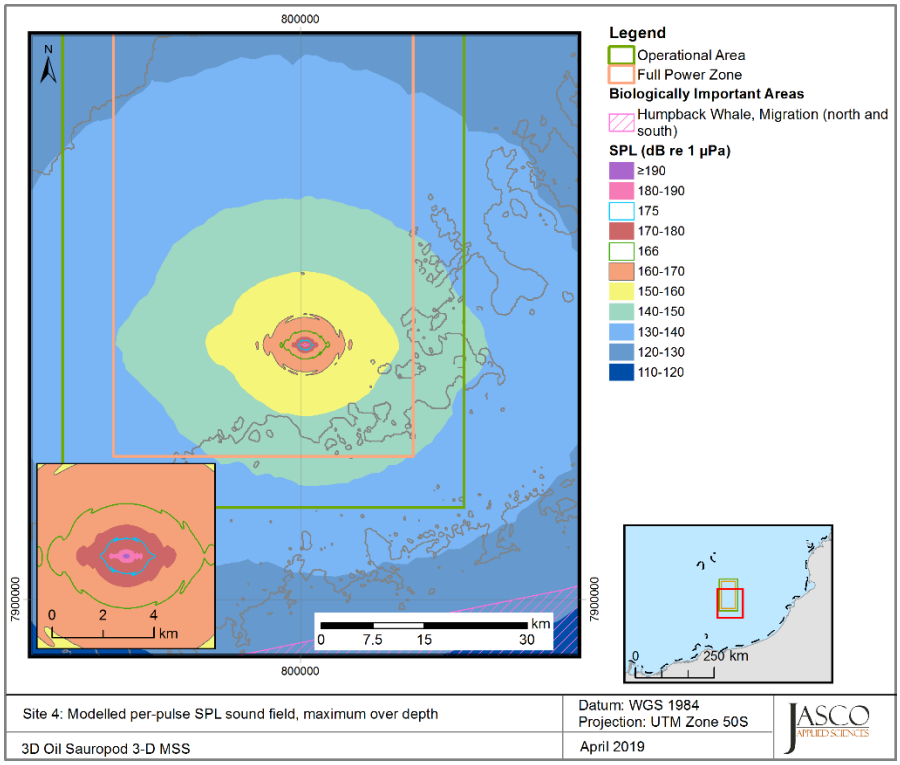


Figure 9. *Site 4, SPL:* Sound level contour map showing unweighted maximum-over-depth results.

5.2.2.2. Vertical slices of modelled sound fields

Vertical slices of the SPL sound fields for the 3090 in^3 airgun array are shown in Figures 10–13.

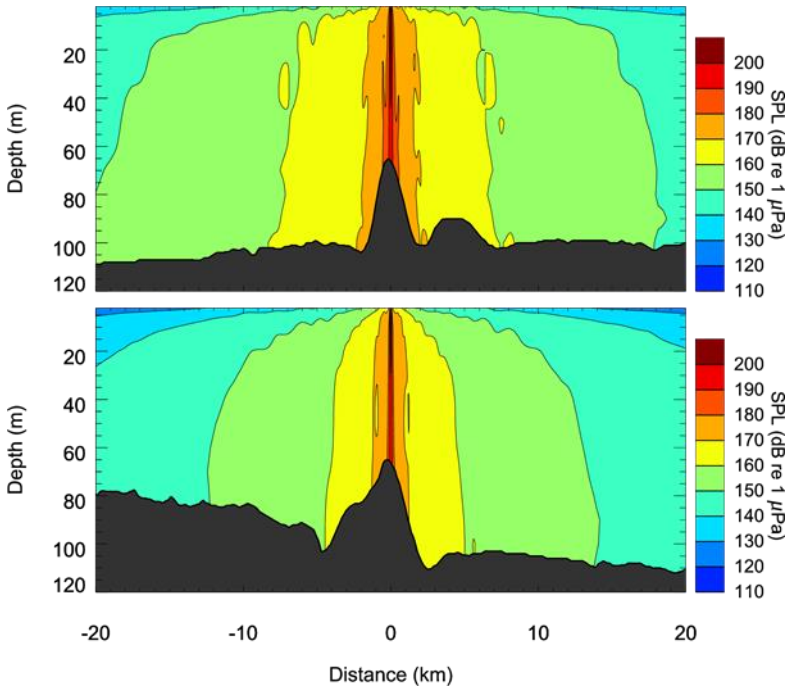


Figure 10. *Site 1, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. Levels are shown along the broadside (top) and endfire (bottom) directions.

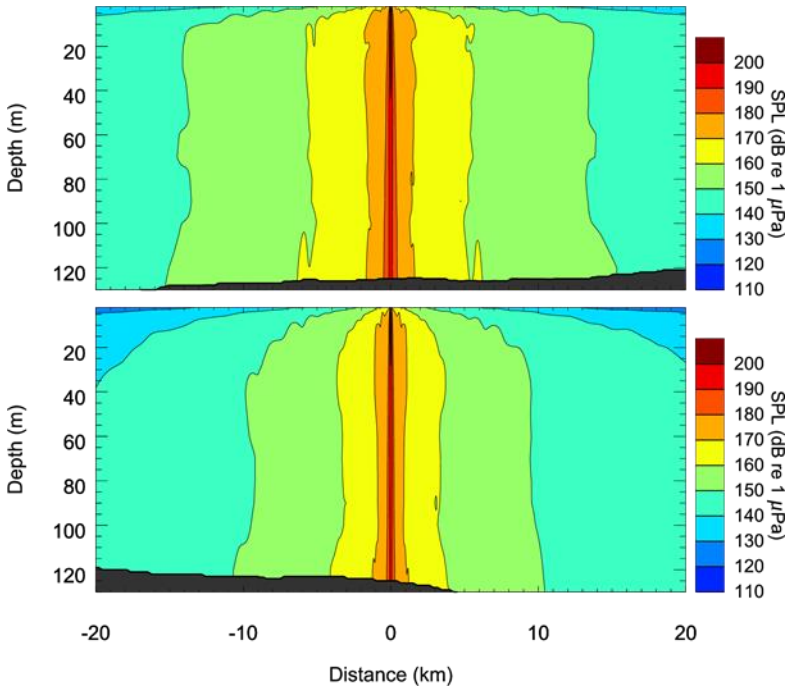


Figure 11. *Site 2, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. Levels are shown along the broadside (top) and endfire (bottom) directions.

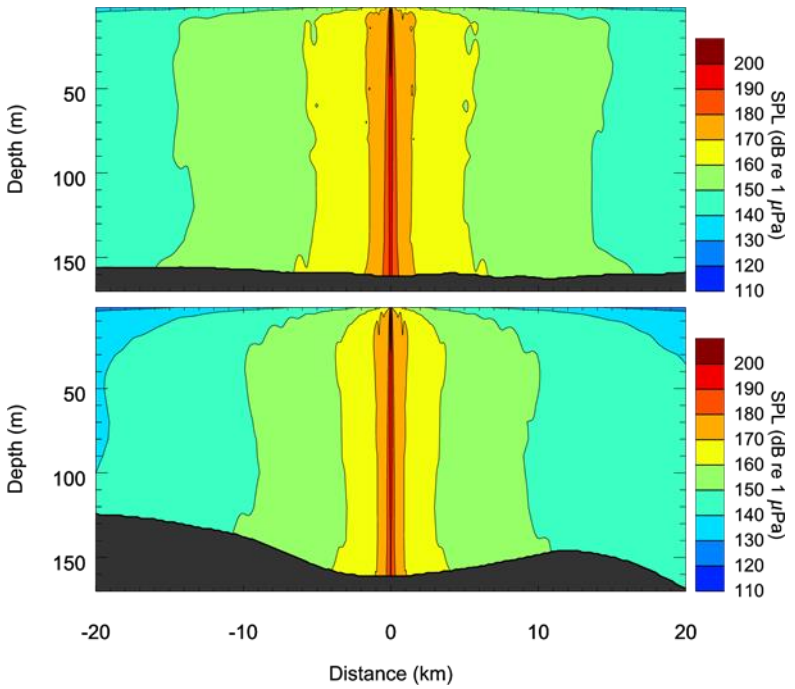


Figure 12. *Site 3, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. Levels are shown along the broadside (top) and endfire (bottom) directions.

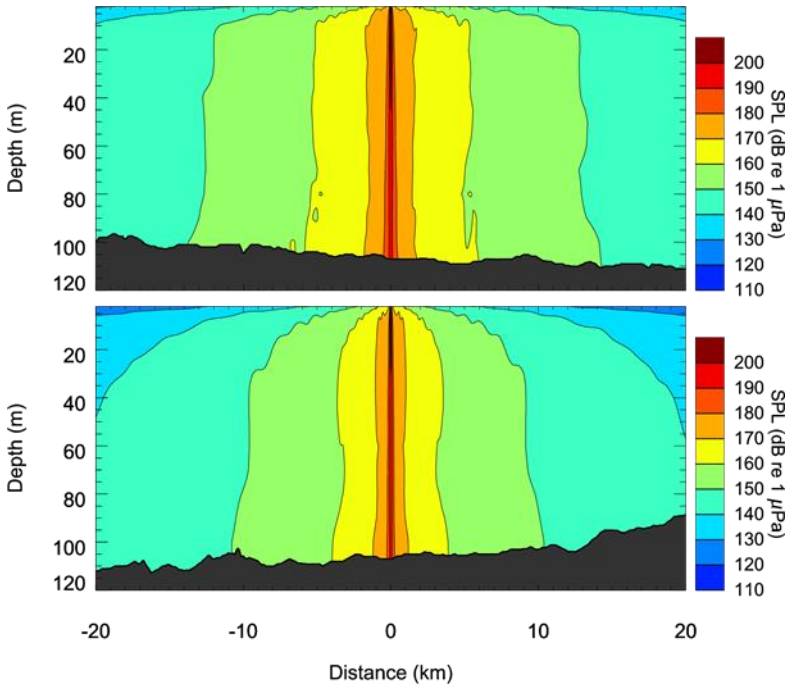


Figure 13. *Site 4, SPL*: Vertical slice of the predicted SPL for the 3090 in^3 array. Levels are shown along the broadside (top) and endfire (bottom) directions.

5.2.3. Particle motion

Particle acceleration and velocity was modelled for seafloor receivers at each site. Modelling was performed in the broadside directions because particle motion was highest along those azimuths. From the modelled 3-D particle motion traces, the peak acceleration and velocity were computed as a function of horizontal range from the centre of the array. The maximum horizontal distance to a peak particle acceleration of 37.57 ms^{-2} (Section 3.3; Day et al. (2016b) is3.3; (Day et al. 2016a)) was 9.1 m, which occurred at the shallowest site, Site 1, Figure 14. The results for Sites 2–4 are shown in Appendix E.1, Figures E-1 to E-3.

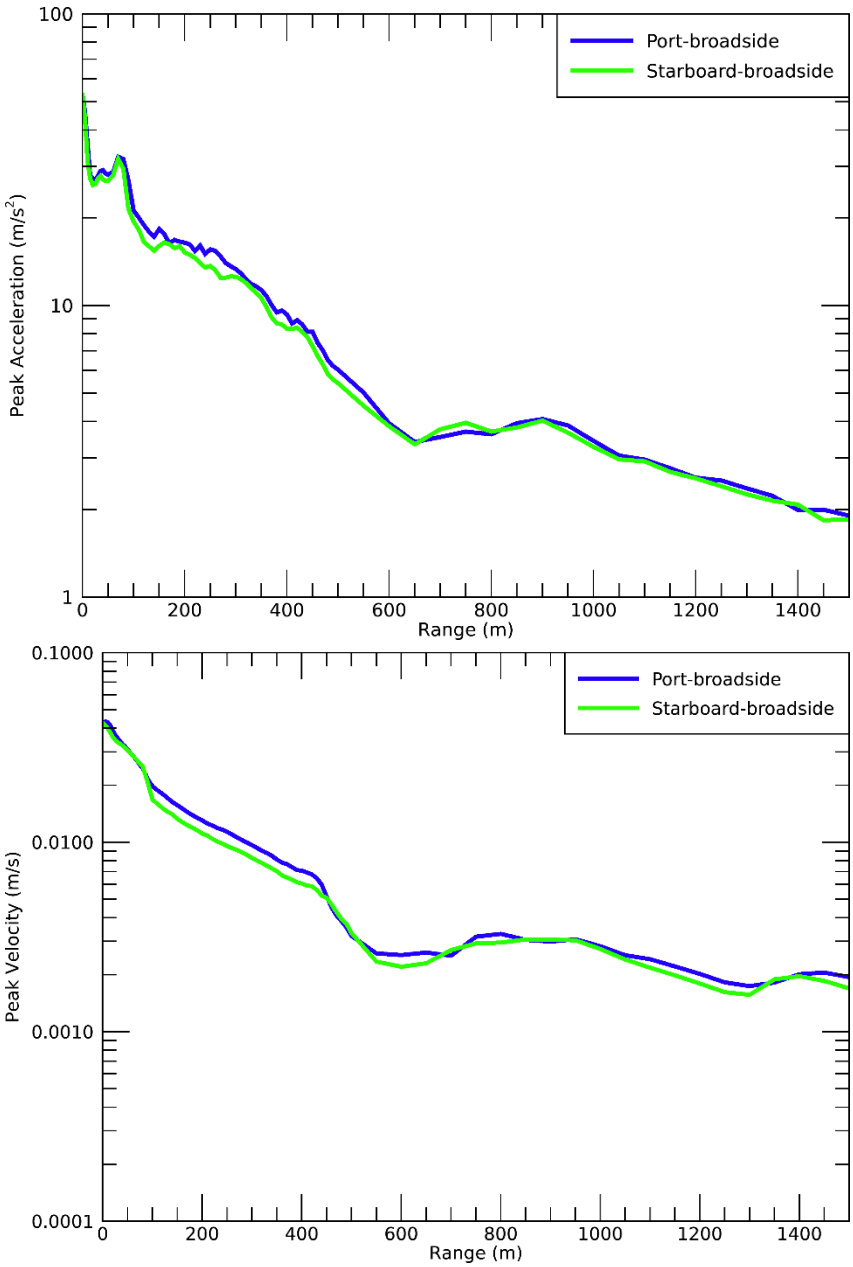


Figure 14. Site 1: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions.

5.3. Multiple Pulse Sound Fields

The SEL_{24h} results for the proposed survey are presented for one possible operational scenario within the Acquisition Area (Section 2). Tables 14 and 15 show the estimated ranges to the appropriate cumulative exposure criterion contour for the various marine fauna groups considered and the corresponding ensonified areas. The ranges in this section are the perpendicular distance from the survey line to the relevant isopleth. Estimates of the maximum-over-depth sound fields, including threshold contours relating to cetaceans and fish, are presented in Figure 15, while estimates of the sound field at the seafloor and threshold contours relevant to fish are presented in Figure 16.

Table 14. Maximum-over-depth distances to SEL_{24h} based marine mammal PTS and TTS thresholds (NMFS 2018).

Hearing group	PTS		
	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	R_{max} (km)	Area (km²)
Low-frequency cetaceans	183	0.63	147.93
Mid-frequency cetaceans	185	—	—
High-frequency cetaceans	155	0.03	8.99
Hearing group	**TTS**		
	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	R_{max} (km)	Area (km²)
Low-frequency cetaceans	168	15.4	2974.8
Mid-frequency cetaceans	170	—	—
High-frequency cetaceans	140	0.23	78.2

A dash indicates the threshold is not reached.

Table 15. Distances to SEL_{24h} based fish criteria.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth		Seafloor	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
Mortality and potential mortal injury					
I	219	<0.03	9.75	—	—
II, Fish eggs and fish larvae	210	<0.03	12.44	—	—
III	207	0.04	13.28	—	—
Fish recoverable injury					
I	216	<0.03	12.00	—	—
II, III	203	0.04	13.28	—	—
Fish TTS					
I, II, III	186	2.81	720.12	2.79	715.75

A dash denotes a value below the minimum resolution of the modelling.
Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.

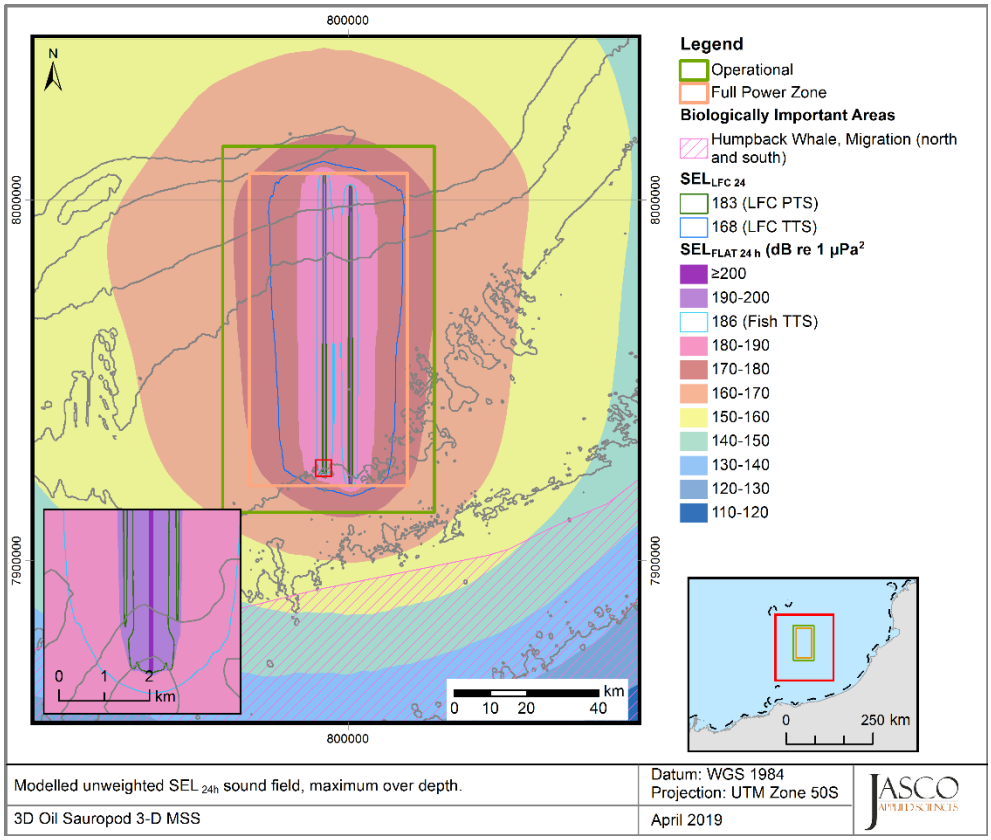


Figure 15. Sound level contour map showing maximum-over-depth SEL_{24h} results.

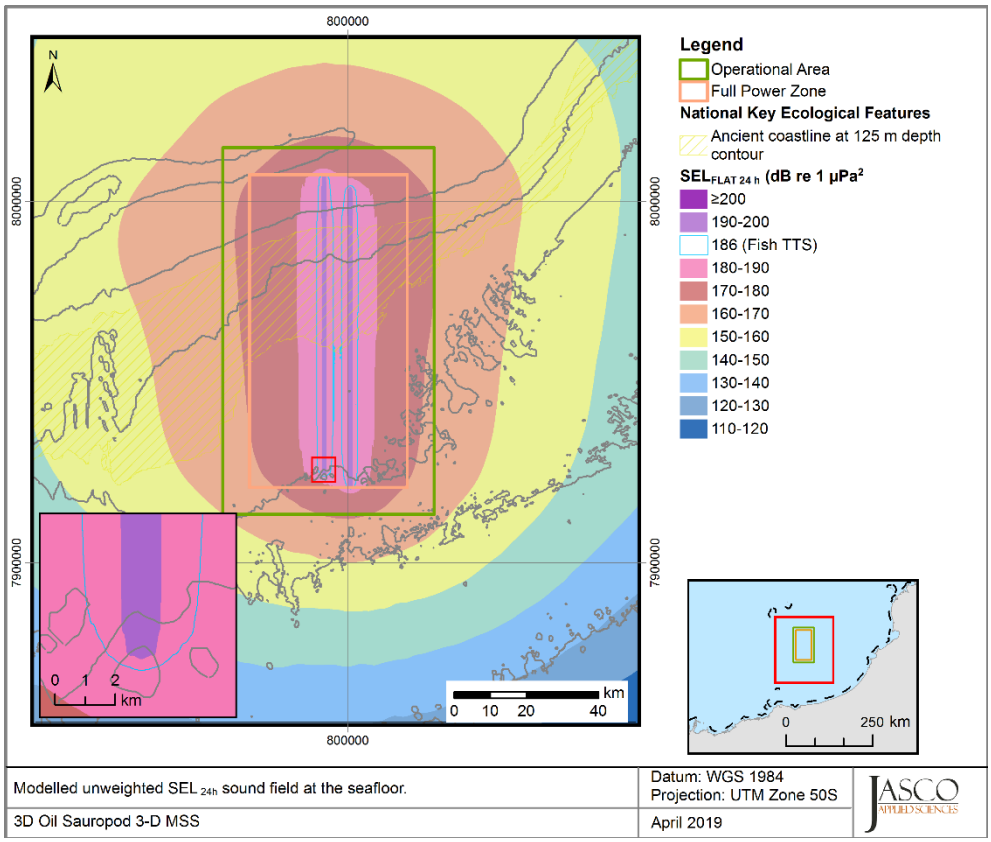


Figure 16. Sound level contour map showing seafloor SEL_{24h} results.

6. Discussion

6.1. Overview and Source Levels

This modelling study predicted underwater sound levels associated with the planned Sauropod 3-D MSS. The underwater sound field was modelled for a 3090 in^3 seismic source (Appendix B) with a water column sound speed profile for May. An analysis of seasonal sound speed profiles (Appendix D.3.2) indicated that this month was the most conducive to sound propagation, and as such it was selected to ensure a conservative estimation of distances to received sound level thresholds over the entire survey period. The modelling also accounted for site-specific bathymetric variations (Appendix D.3.1) and local geoacoustic properties (Appendix D.3.3).

Most acoustic energy from the seismic source is output at lower frequencies, in the tens to hundreds of hertz. The array had a pronounced broadside directivity for 1/3-octave-bands between approximately 158 to about 316 Hz (Appendix B.2), which caused a noticeable axial bulge in the modelled acoustic footprints.

The overall broadband (10–25000 Hz) unweighted per-pulse SEL source level of the 3090 in^3 array operating at 6 m depth was 225.1 dB 1 μPa^2m^2s in the broadside direction and 223.3 dB 1 μPa^2m^2s in the endfire direction. The peak pressure level in the same directions was 249.4 and 245.7 dB re 1 µPa m, respectively, these results are presented in Table 7.

6.2. Per-Pulse Sound Fields

At all sites, the distances to identified isopleths were greater in the broadside direction than in the endfire direction, which is apparent in all footprint maps in Section 5.2.2; this is due to the directionality of the array. The acoustic footprints were not substantially influenced by changes in water depth because changes in bathymetry within the modelling area was marginal and gradual (Figure D-3). The shallowest site, Site 1 (66 m) had the farthest distance to almost all isopleths, with the distances at the other three modelling sites being more similar. The combination of the geology, water depth, local and bathymetry support longer range propagation at this site when compared to the three other sites in deeper water. This difference is noticeable in both the close range seafloor modelling results (Table 12) and the maximum-over-depth results at greater distances (Table 8). The vertical slice plot for Site 1 (Figure 10) shows that this site is located on a localised shallow point surrounded by deeper water, which contributes to the way the sound is reflected both from and within the seafloor at this site. The other vertical slice plots (Section 5.2.2.2) demonstrate the difference between the broadside and endfire directions within the water column but also the similarity of the footprints for each respective direction at Sites 2–4.

The distances to PK based potential injury criteria (Section 3.2 and 3.3) for fish and benthic crustaceans at the seafloor decreased with increasing depth, apart from the distance to the 202 dB re 1 µPa (PK-PK) relevant to crustaceans, which increased with increasing depth. The distances to these criteria did not always consistently change with increasing depth, phenomena related to complex patterns of surface and bottom reflections that affect sound propagation in shallow water; the distances could be greater for depths even slightly shallower or deeper. However, the number of modelling sites considered within the Acquisition Area, representing the variations in bathymetry, provides a good representation of potential variability.

6.3. Particle Motion

Section 3.3 discuss the relevance of particle motion (acceleration and velocity) to benthic invertebrates. Peak particle acceleration and velocity decayed rapidly with horizontal distance from the centre of the array (Figure 14). There was little difference in particle motion between the two modelled broadside directions.

Particle motion traces generated during the modelling showed that vertical particle motion was larger than horizontal particle motion for receivers directly underneath or at short ranges from the array, but

at longer ranges the horizontal particle motion dominated. The duration of particle motion also increased with distance as critically reflected multipath propagation becomes important.

Day et al. (2016a) included an empirical regression of particle acceleration versus range for the single 150 in^3 airgun used in their study (minimum range of 6 m) and showed that acceleration between 10 and 100 m range was typically between 26 and 5 ms^{-2}, respectively. Day et al. (2016a) also referenced an unpublished maximum particle acceleration measurement of 6.2 ms^{-2} from a 3130 in^3 airgun array at 477 m range in 36 m of water. In our study, modelled peak acceleration at 10 m range was predicted to be between 35 and 19 ms^{-2} depending on the site; corresponding values at 100 m range are between 21 and 12 ms^{-2}. At approximately 477 m, our study predicts an acceleration of between 8.5 and 5.8 ms^{-2} in both the port and starboard broadside directions. This result aligns reasonably with the measurements reported in Day et al. (2016a).

The maximum distance to peak particle acceleration of 37.57 ms^{-2}, determined for comparing literature (Section 3.3; (Day et al. 2016a), Day et al. (2016b)) is 9.1 m (Figure 14). This distance is less than that predicted for other studies in the region (Quijano et al. 2018); however, the difference is likely due to the different airgun array configuration and tow depth, as well as the geology for the respective studies. The geology for this study, silty carbonate sand to calcarenites (Appendix D.3.3), is less reflective than seabeds that have thin layers of sand over calcarenite substrate.

6.4. Multiple Pulse Sound Fields

The accumulated SEL over 24 hours of seismic operation was modelled considering a realistic acquisition pattern within the Acquisition Area. The model predicted the accumulation of sound energy, considering the change in location and the azimuth of the source at each pulse point, which were used to assess possible injury in cetaceans and the SEL_{24h} based fish criteria. The results were presented both as maps of the accumulated exposure levels and as tables of ranges to threshold levels and areas exposed above given effects criteria (Section 5.3). The footprint of the accumulated SEL (Figures 15 and 16) showed a slight widening of the contours at the deeper end of the survey lines. The single impulse modelling site, Site 1, was only representative of a small portion of the survey lines; therefore, despite having the largest single impulse footprints, the influence on the 24 h footprints was not noticeable.

The extents of isopleths associated with criteria for cetaceans and fish was relatively uniform along the survey lines, with the maximum distances being reached only a few kilometres to the side of each modelled survey line, as shown in the insert maps in Figures 15 and 16. The distance to the maximum-over-depth SEL_{24h} of 219 dB re 1 $\mu Pa^2 \cdot s$ for fish (<30 m) was determined by the lateral distance between the airgun arrays (25 m), with the three arrays operated in a flip-flop-flap configuration. The 219 dB re 1 $\mu Pa^2 \cdot s$ 24-hour contour extended a short distance beyond the outer arrays.

Note that ranges to thresholds were calculated based on maximum over depth levels, these ranges represent a worst-case threshold distance which implies that an animal would remain static throughout the 24 hour period. The actual dose an animal receives will be dependent on the path the animal takes relative to the operating survey; in the case of a fleeing animal, the received sound levels will be typically be much lower than if it remained stationary.

6.5. Summary

The findings of the study pertaining each of the metrics and criteria for various marine species of interest are summarised below with references to the result location.

Cetacean injury and behaviour

- The maximum distance where the NMFS (2014) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) could be exceeded varied between 6.47 and 8.36 km (Site 2, 125 m and Site 1, 66 m), Table 9.
- The results for the criteria applied for marine mammal Permanent Threshold Shift (PTS), NMFS (2018), consider both metrics within the criteria (PK and SEL_{24h}). The longest distance associated

with either metric is required to be applied. Table 16 summarises the maximum distances for PTS, along with the relevant metric.

Table 16. Summary of maximum cetacean PTS onset distances for SEL_{24h} modelled scenarios (PK values from Table 10 and SEL_{24h} values from Table 14)

Relevant hearing group	Metric associated with longest distance to PTS onset	R_{max} (km)
Low-frequency cetaceans†	SEL_{24h}	0.63
Mid-frequency cetaceans	PK	<0.02
High-frequency cetaceans	PK	0.23

† The model does not account for shutdowns.

- The 24-h SEL is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. The corresponding SEL_{24h} radii for low-frequency cetaceans were larger than those for peak pressure criteria, but they represent an unlikely worst-case scenario. More realistically, cetaceans (and fish) would not stay in the same location for 24 hours. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 hours.

Turtles

- The PK turtle injury criteria of 232 dB re 1 µPa for PTS and 226 dB re 1 µPa for TTS from Finneran et al. (2017) was not exceeded at a distance greater than 20 m from the centre of the array. Because the arrays are not a point source (approximately 14 × 8 m), the actual ranges from the edge of airgun arrays are small.
- The distances to where the NMFS criterion (NSF 2011) for behavioural effects in turtles of turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b) could be exceeded are summarised in Table 17.

Table 17. Distances to turtle behavioural response criteria (from Table 9).

SPL (L_p; dB re 1 µPa)	Distance (km)	
	Min	Max
175†	1.00	1.20
166‡	3.28	5.10

† Threshold for turtle behavioural response to impulsive noise (Moein et al. 1995, McCauley et al. 2000a, McCauley et al. 2000b).
‡ Threshold for turtle behavioural response to impulsive noise (NSF 2011).

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} (water column only) metrics associated with mortality and potential mortal injury and impairment in the following groups:
  - Fish without a swim bladder (also appropriate for sharks in the absence of other information)
  - Fish with a swim bladder that do not use it for hearing
  - Fish that use their swim bladders for hearing
  - Fish eggs and fish larvae
- Table 18 summarises the distances to injury criteria for fish, fish eggs, and fish larvae along with the relevant metric.

Table 18. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios (PK values from Tables 10 and 12, SEL_{24h} values from Table 15).

Relevant hearing group	Injury criteria	Water column		Seafloor	
		Metric associated with longest distance to injury criteria	R_{max} (km)	Metric associated with longest distance to injury criteria	R_{max} (km)
Fish: No swim bladder	Injury	PK	0.06	PK	0.08
	TTS	SEL_{24h}	2.81	SEL_{24h}	2.79
Fish: Swim bladder not involved in hearing Swim bladder involved in hearing	Injury	PK	0.13	PK	0.19
	TTS	SEL_{24h}	2.81	SEL_{24h}	2.79
Fish eggs, and larvae	Injury	PK	0.13	PK	0.19

Crustaceans and Bivalves, Sponges and Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following have been determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) was considered; it was reached at ranges between 468 and 709 m depending on the modelled site (Table 13).
- Bivalves: the distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). The maximum distance to this particle acceleration level was 9.1 m, Section 5.2.3.
- Sponges and coral: The PK sound level at the seafloor directly underneath the seismic source was estimated at all modelling sites considered for seafloor fish receptors, and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was found that the level was not reached at any of the four considered sites (Table 12).
- Plankton: The distance to the sound level of 178 dB re 1 µPa PK-PK from McCauley et al. (2017) was estimated at two modelling sites through full-waveform modelling using FWRAM; the results ranged from 5.32 km to 7.93 km (Table 11).

Glossary

1/3-octave
One third of an octave. Note: A one-third octave is approximately equal to one decidecade (1/3 oct ≈ 1.003 ddec; ISO 2017a).

1/3-octave-band
Frequency band whose bandwidth is one one-third octave. Note: The bandwidth of a one-third octave-band increases with increasing centre frequency.

90%-energy time window
The time interval over which the cumulative energy rises from 5 to 95% of the total pulse energy. This interval contains 90% of the total pulse energy. Symbol: T_{90}.

azimuth
A horizontal angle relative to a reference direction, which is often magnetic north or the direction of travel. In navigation it is also called bearing.

broadband sound level
The total sound pressure level measured over a specified frequency range. If the frequency range is unspecified, it refers to the entire measured frequency range.

broadside direction
Perpendicular to the travel direction of a source. Compare with endfire direction.

cavitation
A rapid formation and collapse of vapor cavities (i.e., bubbles or voids) in water, most often caused by a rapid change in pressure. Fast-spinning vessel propellers typically cause cavitation, which creates a lot of noise.

cetacean
Any animal in the order Cetacea. These are aquatic, mostly marine mammals and include whales, dolphins, and porpoises.

compressional wave
A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave.

decibel (dB)
One-tenth of a bel. Unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power (ANSI S1.1-1994 R2004).

endfire direction
Parallel to the travel direction of a source. See also broadside direction.

ensonified
Exposed to sound.

far-field
The zone where, to an observer, sound originating from an array of sources (or a spatially distributed source) appears to radiate from a single point. The distance to the acoustic far-field increases with frequency.

frequency
The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: *f*. 1 Hz is equal to 1 cycle per second.

hearing group
Groups of marine mammal species with similar hearing ranges. Commonly defined functional hearing groups include low-, mid-, and high-frequency cetaceans, pinnipeds in water, and pinnipeds in air.

geoacoustic
Relating to the acoustic properties of the seabed.

hertz (Hz)
A unit of frequency defined as one cycle per second.

high-frequency (HF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for hearing high frequencies.

impulsive sound
Sound that is typically brief and intermittent with rapid (within a few seconds) rise time and decay back to ambient levels (NOAA 2013, ANSI S12.7-1986 R2006). For example, seismic airguns and impact pile driving.

low-frequency (LF) cetacean
The functional cetacean hearing group that represents mysticetes (baleen whales) specialized for hearing low frequencies.

mean-square sound pressure spectral density
Distribution as a function of frequency of the mean-square sound pressure per unit bandwidth (usually 1 Hz) of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: $\mu Pa^2/Hz$.

mid-frequency (MF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for mid-frequency hearing.

octave
The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

parabolic equation method
A computationally efficient solution to the acoustic wave equation that is used to model transmission loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of transmission loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

particle acceleration
The rate of change of particle velocity. Unit: meters per second squared (m/s^2). Symbol: *a*.

particle velocity
The physical speed of a particle in a material moving back and forth in the direction of the pressure wave. Unit: meters per second (m/s). Symbol: *v*.

peak pressure level (PK)
The maximum instantaneous sound pressure level, in a stated frequency band, within a stated period. Also called zero-to-peak pressure level. Unit: decibel (dB).

peak-to-peak pressure level (PK-PK)
The difference between the maximum and minimum instantaneous pressure levels. Unit: decibel (dB).

permanent threshold shift (PTS)
A permanent loss of hearing sensitivity caused by excessive noise exposure. PTS is considered auditory injury.

point source
A source that radiates sound as if from a single point (ANSI S1.1-1994 R2004).

pressure, acoustic
The deviation from the ambient hydrostatic pressure caused by a sound wave. Also called overpressure. Unit: pascal (Pa). Symbol: *p*.

received level (RL)
The sound level measured (or that would be measured) at a defined location.

rms
root-mean-square.

shear wave
A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called secondary wave or S-wave. Shear waves propagate only in solid media, such as sediments or rock. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

signature
Pressure signal generated by a source.

sound
A time-varying pressure disturbance generated by mechanical vibration waves travelling through a fluid medium such as air or water.

sound exposure
Time integral of squared, instantaneous frequency-weighted sound pressure over a stated time interval or event. Unit: pascal-squared second ($Pa^2 \cdot s$) (ANSI S1.1-1994 R2004).

sound exposure level (SEL)
A cumulative measure related to the sound energy in one or more pulses. Unit: dB re 1 $\mu Pa^2 \cdot s$. SEL is expressed over the summation period (e.g., per-pulse SEL [for airguns], single-strike SEL [for pile drivers], 24-hour SEL).

sound exposure spectral density
Distribution as a function of frequency of the time-integrated squared sound pressure per unit bandwidth of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: $\mu Pa^2 \cdot s/Hz$.

sound field
Region containing sound waves (ANSI S1.1-1994 R2004).

sound intensity
Sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound speed profile
The speed of sound in the water column as a function of depth below the water surface.

source level (SL)
The sound level measured in the far-field and scaled back to a standard reference distance of 1 metre from the acoustic centre of the source. Unit: dB re 1 µPa m (pressure level) or dB re 1 $\mu Pa^2 \cdot s \cdot m^2$ (exposure level).

spectral density level
The decibel level ($10 \cdot \log_{10}$) of the spectral density of a given parameter such as SPL or SEL, for which the units are dB re 1 $\mu Pa^2/Hz$ and dB re 1 $\mu Pa^2 \cdot s/Hz$, respectively.

spectrum
An acoustic signal represented in terms of its power, energy, mean-square sound pressure, or sound exposure distribution with frequency.

surface duct
The upper portion of a water column within which the sound speed profile gradient causes sound to refract upward and therefore reflect off the surface resulting in relatively long-range sound propagation with little loss.

temporary threshold shift (TTS)
Temporary loss of hearing sensitivity caused by excessive noise exposure.

thermocline
The depth interval near the ocean surface that experiences temperature gradients due to warming or cooling by heat conduction from the atmosphere and by warming from solar heating.

transmission loss (TL)
The decibel reduction in sound level between two stated points that results from sound spreading away from an acoustic source subject to the influence of the surrounding environment. Also referred to as propagation loss.

wavelength
Distance over which a wave completes one cycle of oscillation. Unit: metre (m). Symbol: λ.

Literature Cited

[DEWHA] Department of the Environment Water Heritage and the Arts. 2008. *EPBC Act Policy Statement 2.1 - Interaction Between Offshore Seismic Exploration and Whales*. *In*: Australian Government - Department of the Environment, Water, Heritage and the Arts. 14 p. http://www.environment.gov.au/resource/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales.

[HESS] High Energy Seismic Survey. 1999. *High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California*. Prepared for the California State Lands Commission and the United States Minerals Management Service Pacific Outer Continental Shelf Region by the High Energy Seismic Survey Team, Camarillo, CA, USA. 98 p. https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2001100103.xhtml.

[ISO] International Organization for Standardization. 2017a. *ISO 18405:2017. Underwater acoustics – Terminology*. Geneva. https://www.iso.org/standard/62406.html.

[ISO] International Organization for Standardization. 2017b. *ISO/DIS 18405.2:2017. Underwater acoustics—Terminology*. Geneva. https://www.iso.org/standard/62406.html.

[NMFS] National Marine Fisheries Service. 2014. *Marine Mammals: Interim Sound Threshold Guidance* (webpage). National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html.

[NMFS] National Marine Fisheries Service (US). 1998. *Acoustic Criteria Workshop*. Dr. Roger Gentry and Dr. Jeanette Thomas Co-Chairs.

[NMFS] National Marine Fisheries Service (US). 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178 p.

[NMFS] National Marine Fisheries Service (US). 2018. *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://www.fisheries.noaa.gov/webdam/download/75962998.

[NOAA] National Oceanic and Atmospheric Administration (US). 2013. *Draft guidance for assessing the effects of anthropogenic sound on marine mammals: Acoustic threshold levels for onset of permanent and temporary threshold shifts*. National Oceanic and Atmospheric Administration, US Department of Commerce, and NMFS Office of Protected Resources, Silver Spring, MD, USA. 76 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2015. *Draft guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic threshold levels for onset of permanent and temporary threshold shifts*. NMFS Office of Protected Resources, Silver Spring, MD, USA. 180 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2016. *Document Containing Proposed Changes to the NOAA Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts*. National Oceanic and Atmospheric Administration and US Department of Commerce. 24 p.

[NSF] National Science Foundation (US), Geological Survey (US), and [NOAA] National Oceanic and Atmospheric Administration (US). 2011. *Final Programmatic Environmental Impact Statement/Overseas. Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the US Geological Survey*. National Science Foundation, Arlington, VA, USA. https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf.

[ONR] Office of Naval Research. 1998. *ONR Workshop on the Effect of Anthropogenic Noise in the Marine Environment*. Dr. R. Gisiner, Chair.

Aerts, L.A.M., M. Blees, S.B. Blackwell, C.R. Greene, Jr., K.H. Kim, D.E. Hannay, and M.E. Austin. 2008. *Marine mammal monitoring and mitigation during BP Liberty OBC seismic survey in Foggy Island Bay, Beaufort Sea, July-August 2008: 90-day report*. Document Number P1011-1. Report by LGL Alaska Research Associates Inc., LGL Ltd., Greeneridge Sciences Inc., and JASCO Applied Sciences for BP Exploration Alaska. 199 p. ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/Auke%20Bay/AukeBayScans/Removable%20Disk/P1011-1.pdf.

ANSI S12.7-1986. R2006. *American National Standard Methods for Measurements of Impulsive Noise*. American National Standards Institute, NY, USA.

ANSI S1.1-1994. R2004. *American National Standard Acoustical Terminology*. American National Standards Institute, NY, USA.

Austin, M.E. and G.A. Warner. 2012. *Sound Source Acoustic Measurements for Apache's 2012 Cook Inlet Seismic Survey*. Version 2.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation.

Austin, M.E. and L. Bailey. 2013. *Sound Source Verification: TGS Chukchi Sea Seismic Survey Program 2013*. Document Number 00706, Version 1.0. Technical report by JASCO Applied Sciences for TGS-NOPEC Geophysical Company.

Austin, M.E., A. McCrodan, C. O'Neill, Z. Li, and A.O. MacGillivray. 2013. *Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort Seas, July–November 2012: 90-Day Report*. *In*: Funk, D.W., C.M. Reiser, and W.R. Koski (eds.). Underwater Sound Measurements. LGL Rep. P1272D–1. Report from LGL Alaska Research Associates Inc. and JASCO Applied Sciences, for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 266 pp plus appendices.

Austin, M.E. 2014. Underwater noise emissions from drillships in the Arctic. *In*: Papadakis, J.S. and L. Bjørnø (eds.). *UA2014 - 2nd International Conference and Exhibition on Underwater Acoustics*. 22-27 Jun 2014, Rhodes, Greece. pp. 257-263.

Austin, M.E., H. Yurk, and R. Mills. 2015. *Acoustic Measurements and Animal Exclusion Zone Distance Verification for Furie's 2015 Kitchen Light Pile Driving Operations in Cook Inlet*. Version 2.0. Technical report by JASCO Applied Sciences for Jacobs LLC and Furie Alaska.

Austin, M.E. and Z. Li. 2016. *Marine Mammal Monitoring and Mitigation During Exploratory Drilling by Shell in the Alaskan Chukchi Sea, July–October 2015: Draft 90-day report*. *In*: Ireland, D.S. and L.N. Bisson (eds.). Underwater Sound Measurements. LGL Rep. P1363D. Report from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. For Shell Gulf of Mexico Inc, National Marine Fisheries Service, and US Fish and Wildlife Service. 188 pp + appendices.

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137-152. https://doi.org/10.1121/1.1810231.

Carnes, M.R. 2009. *Description and Evaluation of GDEM-V 3.0*. US Naval Research Laboratory, Stennis Space Center, MS. NRL Memorandum Report 7330-09-9165. 21 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/a494306.pdf.

Collins, M.D. 1993. A split-step Padé solution for the parabolic equation method. *Journal of the Acoustical Society of America* 93(4): 1736-1742. https://doi.org/10.1121/1.406739.

Collins, M.D., R.J. Cederberg, D.B. King, and S. Chin-Bing. 1996. Comparison of algorithms for solving parabolic wave equations. *Journal of the Acoustical Society of America* 100(1): 178-182. https://doi.org/10.1121/1.415921.

Coppens, A.B. 1981. Simple equations for the speed of sound in Neptunian waters. *Journal of the Acoustical Society of America* 69(3): 862-863. https://doi.org/10.1121/1.382038.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, K. Hartmann, J.M. Semmens, and Institute for Marine and Antarctic Studies. 2016a. *Assessing the Impact of Marine Seismic Surveys on Southeast Australian Scallop and Lobster Fisheries*. Impacts of Marine Seismic Surveys on Scallop and Lobster Fisheries. Fisheries Ressearch & Development Corporation. FRDC Project No 2012/008, University of Tasmania, Hobart. 159 p.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, and J.M. Semmens. 2016b. Seismic air gun exposure during early-stage embryonic development does not negatively affect spiny lobster *Jasus edwardsii larvae* (Decapoda:Palinuridae). *Scientific Reports* 6: 1-9. https://doi.org/10.1038/srep22723.

Dragoset, W.H. 1984. A comprehensive method for evaluating the design of airguns and airgun arrays. *16th Annual Offshore Technology Conference* Volume 3, 7-9 May 1984. OTC 4747, Houston, TX, USA. pp. 75–84. https://doi.org/10.4043/4783-MS.

Ellison, W.T. and P.J. Stein. 1999. *SURTASS LFA High Frequency Marine Mammal Monitoring (HF/M3) Sonar: Sustem Description and Test & Evaluation*. Under US Navy Contract N66604-98-D-5725. http://www.surtass-lfa-eis.com/wp-content/uploads/2018/02/HF-M3-Ellison-Report-2-4a.pdf.

Finneran, J.J. and C.E. Schlundt. 2010. Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*). *Journal of the Acoustical Society of America* 128(2): 567-570. https://doi.org/10.1121/1.3458814.

Finneran, J.J. and A.K. Jenkins. 2012. *Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis*. SPAWAR Systems Center Pacific, San Diego, CA, USA. 64 p.

Finneran, J.J. 2015. *Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores*. Technical report by SSC Pacific, San Diego, CA, USA.

Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report for Space and Naval Warfare Systems Center Pacific, San Diego, CA, USA. 49 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/1026445.pdf.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/a561707.pdf.

Fisher, F.H. and V.P. Simmons. 1977. Sound absorption in sea water. *Journal of the Acoustical Society of America* 62(3): 558-564. https://doi.org/10.1121/1.381574.

Funk, D.W., D.E. Hannay, D.S. Ireland, R. Rodrigues, and W.R. Koski. 2008. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–November 2007: 90-day report*. LGL Report P969-1.

Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 218 p.

Gedamke, J., N. Gales, and S. Frydman. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: The effect of uncertainty and individual variation. *Journal of the Acoustical Society of America* 129(1): 496-506. https://doi.org/10.1121/1.3493445.

Hannay, D.E. and R.G. Racca. 2005. *Acoustic Model Validation*. Document Number 0000-S-90-04-T-7006-00-E, Revision 02. Technical report by JASCO Research Ltd. for Sakhalin Energy Investment Company Ltd. 34 p.

Heyward, A., J. Colquhoun, E. Cripps, D. McCorry, M. Stowar, B. Radford, K. Miller, I. Miller, and C. Battershill. 2018. No evidence of damage to the soft tissue or skeletal integrity of mesophotic corals exposed to a 3D marine seismic survey. *Marine Pollution Bulletin* 129(1): 8-13. https://doi.org/10.1016/j.marpolbul.2018.01.057.

Ireland, D.S., R. Rodrigues, D.W. Funk, W.R. Koski, and D.E. Hannay. 2009. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–October 2008: 90-Day Report*. Document Number P1049-1. 277 p.

Landrø, M. 1992. Modeling of GI gun signatures. *Geophysical Prospecting* 40(7): 721–747. https://doi.org/10.1111/j.1365-2478.1992.tb00549.x.

Laws, R.M., L. Hatton, and M. Haartsen. 1990. Computer modeling of clustered airguns. *First Break* 8(9): 331–338.

Lucke, K., U. Siebert, P. Lepper, A., and M.-A. Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. *Journal of the Acoustical Society of America* 125(6): 4060-4070. https://doi.org/10.1121/1.3117443.

Lurton, X. 2002. *An Introduction to Underwater Acoustics: Principles and Applications*. Springer, Chichester, UK. 347 p.

MacGillivray, A.O. and N.R. Chapman. 2012. Modeling underwater sound propagation from an airgun array using the parabolic equation method. *Canadian Acoustics* 40(1): 19-25. https://jcaa.caa-aca.ca/index.php/jcaa/article/view/2502/2251.

MacGillivray, A.O. 2018. Underwater noise from pile driving of conductor casing at a deep-water oil platform. *Journal of the Acoustical Society of America* 143(1): 450-459. https://doi.org/10.1121/1.5021554.

Martin, B., K. Bröker, M.-N.R. Matthews, J.T. MacDonnell, and L. Bailey. 2015. Comparison of measured and modeled air-gun array sound levels in Baffin Bay, West Greenland. *OceanNoise 2015*. 11-15 May 2015, Barcelona, Spain.

Martin, B., J.T. MacDonnell, and K. Bröker. 2017a. Cumulative sound exposure levels—Insights from seismic survey measurements. *Journal of the Acoustical Society of America* 141(5): 3603-3603. https://doi.org/10.1121/1.4987709.

Martin, S.B. and A.N. Popper. 2016. Short- and long-term monitoring of underwater sound levels in the Hudson River (New York, USA). *Journal of the Acoustical Society of America* 139(4): 1886-1897. https://doi.org/10.1121/1.4944876.

Martin, S.B., M.-N.R. Matthews, J.T. MacDonnell, and K. Bröker. 2017b. Characteristics of seismic survey pulses and the ambient soundscape in Baffin Bay and Melville Bay, West Greenland. *Journal of the Acoustical Society of America* 142(6): 3331-3346. https://doi.org/10.1121/1.5014049.

Matthews, M.-N.R. and A.O. MacGillivray. 2013. Comparing modeled and measured sound levels from a seismic survey in the Canadian Beaufort Sea. *Proceedings of Meetings on Acoustics* 19(1): 1-8. https://doi.org/10.1121/1.4800553

Mattsson, A. and M. Jenkerson. 2008. Single Airgun and Cluster Measurement Project. *Joint Industry Programme (JIP) on Exploration and Production Sound and Marine Life Proramme Review*. 28-30 Oct 2008. International Association of Oil and Gas Producers, Houston, TX, USA.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000a. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40(1): 692-708. https://doi.org/10.1071/AJ99048.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000b. *Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid*. Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia. 198 p. https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/McCauley-et-al-Seismic-effects-2000.pdf.

McCauley, R.D., R.D. Day, K.M. Swadling, Q.P. Fitzgibbon, R.A. Watson, and J.M. Semmens. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nature Ecology & Evolution* 1(7): 1-8. https://doi.org/10.1038/s41559-017-0195.

McCrodan, A., C.R. McPherson, and D.E. Hannay. 2011. *Sound Source Characterization (SSC) Measurements for Apache's 2011 Cook Inlet 2D Technology Test*. Version 3.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation. 51 p.

McPherson, C.R. and G.A. Warner. 2012. *Sound Sources Characterization for the 2012 Simpson Lagoon OBC Seismic Survey 90-Day Report*. Document Number 00443, Version 2.0. Technical report by JASCO Applied Sciences for BP Exploration (Alaska) Inc. http://www.nmfs.noaa.gov/pr/pdfs/permits/bp_openwater_90dayreport_appendices.pdf.

McPherson, C.R., K. Lucke, B.J. Gaudet, S.B. Martin, and C.J. Whitt. 2018. *Pelican 3-D Seismic Survey Sound Source Characterisation*. Document Number 001583. Version 1.0. Technical report by JASCO Applied Sciences for RPS Energy Services Pty Ltd.

McPherson, C.R. and B. Martin. 2018. *Characterisation of Polarcus 2380 in^3 Airgun Array*. Document Number 001599, Version 1.0. Technical report by JASCO Applied Sciences for Polarcus Asia Pacific Pte Ltd.

Moein, S.E., J.A. Musick, J.A. Keinath, D.E. Barnard, M.L. Lenhardt, and R. George. 1995. *Evaluation of Seismic Sources for Repelling Sea Turtles from Hopper Dredges, in Sea Turtle Research Program: Summary Report*. *In*: Hales, L.Z. (ed.). Report from US Army Engineer Division and US Naval Submarine Base. Technical Report CERC-95. 90 p.

Nedwell, J.R. and A.W. Turnpenny. 1998. The use of a generic frequency weighting scale in estimating environmental effect. *Workshop on Seismics and Marine Mammals*. 23–25 Jun 1998, London, UK.

Nedwell, J.R., A.W. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, J.A.L. Spinks, and D. Howell. 2007. *A validation of the dB$_{ht}$ as a measure of the behavioural and auditory effects of underwater noise*. Document Number 534R1231 Report prepared by Subacoustech Ltd. for Chevron Ltd, TotalFinaElf Exploration UK PLC, Department of Business, Enterprise and Regulatory Reform, Shell UK Exploration and Production Ltd, The Industry Technology Facilitator, Joint Nature Conservation Committee, and The UK Ministry of Defence. 74 p. https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-et-al-2007.pdf.

O'Neill, C., D. Leary, and A. McCrodan. 2010. Sound Source Verification. (Chapter 3) *In* Blees, M.K., K.G. Hartin, D.S. Ireland, and D.E. Hannay (eds.). *Marine mammal monitoring and mitigation during open water seismic exploration by Statoil USA E&P Inc. in the Chukchi Sea, August-October 2010: 90-day report*. LGL Report P1119. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. for Statoil USA E&P Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. pp. 1-34.

Payne, J.F., C. Andrews, L. Fancey, D. White, and J. Christian. 2008. *Potential Effects of Seismic Energy on Fish and Shellfish: An Update since 2003*. Report Number 2008/060. Canadian Science Advisory Secretariat. 22 p.

Payne, R. and D. Webb. 1971. Orientation by means of long range acoustic signaling in baleen whales. *Annals of the New York Academy of Sciences* 188: 110-141. https://doi.org/10.1111/j.1749-6632.1971.tb13093.x.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Popper, A.N., T.J. Carlson, J.A. Gross, A.D. Hawkins, D.G. Zeddies, L. Powell, and J. Young. 2016. Effects of seismic air guns on pallid sturgeon and paddlefish. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, New York. pp. 871-878. https://doi.org/10.1007/978-1-4939-2981-8_107.

Porter, M.B. and Y.C. Liu. 1994. Finite-element ray tracing. *In*: Lee, D. and M.H. Schultz (eds.). *International Conference on Theoretical and Computational Acoustics*. Volume 2. World Scientific Publishing Co. pp. 947-956.

Quijano, J., R. Racca, and C. McPherson. 2018. *Keraudren 3-D Marine Seismic Survey: Acoustic Modelling for Assessing Marine Fauna Sound Exposures*. Document Number 01678, Version 1.0. Technical report by JASCO Applied Sciences for Quadrant Energy Limited. .

Racca, R.G., A.N. Rutenko, K. Bröker, and M.E. Austin. 2012a. A line in the water - design and enactment of a closed loop, model based sound level boundary estimation strategy for mitigation of behavioural impacts from a seismic survey. *11th European Conference on Underwater Acoustics*. Volume 34(3), Edinburgh, UK.

Racca, R.G., A.N. Rutenko, K. Bröker, and G. Gailey. 2012b. Model based sound level estimation and in-field adjustment for real-time mitigation of behavioural impacts from a seismic survey and post-event evaluation of sound exposure for individual whales. *In*: McMinn, T. (ed.). *Acoustics 2012*. Fremantle, Australia. http://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p92.pdf.

Racca, R.G., M.E. Austin, A.N. Rutenko, and K. Bröker. 2015. Monitoring the gray whale sound exposure mitigation zone and estimating acoustic transmission during a 4-D seismic survey, Sakhalin Island, Russia. *Endangered Species Research* 29(2): 131-146. https://doi.org/10.3354/esr00703.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4): 411-521.

Teague, W.J., M.J. Carron, and P.J. Hogan. 1990. A comparison between the Generalized Digital Environmental Model and Levitus climatologies. *Journal of Geophysical Research* 95(C5): 7167-7183. https://doi.org/10.1029/JC095iC05p07167.

Tougaard, J., A.J. Wright, and P.T. Madsen. 2015. Cetacean noise criteria revisited in the light of proposed exposure limits for harbour porpoises. *Marine Pollution Bulletin* 90(1-2): 196-208. https://doi.org/10.1016/j.marpolbul.2014.10.051.

Warner, G.A., C. Erbe, and D.E. Hannay. 2010. Underwater Sound Measurements. (Chapter 3) *In* Reiser, C.M., D. Funk, R. Rodrigues, and D.E. Hannay (eds.). *Marine Mammal Monitoring and Mitigation during Open Water Shallow Hazards and Site Clearance Surveys by Shell Offshore Inc. in the Alaskan Chukchi Sea, July-October 2009: 90-Day Report*. LGL Report P1112-1. Report by LGL Alaska Research Associates Inc. and JASCO Applied Sciences for Shell Offshore Inc., National Marine Fisheries Service (US), and Fish and Wildlife Service (US). pp. 1-54.

Warner, G.A., M.E. Austin, and A.O. MacGillivray. 2017. Hydroacoustic measurements and modeling of pile driving operations in Ketchikan, Alaska [Abstract]. *Journal of the Acoustical Society of America* 141(5): 3992. https://doi.org/10.1121/1.4989141.

Whiteway, T. 2009. *Australian Bathymetry and Topography Grid, June 2009*. GeoScience Australia, Canberra. http://pid.geoscience.gov.au/dataset/ga/67703.

Wood, J.D., B.L. Southall, and D.J. Tollit. 2012. *PG&E offshore 3-D Seismic Survey Project Environmental Impact Report–Marine Mammal Technical Draft Report*. Report by SMRU Ltd. 121 p. https://www.coastal.ca.gov/energy/seismic/mm-technical-report-EIR.pdf.

Zhang, Z.Y. and C.T. Tindle. 1995. Improved equivalent fluid approximations for a low shear speed ocean bottom. *Journal of the Acoustical Society of America* 98(6): 3391-3396. https://doi.org/10.1121/1.413789.

Ziolkowski, A.M. 1970. A method for calculating the output pressure waveform from an air gun. *Geophysical Journal International* 21(2): 137-161. https://doi.org/10.1111/j.1365-246X.1970.tb01773.x.

Zykov, M.M. and J.T. MacDonnell. 2013. *Sound Source Characterizations for the Collaborative Baseline Survey Offshore Massachusetts Final Report: Side Scan Sonar, Sub-Bottom Profiler, and the R/V Small Research Vessel experimental*. Document Number 00413, Version 2.0. Technical report by JASCO Applied Sciences for Fugro GeoServices, Inc. and the (US) Bureau of Ocean Energy Management.

Appendix A. Acoustic Metrics

A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 µPa. Because the perceived loudness of sound, especially impulsive noise such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate noise and its effects on marine life. We provide specific definitions of relevant metrics used in the accompanying report. Where possible we follow the ANSI and ISO standard definitions and symbols for sound metrics, but these standards are not always consistent.

The zero-to-peak sound pressure level (PK; L_{pk}; $L_{p,pk}$; dB re 1 µPa), is the maximum instantaneous sound pressure level in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,pk} = 20\log_{10}\left[\frac{\max\left(|p(t)|\right)}{p_0}\right] \quad \text{(A-1)}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of a noise event, it is generally a poor indicator of perceived loudness.

The peak-to-peak sound pressure level (PK-PK; $L_{pk\text{-}pk}$; $L_{p,pk\text{-}pk}$; dB re 1 µPa) is the difference between the maximum and minimum instantaneous sound pressure levels in a stated frequency band attained by an impulsive sound, $p(t)$:

$$L_{p,pk-pk} = 10\log_{10}\left\{\frac{\left[\max\left(p(t)\right) - \min\left(p(t)\right)\right]^2}{p_0^2}\right\} \quad \text{(A-2)}$$

The sound pressure level (SPL; L_p; dB re 1 µPa) is the rms pressure level in a stated frequency band over a specified time window (T, s) containing the acoustic event of interest. It is important to note that SPL always refers to a rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T p^2(t)dt \Big/ p_0^2\right) \quad \text{(A-3)}$$

The SPL represents a nominal effective continuous sound over the duration of an acoustic event, such as the emission of one acoustic pulse, a marine mammal vocalization, the passage of a vessel, or over a fixed duration. Because the window length, T, is the divisor, events with similar sound exposure level (SEL) but more spread out in time have a lower SPL. A fixed window length of 0.125 s (critical duration defined by Tougaard et al. (2015)) is used in this study for impulsive sounds.

The sound exposure level (SEL; L_E; $L_{E,p}$; dB re 1 µPa^2·s) is a measure related to the acoustic energy contained in one or more acoustic events (N). The SEL for a single event is computed from the time-integral of the squared pressure over the full event duration (T):

$$L_E = 10\log_{10}\left(\int_T p^2(t)dt \Big/ T_0 p_0^2\right) \quad \text{(A-4)}$$

where T_0 is a reference time interval of 1 s. The SEL continues to increase with time when non-zero pressure signals are present. It therefore can be construed as a dose-type measurement, so the integration time used must be carefully considered in terms of relevance for impact to the exposed recipients.

SEL can be calculated over periods with multiple acoustic events or over a fixed duration. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the *N* individual events:

$$L_{E,N} = 10\log_{10}\left(\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}}\right). \qquad \text{(A-5)}$$

If applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LFC,24h}$; Appendix A.3). The use of fast, slow, or impulse exponential-time-averaging or other time-related characteristics should else be specified.

A.2. Marine Mammal Impact Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggested that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources—primarily airguns used in seismic surveys—could cause auditory injury. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for both injury and disturbance. The following sections summarize the recent development of thresholds; however, this field remains an active research topic.

A.2.1. Injury

In recognition of shortcomings of the SPL-only based injury criteria, in 2005 NMFS sponsored the Noise Criteria Group to review literature on marine mammal hearing to propose new noise exposure criteria. Some members of this expert group published a landmark paper (Southall et al. 2007) that suggested assessment methods similar to those applied for humans. The resulting recommendations introduced dual acoustic injury criteria for impulsive sounds that included peak pressure level thresholds and SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak pressure level criterion is not frequency weighted whereas the SEL_{24h} is frequency weighted according to one of four marine mammal species hearing groups: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively) and Pinnipeds in Water (PINN). These weighting functions are referred to as M-weighting filters (analogous to the A-weighting filter for human; Appendix A.3). The SEL_{24h} thresholds were obtained by extrapolating measurements of onset levels of Temporary Threshold Shift (TTS) in belugas by the amount of TTS required to produce Permanent Threshold Shift (PTS) in chinchillas. The Southall et al. (2007) recommendations do not specify an exchange rate, which suggests that the thresholds are the same regardless of the duration of exposure (i.e., it implies a 3 dB exchange rate).

Wood et al. (2012) refined Southall et al.'s (2007) thresholds, suggesting lower injury values for LF and HF cetaceans while retaining the filter shapes. Their revised thresholds were based on TTS-onset levels in harbour porpoises from Lucke et al. (2009), which led to a revised impulsive sound PTS threshold for HF cetaceans of 179 dB re 1 $\mu Pa^2 \cdot s$. Because there were no data available for baleen whales, Wood et al. (2012) based their recommendations for LF cetaceans on results obtained from MF cetacean studies. In particular they referenced Finneran and Schlundt (2010) research, which found mid-frequency cetaceans are more sensitive to non-impulsive sound exposure than Southall et al. (2007) assumed. Wood et al. (2012) thus recommended a more conservative TTS-onset level for LF cetaceans of 192 dB re 1 $\mu Pa^2 \cdot s$.

As of 2017, an optimal approach is not apparent. There is consensus in the research community that an SEL-based method is preferable either separately or in addition to an SPL-based approach to assess the potential for injuries. In August 2016, after substantial public and expert input into three draft versions and based largely on the above-mentioned literature (NOAA 2013, 2015, 2016), NMFS finalised technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing (NMFS 2016). The guidance describes injury criteria with new thresholds and frequency

weighting functions for the five hearing groups described by Finneran and Jenkins (2012). The latest revision to this work was published in 2018; only the PK criteria defined in NMFS (2018) are applied in this report.

A.3. Marine Mammal Frequency Weighting

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

A.3.1. Marine mammal frequency weighting functions

In 2015, a U.S. Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^{2}\right]^{a}\left[1+(f/f_{hi})^{2}\right]^{b}}\right)\right] \quad \text{(A-6)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid-, and high-frequency cetaceans, phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses noise impacts on marine mammals (NMFS 2016, NMFS 2018). Table A-1 lists the frequency-weighting parameters for each hearing group; Figure A-1 shows the resulting frequency-weighting curves.

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2018).

Hearing group	a	b	f_{lo} (Hz)	f_{hi} (kHz)	K (dB)
Low-frequency cetaceans (baleen whales)	1.0	2	200	19,000	0.13
Mid-frequency cetaceans (dolphins, plus toothed, beaked, and bottlenose whales)	1.6	2	8,800	110,000	1.20
High-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	1.8	2	12,000	140,000	1.36

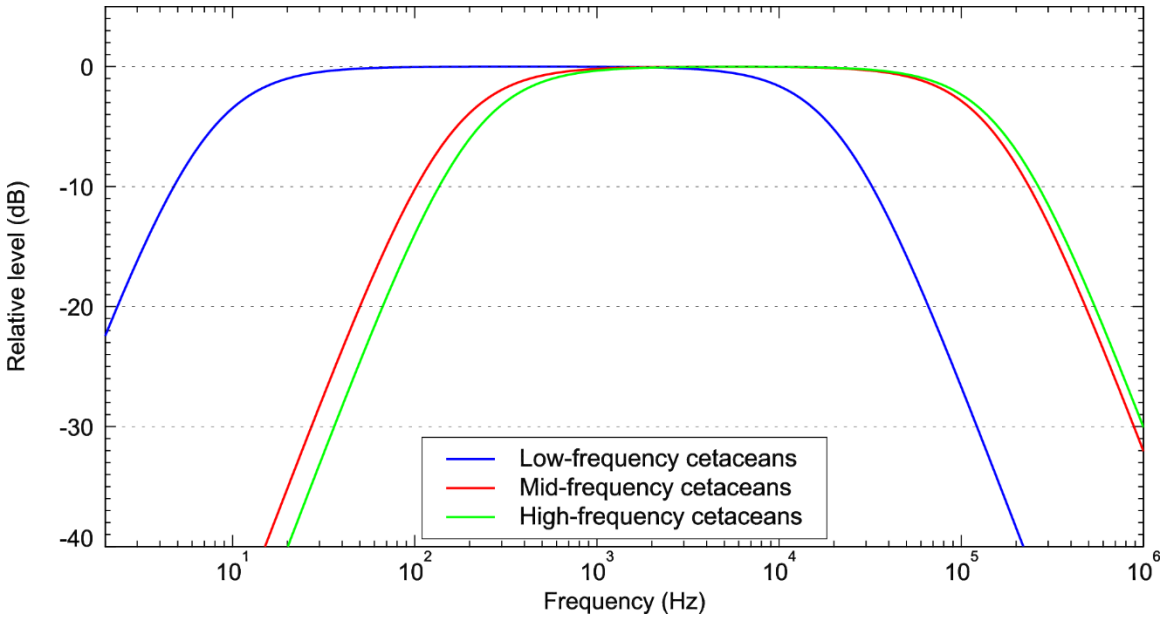


Figure A-1. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2018).

Appendix B. Acoustic Source Model

B.1. Airgun Array Source Model

The source levels and directivity of the seismic source were predicted with JASCO's Airgun Array Source Model (AASM). AASM includes low- and high-frequency modules for predicting different components of the seismic source spectrum. The low-frequency module is based on the physics of oscillation and radiation of airgun bubbles, as originally described by Ziolkowski (1970), that solves the set of parallel differential equations that govern bubble oscillations. Physical effects accounted for in the simulation include pressure interactions between airguns, port throttling, bubble damping, and generator-injector (GI) gun behaviour discussed by Dragoset (1984), Laws et al. (1990), and Landrø (1992). A global optimisation algorithm tunes free parameters in the model to a large library of airgun source signatures.

While airgun signatures are highly repeatable at the low frequencies, which are used for seismic imaging, their sound emissions have a large random component at higher frequencies that cannot be predicted using a deterministic model. Therefore, AASM uses a stochastic simulation to predict the high-frequency (800−25,000 Hz) sound emissions of individual airguns, using a data-driven multiple-regression model. The multiple-regression model is based on a statistical analysis of a large collection of high quality seismic source signature data recently obtained from the Joint Industry Program (JIP) on Sound and Marine Life (Mattsson and Jenkerson 2008). The stochastic model uses a Monte-Carlo simulation to simulate the random component of the high-frequency spectrum of each airgun in an array. The mean high-frequency spectra from the stochastic model augment the low-frequency signatures from the physical model, allowing AASM to predict airgun source levels at frequencies up to 25,000 Hz.

AASM produces a set of "notional" signatures for each array element based on:

- Array layout
- Volume, tow depth, and firing pressure of each airgun
- Interactions between different airguns in the array

These notional signatures are the pressure waveforms of the individual airguns at a standard reference distance of 1 m; they account for the interactions with the other airguns in the array. The signatures are summed with the appropriate phase delays to obtain the far-field source signature of the entire array in all directions. This far-field array signature is filtered into 1/3-octave-bands to compute the source levels of the array as a function of frequency band and azimuthal angle in the horizontal plane (at the source depth), after which it is considered a directional point source in the far field.

A seismic array consists of many sources and the point source assumption is invalid in the near field where the array elements add incoherently. The maximum extent of the near field of an array (R_{nf}) is:

$$R_{\mathrm{nf}} < \frac{l^2}{4\lambda} \tag{B-1}$$

where λ is the sound wavelength and l is the longest dimension of the array (Lurton 2002, §5.2.4). For example, a seismic source length of l = 21 m yields a near-field range of 147 m at 2 kHz and 7 m at 100 Hz. Beyond this R_{nf} range, the array is assumed to radiate like a directional point source and is treated as such for propagation modelling.

The interactions between individual elements of the array create directionality in the overall acoustic emission. Generally, this directionality is prominent mainly at frequencies in the mid-range between tens of hertz to several hundred hertz. At lower frequencies, with acoustic wavelengths much larger than the inter-airgun separation distances, the directionality is small. At higher frequencies, the pattern of lobes is too finely spaced to be resolved and the effective directivity is less.

B.2. Array Source Levels and Directivity

Figure B-1 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction), and vertical overpressure signature and corresponding power spectrum levels for the 3090 in^3 array (Appendix D.4).

Horizontal 1/3-octave-band source levels are shown as a function of band centre frequency and azimuth (Figure B-2); directivity in the sound field is most noticeable at mid-frequencies as described in the model detail in Appendix B.1.

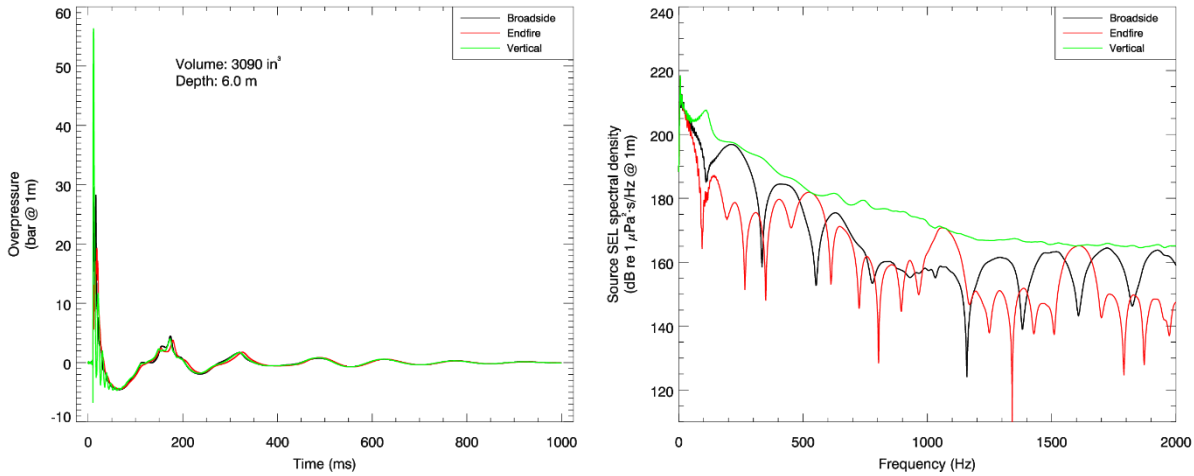


Figure B-1. Predicted source level details for the 3090 in^3 array at a 6 m towed depth. (Left) the overpressure signature and (right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions.

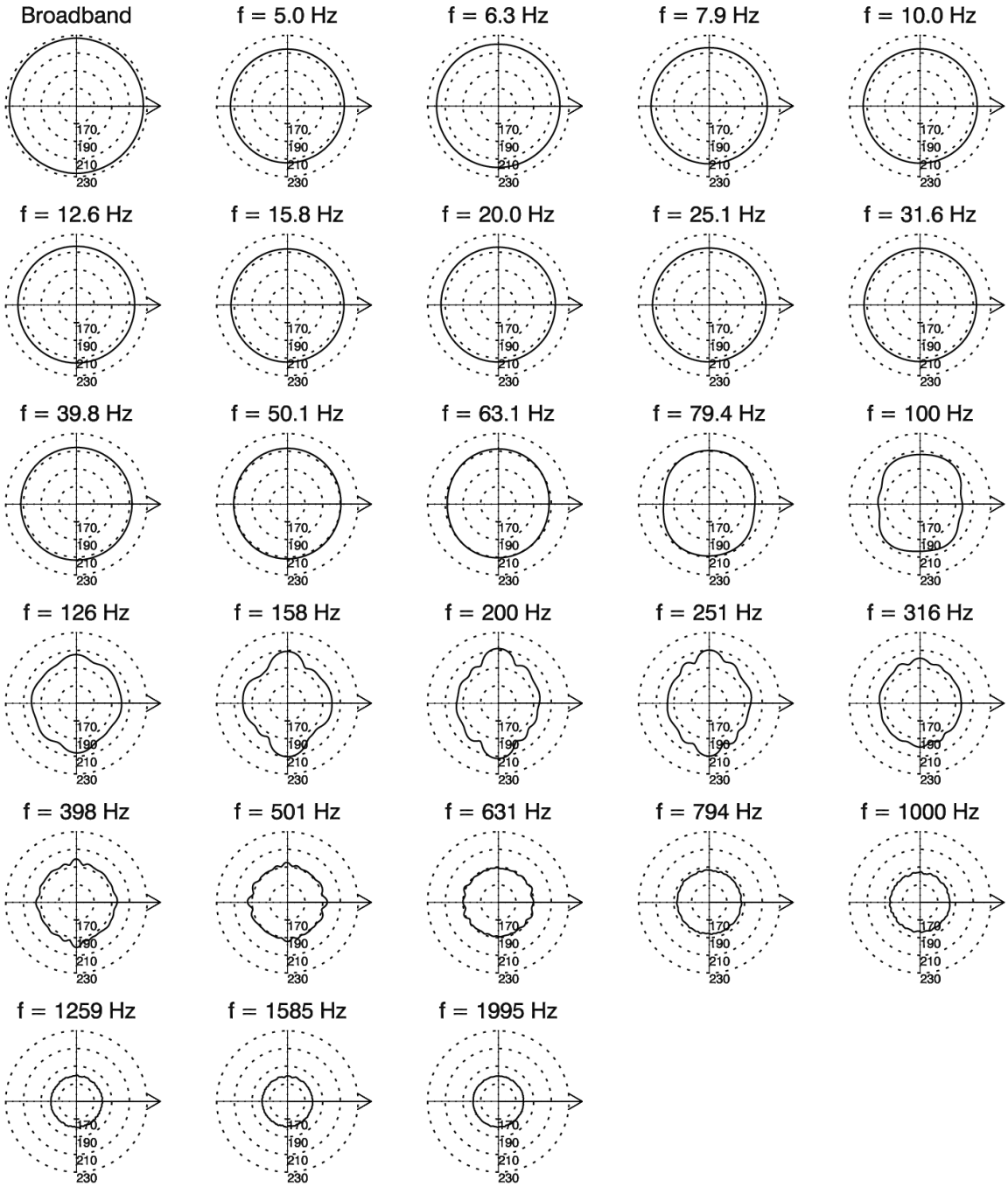


Figure B-2. Directionality of the predicted horizontal source levels for the 3090 in^3 seismic source array, 10 Hz to 2 kHz. Source levels (in dB re 1 µPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the 1/3-octave-bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 6 m (see Figure B-1).

Appendix C. Sound Propagation Models

C.1. MONM-BELLHOP

Long-range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). Compared to VSTACK, MONM less accurately predicts steep-angle propagation for environments with higher shear speed but is well suited for effective longer-range estimation. This model computes sound propagation at frequencies of 10 Hz to 1.25 kHz via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). MONM computes sound propagation at frequencies > 1.25 kHz via the BELLHOP Gaussian beam acoustic ray-trace model (Porter and Liu 1994).

The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM accounts for the additional reflection loss at the seabed, which results from partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

This version of MONM accounts for sound attenuation due to energy absorption through ion relaxation and viscosity of water in addition to acoustic attenuation due to reflection at the medium boundaries and internal layers (Fisher and Simmons 1977). The former type of sound attenuation is significant for frequencies higher than 5 kHz and cannot be neglected without noticeably affecting the model results.

MONM computes acoustic fields in three dimensions by modelling transmission loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ number of planes (Figure C-1).

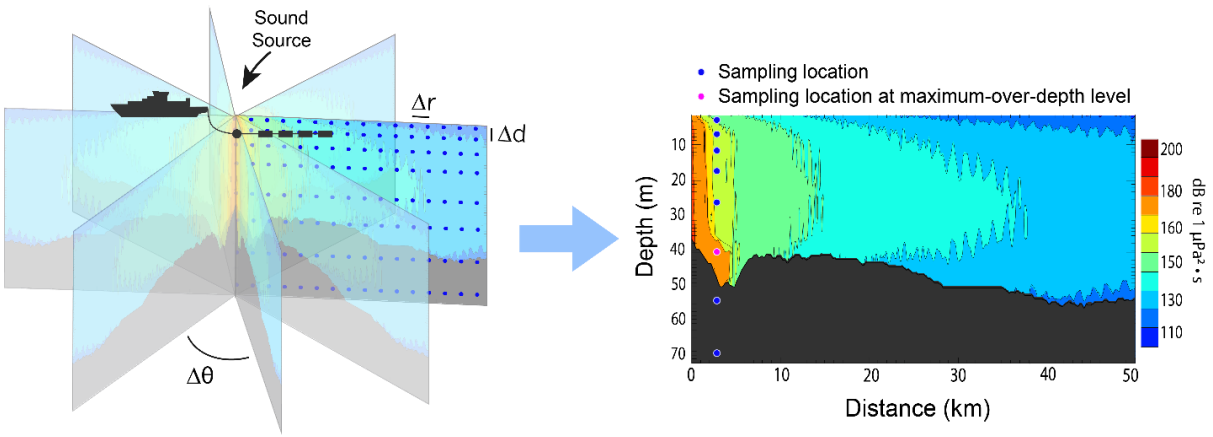


Figure C-1. The N×2-D and maximum-over-depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic transmission loss at the centre frequencies of 1/3-octave-bands. Sufficiently many 1/3-octave-bands, starting at 10 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the transmission loss is modelled within each of the N vertical planes as a function of depth and range from the source. The 1/3-octave-band received per-pulse SEL are computed by subtracting the band transmission loss values from the directional source level in that frequency band. Composite broadband received per-pulse SEL are then computed by summing the received 1/3-octave-band levels.

The received per-pulse SEL sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size. At each sampling range along the surface, the sound field is sampled at various depths, with the step size between samples increasing with depth

below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. For areas with deep water, sampling is not performed at depths beyond those reachable by marine mammals. The received per-pulse SEL at a surface sampling location is taken as the maximum value that occurs over all samples within the water column, i.e., the maximum-over-depth received per-pulse SEL. These maximum-over-depth per-pulse SEL are presented as colour contours around the source.

An inherent variability in measured sound levels is caused by temporal variability in the environment and the variability in the signature of repeated acoustic impulses (sample sound source verification results is presented in Figure C-2). While MONM's predictions correspond to the averaged received levels, cautionary estimates of the threshold radii are obtained by shifting the best fit line (solid line, Figure C-2) upward so that the trend line encompasses 90% of all the data (dashed line, Figure C-2).

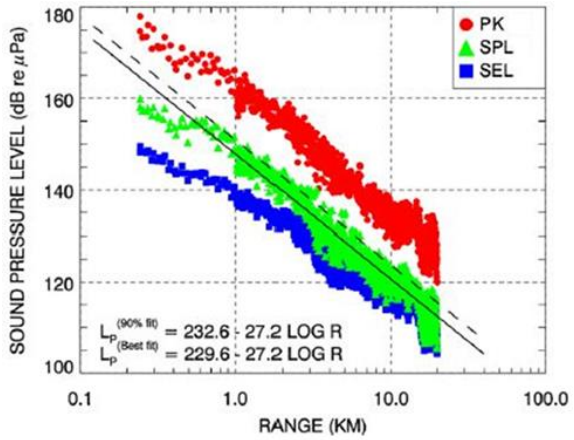


Figure C-2. PK and SPL and per-pulse SEL versus range from a 20 in^3 seismic source. Solid line is the least squares best fit to SPL. Dashed line is the best fit line increased by 3.0 dB to exceed 90% of all SPL values (90th percentile fit) (Ireland et al. 2009, Figure 10).

C.2. Full Waveform Range-dependent Acoustic Model: FWRAM

For impulsive sounds from the seismic source, time-domain representations of the pressure waves generated in the water are required to calculate SPL and PK. Furthermore, the seismic source must be represented as a distributed source to accurately characterise vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on the same wide-angle parabolic equation (PE) algorithm as MONM. FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments, and it takes the same environmental inputs as MONM (bathymetry, water sound speed profile, and seafloor geoacoustic profile). Unlike MONM, FWRAM computes pressure waveforms via Fourier synthesis of the modelled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Besides providing direct calculations of the PK and SPL, the synthetic waveforms from FWRAM can also be used to convert the SEL values from MONM to SPL.

C.3. Wavenumber Integration Model

Sound pressure levels near the seismic source were modelled using JASCO's VSTACK wavenumber integration model. VSTACK computes synthetic pressure waveforms versus depth and range for arbitrarily layered, range-independent acoustic environments using the wavenumber integration approach to solve the exact (range-independent) acoustic wave equation. This model is valid over the full angular range of the wave equation and can fully account for the elasto-acoustic properties of the sub-bottom. Wavenumber integration methods are extensively used in the field of underwater acoustics and seismology where they are often referred to as reflectivity methods or discrete

wavenumber methods. VSTACK computes sound propagation in arbitrarily stratified water and seabed layers by decomposing the outgoing field into a continuum of outward-propagating plane cylindrical waves. Seabed reflectivity in the model is dependent on the seabed layer properties: compressional and shear wave speeds, attenuation coefficients, and layer densities. The output of the model can be post-processed to yield estimates of the SEL, SPL, and PK.

VSTACK accurately predicts steep-angle propagation in the proximity of the source, but it is computationally slow at predicting sound pressures at large distances due to the need for smaller wavenumber steps with increasing distance. Additionally, VSTACK assumes range-invariant bathymetry with a horizontally stratified medium (i.e., a range-independent environment) which is azimuthally symmetric about the source. VSTACK is thus best suited to modelling the sound field near the source.

Appendix D. Methods and Parameters

This section describes the specifications of the seismic source that was used at all sites and the environmental parameters used in the propagation models.

D.1. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) R_{max}, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure D-1).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure D-1(a). In cases such as this, where relatively few points are excluded in any given direction, R_{max} can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure D-1(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases R_{max} might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.

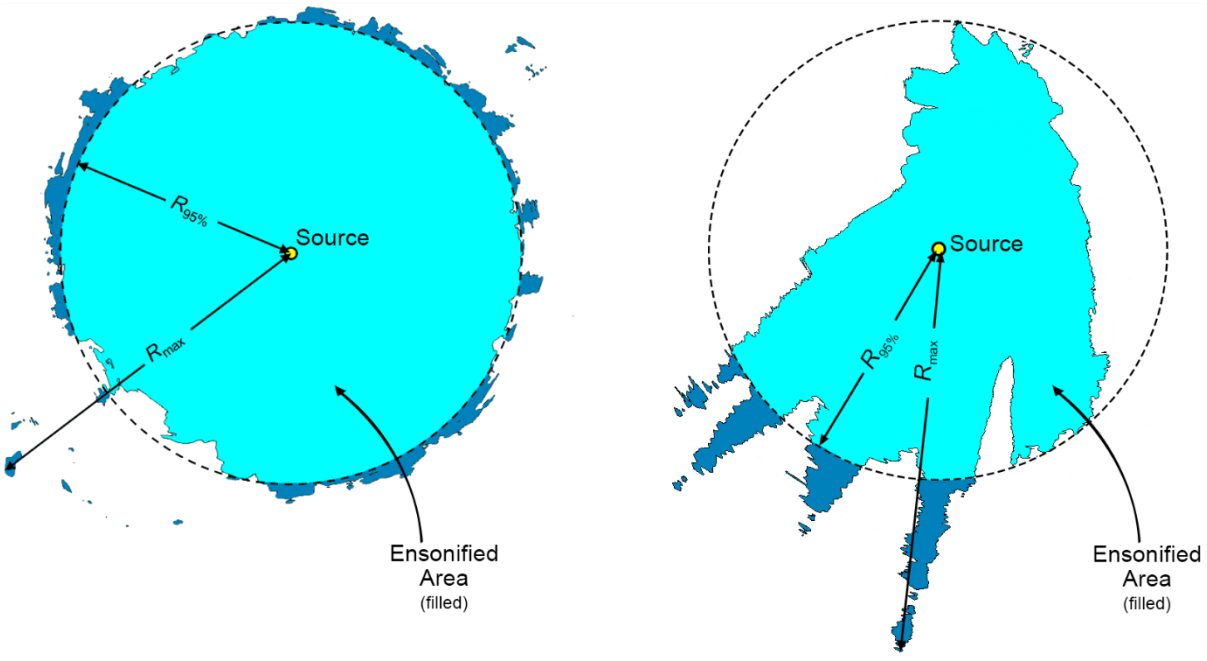


Figure D-1. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two different scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine R_{max}.

D.2. Estimating SPL from Modelled SEL Results

The per-pulse SEL of sound pulses is an energy-like metric related to the dose of sound received over a pulse's entire duration. The pulse SPL on the other hand, is related to its intensity over a specified time interval. Seismic pulses typically lengthen in duration as they propagate away from their source, due to seafloor and surface reflections, and other waveguide dispersion effects. The changes in pulse length, and therefore the time window considered, affect the numeric relationship between SPL and SEL. This study has applied a fixed window duration to calculate SPL (T_{fix} = 125 ms; see Appendix A.1), as implemented in Martin et al. (2017b). Full-waveform modelling was used to estimate SPL, but this type of modelling is computationally intensive, and can be prohibitively time consuming when run at high spatial resolution over large areas.

For the current study, FWRAM (Appendix C.2) was used to model synthetic seismic pulses over the frequency range 5–1024 Hz. This was performed along all broadside and endfire radials at two sites. FWRAM uses Fourier synthesis to recreate the signal in the time domain so that both the SEL and SPL from the source can be calculated. The differences between the SEL and SPL were extracted for all ranges and depths that corresponded to those generated from the high spatial-resolution results from MONM. A 125 ms fixed time window positioned to maximize the SPL over the pulse duration was applied. The resulting SEL -to-SPL offsets were averaged in 0.3 km range bins along each modelled radial and depth, and the 90th percentile was selected at each range to generate a generalised range-dependent conversion function for each site. The range- dependent conversion function was averaged between the two sites and applied to predicted per-pulse SEL results from MONM to model SPL values. Figure D-2 shows the conversion offsets for each site; the spatial variation is caused by changes in the received airgun pulse as it propagates from the source. Modelling was conducted using the average conversion function from all four sites.

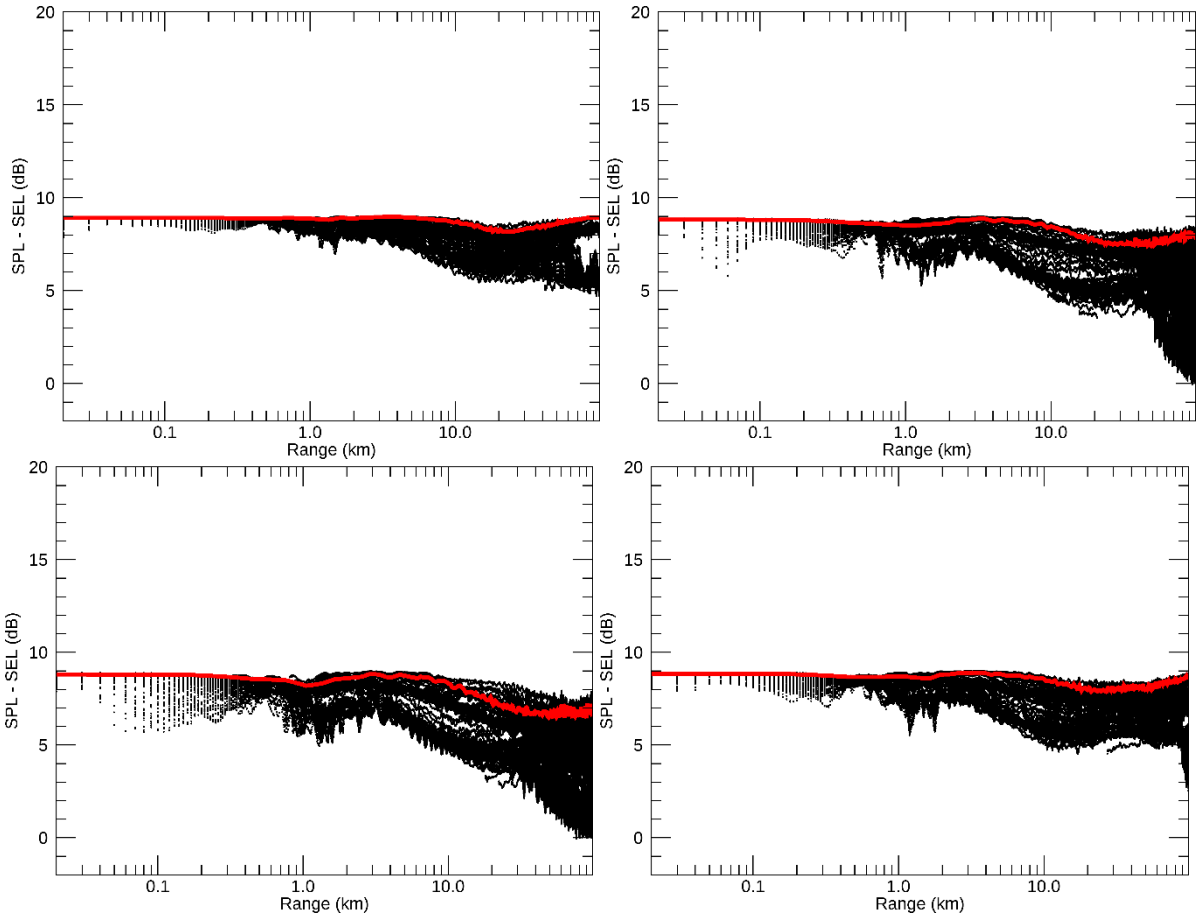


Figure D-2. Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 3090 in^3 modelled Site 1 (top left), Site 2 (top right), Site 3 (bottom left), and Site 4 (bottom right). Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

D.3. Environmental Parameters

D.3.1. Bathymetry

Water depths throughout the modelled area were extracted from the Australian Bathymetry and Topography Grid, a 9 arc-second grid rendered for Australian waters (Whiteway 2009) for the region shown in Figure 1. Bathymetry data were extracted and re-gridded onto a Universal Transverse Mercator (UTM) coordinate projection (Zone 50 S) with a regular grid spacing of 100 × 100 m to generate the bathymetry in Figure D-3.

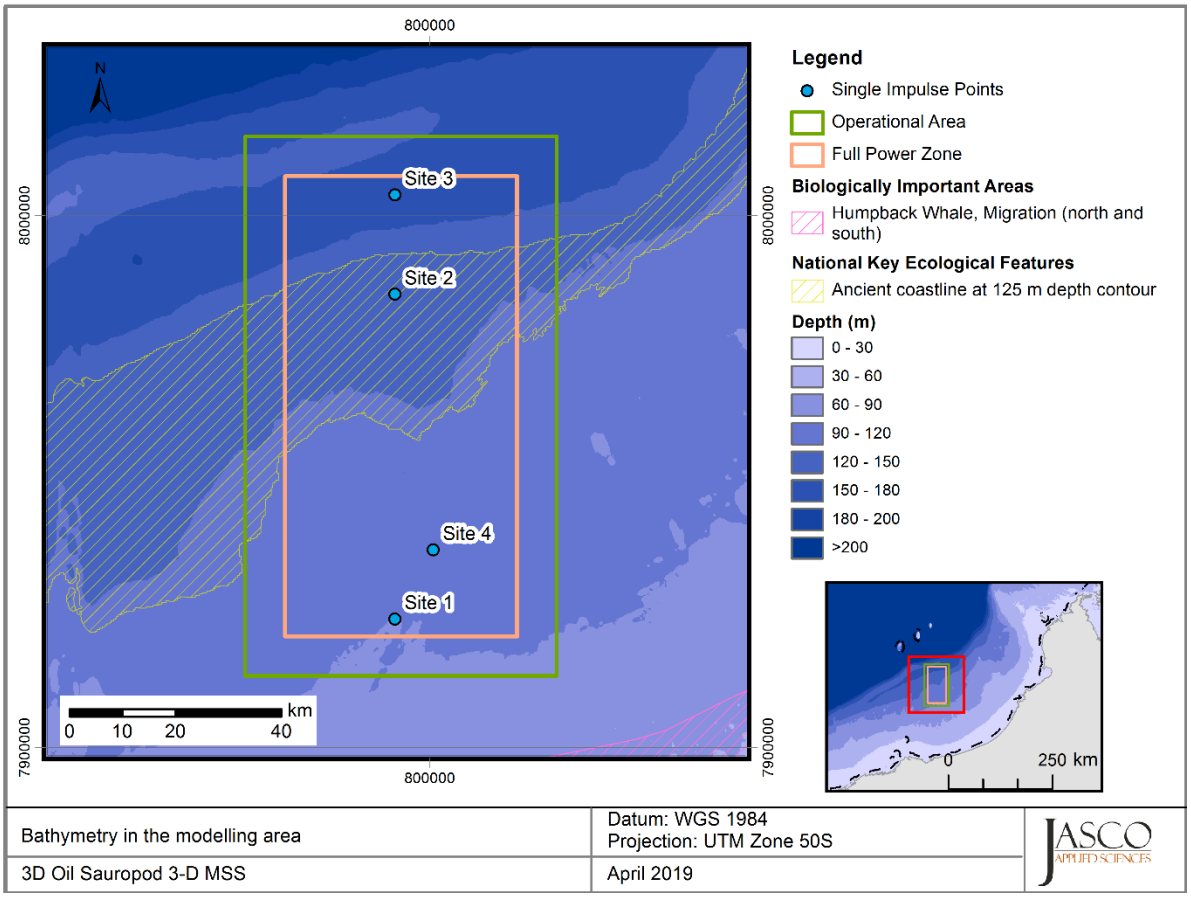


Figure D-3. Bathymetry map of the modelling area.

D.3.2. Sound speed profile

The sound speed profiles for the modelled sites were derived from temperature and salinity profiles from the U.S. Naval Oceanographic Office's *Generalized Digital Environmental Model V 3.0* (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the U.S. Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean monthly sound speed profiles (December to May) were derived from the GDEM profiles within a 200 km box radius encompassing all modelling sites. The May sound speed profile is expected to be most favourable to longer-range sound propagation across the entire year. As such, May was selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure D-4. shows the resulting profile used as input to the sound propagation modelling.

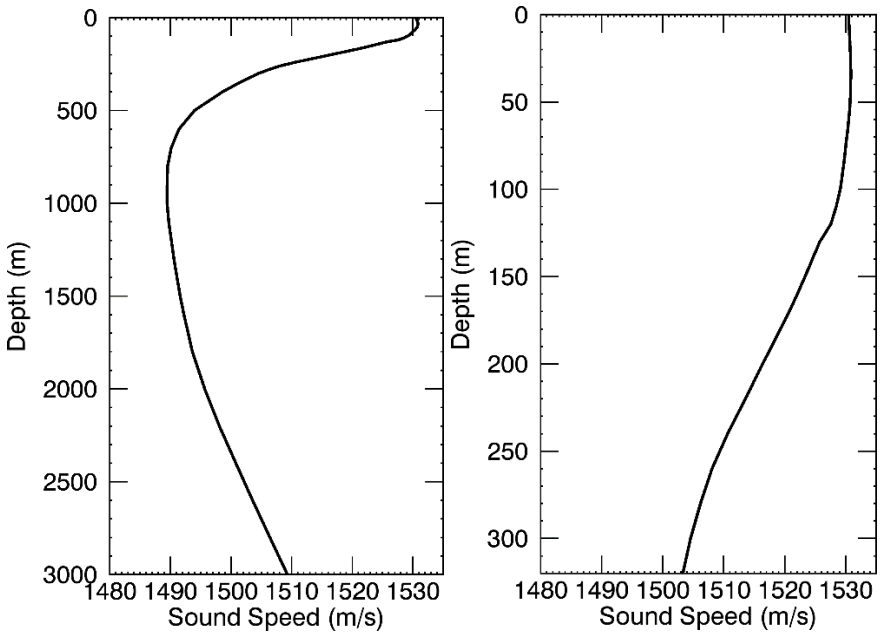


Figure D-4. The final sound speed profile (May) used for the modelling showing the entire water column (left) and the top 300 m within the profile (right). Profiles are calculated from temperature and salinity profiles from GDEM V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

D.3.3. Geoacoustics

Geoacoustic parameters were derived from sedimentary grain size measurements from various locations off the coast of Western Australia. Most samples were taken on or near the seafloor, although a smaller number were from depths of up to 6 m. The geoacoustic parameters used for numeric modelling listed in Table D-1 were estimated from the sediment model of Buckingham (2005).

Table D-1. Geoacoustic profile for all sites in this study. Within each depth range, each parameter varies linearly within the stated range. The compressional wave is the primary wave. The shear wave is the secondary wave.

Depth below seafloor (m)	Predicted lithology	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed (m/s)	Attenuation (dB/λ)
0–26	Silty carbonate sand to interbedded sandy carbonated mud and sand	1.78	1523–1674	0.05-0.67	180	0.1
26–42	Carbonated sandy silt to muddy, sandy carbonate silt/silty mud	1.80	1685–1716	0.68–0.79		
42–72	Carbonate silty sand with occasional poorly cemented calcarenite layers	1.78	1704–1745	0.77–0.91		
72–108	Silty sandy poorly cemented calcarenite	2.32–2.37	2121–2181	0.32–0.33		
108–188	High strength calcarenite zone, locally sandy	2.87–2.96	2781–2909	0.53–0.55		

D.4. Seismic Source

The layout of the seismic sources considered in Appendix B is provided in Figure D-5. Details of the airgun parameters are provided in Table D-2.

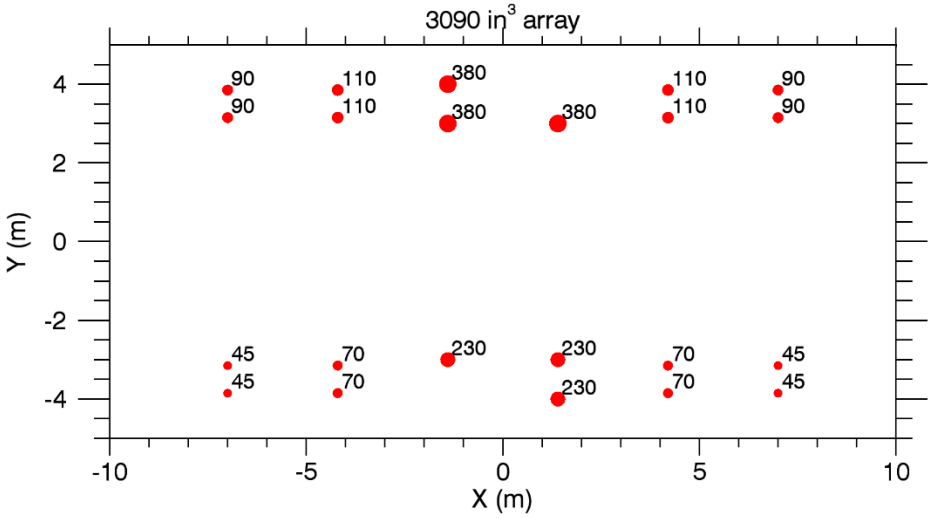


Figure D-5. Layout of the modelled 3090 in^3 seismic source array. Tow depth is 6 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table D-2.

Table D-2. Layout of the modelled 3090 in^3 seismic source array. Tow depth is 6 m. Firing pressure for all guns is 2000 psi. Also see Figure D-5.

Gun	x (m)	y (m)	z (m)	Volume (in^3)	Gun	x (m)	y (m)	z (m)	Volume (in^3)
1	7.00	−3.85	6.00	45	12	7.00	3.15	6.00	90
2	7.00	−3.15	6.00	45	13	7.00	3.85	6.00	90
3	4.20	−3.85	6.00	70	14	4.20	3.15	6.00	110
4	4.20	−3.15	6.00	70	15	4.20	3.85	6.00	110
5	1.40	−4.00	6.00	230	16	1.40	3.00	6.00	380
6	1.40	−3.00	6.00	230	17	−1.40	3.00	6.00	380
7	−1.40	−3.00	6.00	230	18	−1.40	4.00	6.00	380
8	−4.20	−3.85	6.00	70	19	−4.20	3.15	6.00	110
9	−4.20	−3.15	6.00	70	20	−4.20	3.85	6.00	110
10	−7.00	−3.85	6.00	45	21	−7.00	3.15	6.00	90
10	−7.00	−3.15	6.00	45	22	−7.00	3.85	6.00	90

D.5. Model Validation Information

Predictions from JASCO's Airgun Array Source Model (AASM) and propagation models (MONM, FWRAM and VSTACK) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Artic, Canadian and southern United States waters, Greenland, Russia and Australia (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities which have included internal validation of the modelling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016).

Appendix E. Additional Results

E.1. Particle Motion

Figures E-1 to E-3 show the maximum particle acceleration and velocity for Sites 2–4, as a function of horizontal range from the centre of the array in broadside directions, which generate the higher amplitude results, results for Site 1 are shown in Figure 14.

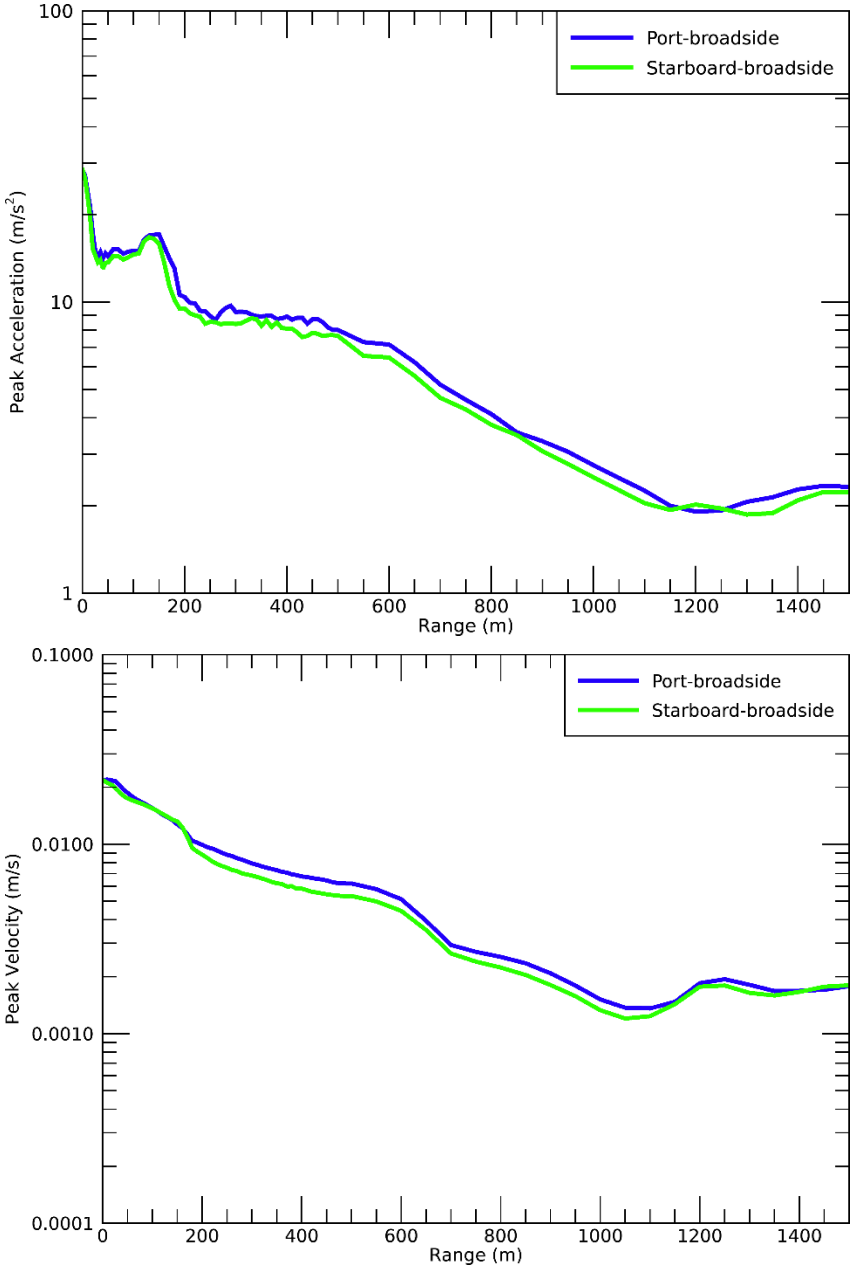


Figure E-1. Site 2: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions.

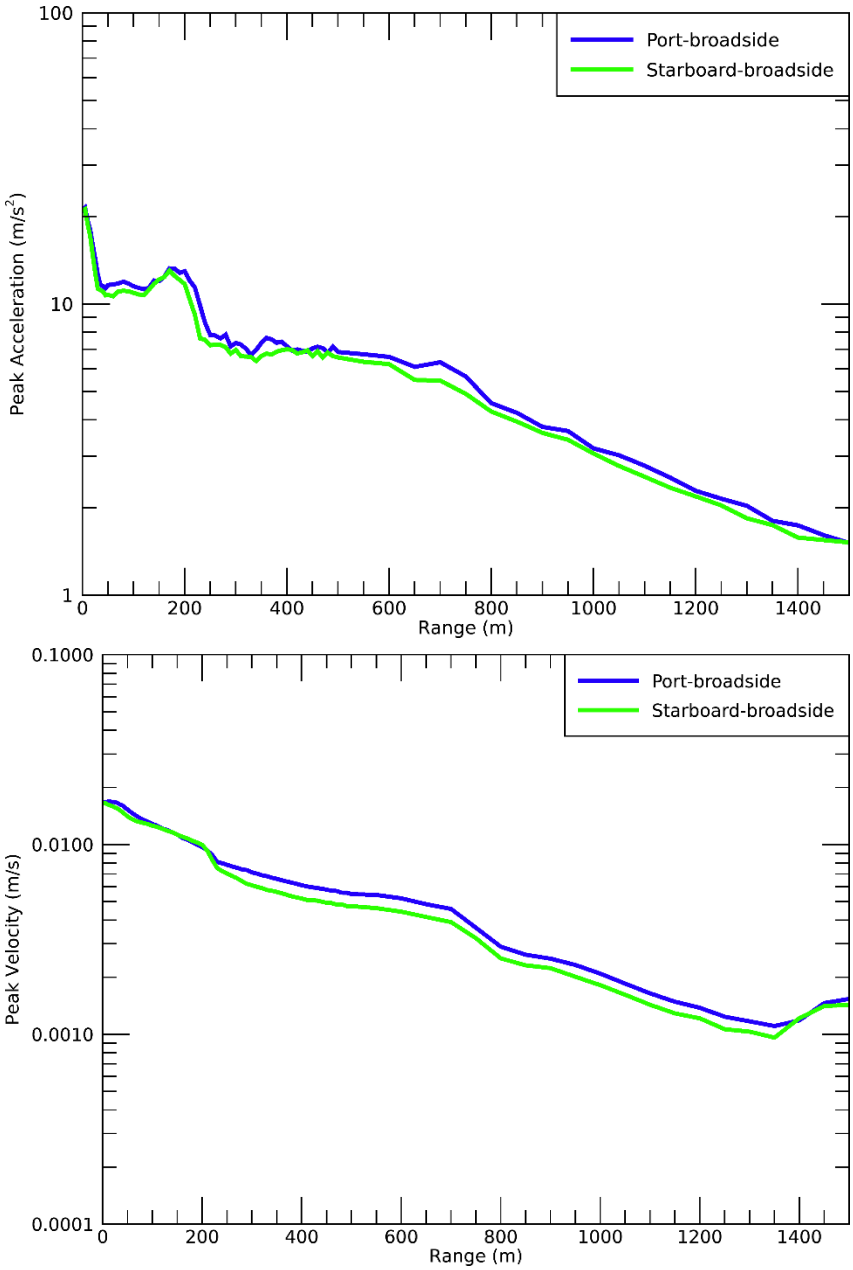


Figure E-2. Site 3: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions.

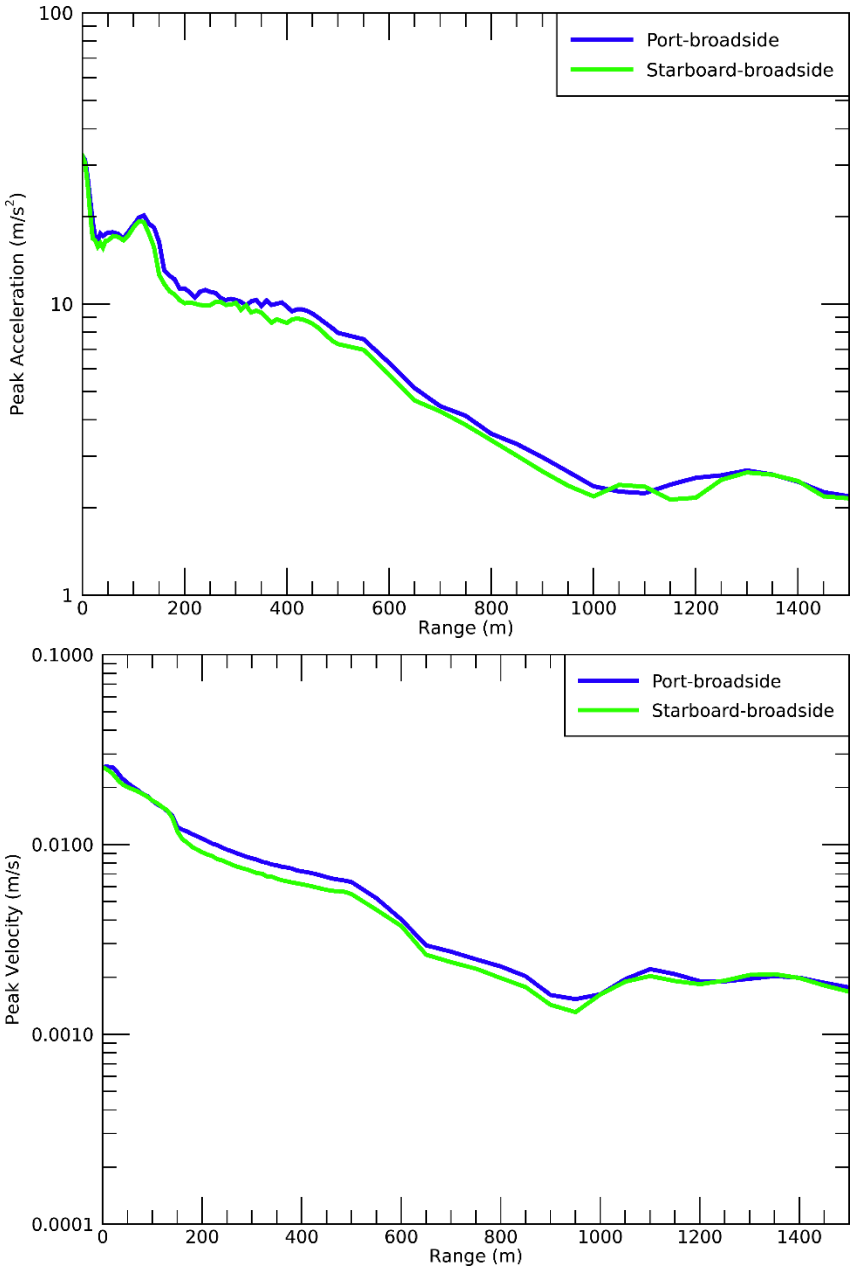


Figure E-3. Site 4: Maximum particle acceleration (top) and velocity (bottom) at the seafloor as a function of horizontal range from the centre of a single 3090 in^3 seismic source along the broadband directions.

Appendix E: Seismic Array Comparison

Unit 1, 14 Hook Street
Capalaba, Queensland, 4157

Tel: +61 7 3823 2620
www.jasco.com

Technical Memo

DATE: 10 August 2021

FROM: Craig McPherson and Jorge E. Quijano (JASCO Applied Sciences (Australia) Pty Ltd)

TO: RPS Australia

Subject: CGG Sauropod Survey, Comparison between the original 3090 in^3 array and the proposed 2820 in^3 array.

JASCO Applied Sciences (JASCO) previously conducted acoustic modelling for the 3D Oil Sauropod Marine Seismic Survey (MSS), and considered using a 3090 in^3 source array with a 6 m tow depth (Quijano and McPherson 2019). CGG, who will be conducting the survey, has identified an alternative seismic source option, a 2820 in^3 array also with a 6 m tow depth (Appendix A). The alternative array, along with a revised acquisition pattern require consideration and explanation to assist the approval process for the survey.

To assist CGG in verifying that the newly identified source will not exceed the sound levels and effects assessed in the 3D Oil Sauropod MSS Environment Plan (EP), JASCO performed the following tasks:

- Source modelling of the 2820 in^3 array
- Comparison of the 3090 in^3 array with the 2820 in^3 array
- Maximum-over-depth Sound Field Comparison for one modelling site (Site 2)
- Qualitative assessment of the survey plans between the old and new survey, to discuss the expected differences in sound field extents for accumulated Sound Exposure Levels (SEL) over 24 h of acquisition.

In the original scope of work, single-impulse sound fields were predicted at four defined locations within the CGG Sauropod survey areas (see Figure 1 and Table 1).

The metrics used to represent underwater acoustic fields and the effect criteria considered, and the details the methodology for predicting the source levels and modelling the sound propagation are provided in Quijano and McPherson (2019). The specifications of both seismic sources are provided in Appendix A. Section 2 presents the results, which are then discussed and summarised in Section 3.

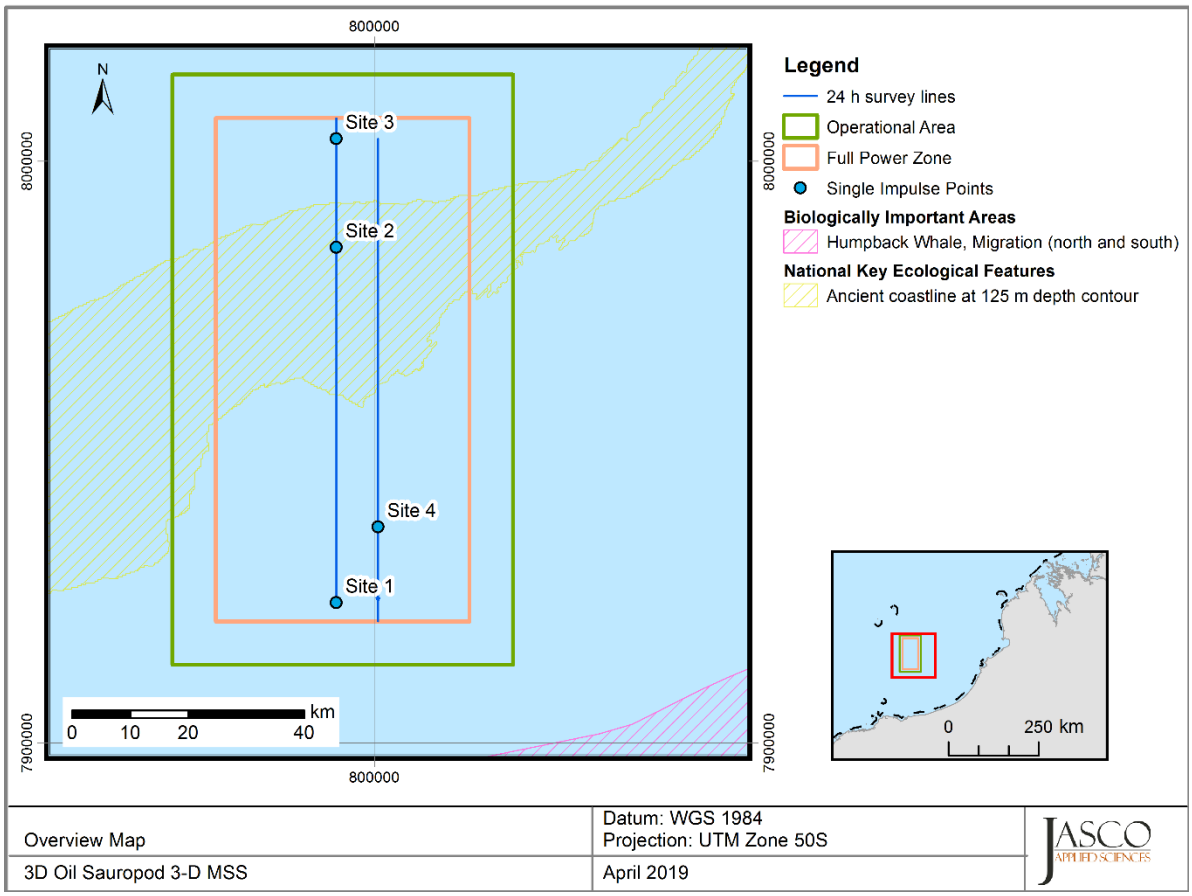


Figure 1. Overview of the modelling sites, acquisition lines, and features for the 3D Oil Sauropod 3-D MSS modelling (Quijano and McPherson 2019).

Table 1. Location details for the 3D Oil Sauropod 3-D MSS modelling sites (Quijano and McPherson 2019).

Site	Latitude (S)	Longitude (E)	UTM (WGS1984) Zone 50S		Water depth (m)	Representative tow direction (°)
			X (m)	*Y* (m)		
1	18° 45' 14.3694"	119° 46' 58.6168"	793425	7924100	66	0 & 180
2	18° 12' 08.6755"	119° 46' 26.6060"	793425	7985200	125	
3	18° 02' 00.9264"	119° 46' 17.0335"	793425	8003900	161	
4	18° 38' 07.1558"	119° 50' 57.1375"	800625	7937133	107	

1. Methods

The specifications of the seismic source and the input parameters for the propagation models are summarised here. A detailed description can be found in Quijano and McPherson (2019).

1.1. Acoustic Source Model

The pressure signature of the individual airguns and the composite decidecade-band point-source equivalent directional levels (i.e., source levels) of the two seismic sources (3090 in^3 and a 2820 in^3) were modelled with JASCO's Airgun Array Source Model (AASM).

AASM considers:

- Array layout.
- Volume, tow depth, and firing pressure of each airgun.
- Interactions between different airguns in the array.

Both seismic source arrays considered were modelled over AASM's full frequency range, up to 25 kHz.

1.2. Sound Propagation Modelling

To compare the two sources in a representative environment. SEL, SPL and zero-to-peak sound pressure level (PK) metrics for each source were predicted with JASCO's Full Waveform Range-dependent Acoustic Model (FWRAM). FWRAM was used to model synthetic seismic pulses out to 100 km at the considered single impulse modelling sites, along four radials (fore and aft endfire, and port and starboard broadside). The acoustic fields were modelled with the same input configuration as discussed in Quijano and McPherson (2019).

2. Results

2.1. Acoustic Source Levels and Directivity

Table 2 shows the PK and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions for the two different seismic sources considered during the seismic source analysis. The broadside, endfire, and vertical overpressure signature and corresponding power spectrum levels for the additional sources considered, the 2820 and 3090 in^3 sources with a 6 m tow depth, are provided in Appendix A.

Table 2. Far-field source level specifications for the 3090 and 2820 in^3 sources with a 6 m tow depth. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Total volume (in^3)	Direction	Peak source pressure level ($L_{S,pk}$; dB re 1 µPa m)	Per-pulse source SEL ($L_{S,E}$; dB 1 µPa^{2}m^{2}s)
			10–25000 Hz
3090[A]	Broadside	249.4	225.1
2820		248.8	224.5
3090[A]	Endfire	245.7	223.3
2820		244.8	223.0
3090[A]	Vertical	255.0	228.2
2820		254.9	227.9

[A] Far-field source level from Quijano and McPherson (2019).

2.2. Per-Pulse Sound Fields

FWRAM (Section 1.2) was used to model synthetic seismic pulses at the 4 sites using the 3090 and 2820 in^3 arrays. FWRAM calculated SEL, SPL and zero-to-peak sound pressure level (PK) metrics for each source, which allowed the two sources to be compared in a representative environment. Modelling was performed over all broadside and endfire radials. Figures 2–5 show the maximum-over-depth for all radials for SEL and PK metrics as a function of range. The SEL curves can be used to compare the energy emission of the arrays into the environment and the PK curves can be used to assess source pulse characteristics in the environment.

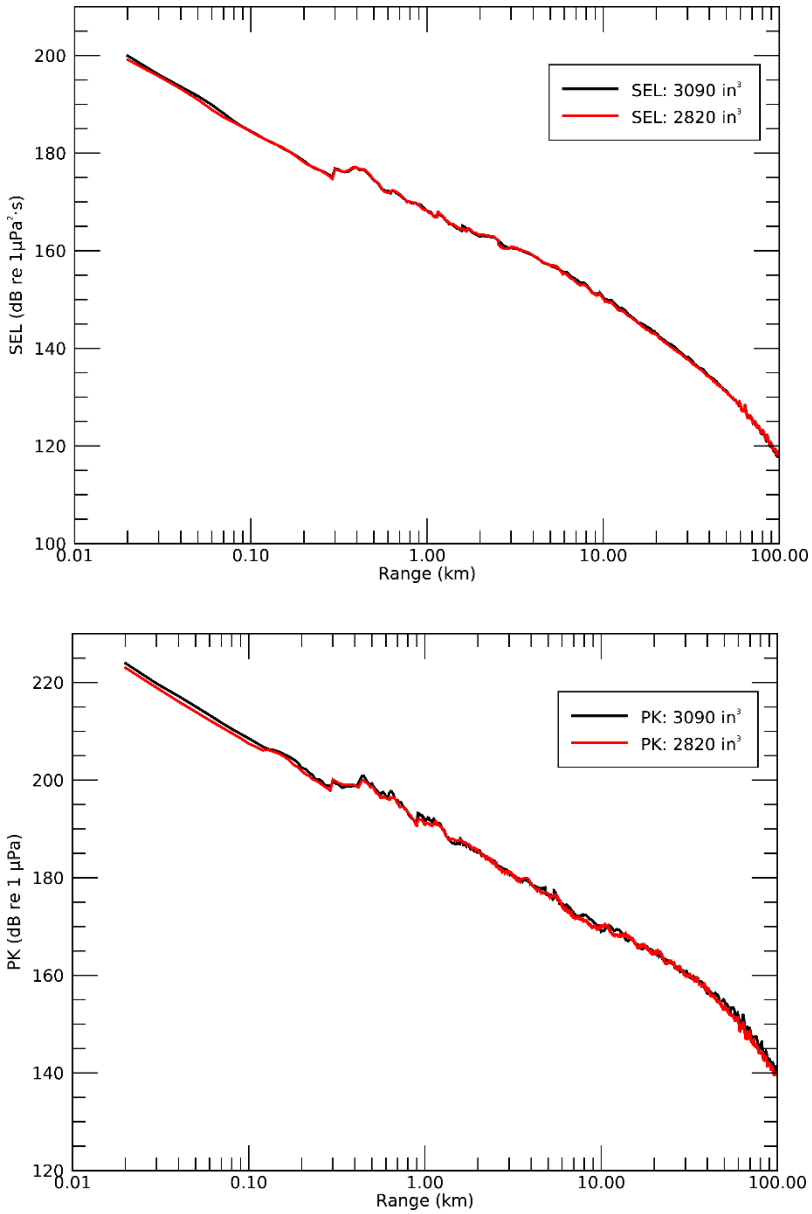


Figure 2. Site 1: Maximum-over-depth SEL (top) and PK (bottom) predicted for the 3090 and 2820 in³ sources from FWRAM. Levels are the maximum over all the broadside and endfire directions.

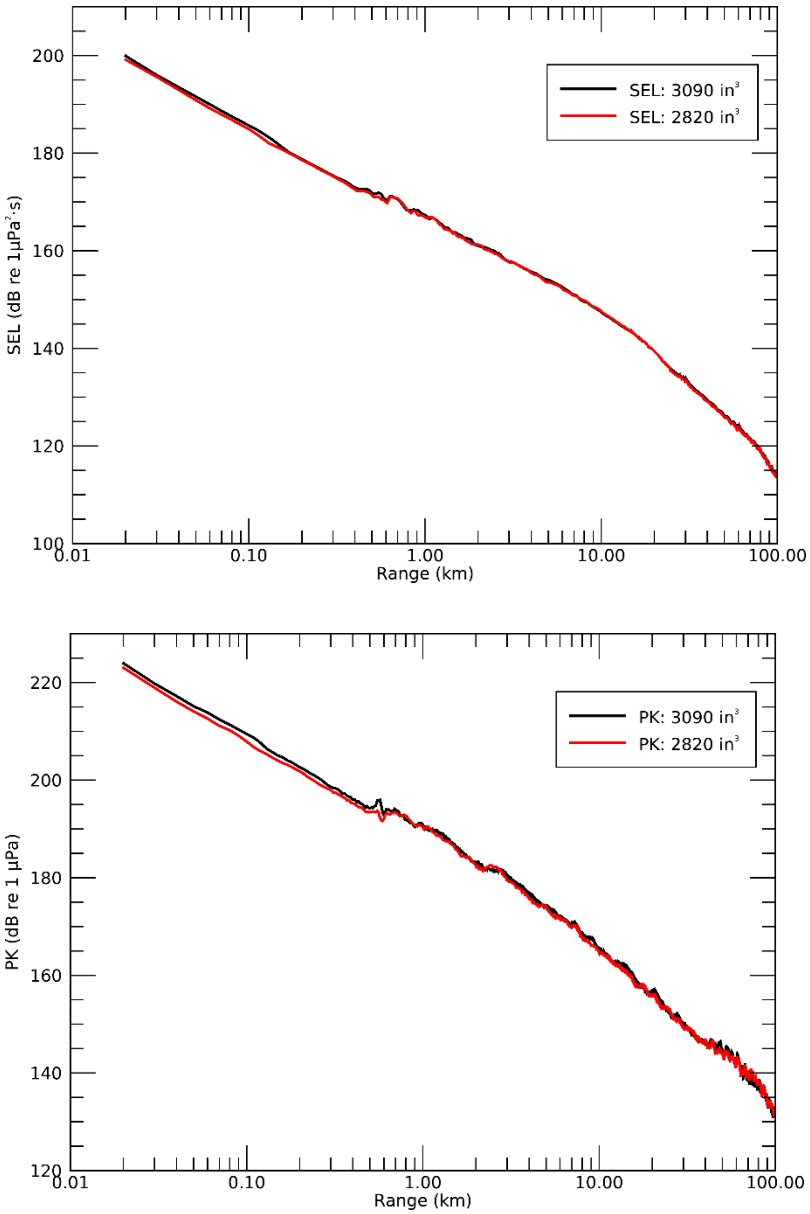


Figure 3. Site 2: Maximum-over-depth SEL (top) and PK (bottom) predicted for the 3090 and 2820 in^3 sources from FWRAM. Levels are the maximum over all the broadside and endfire directions.

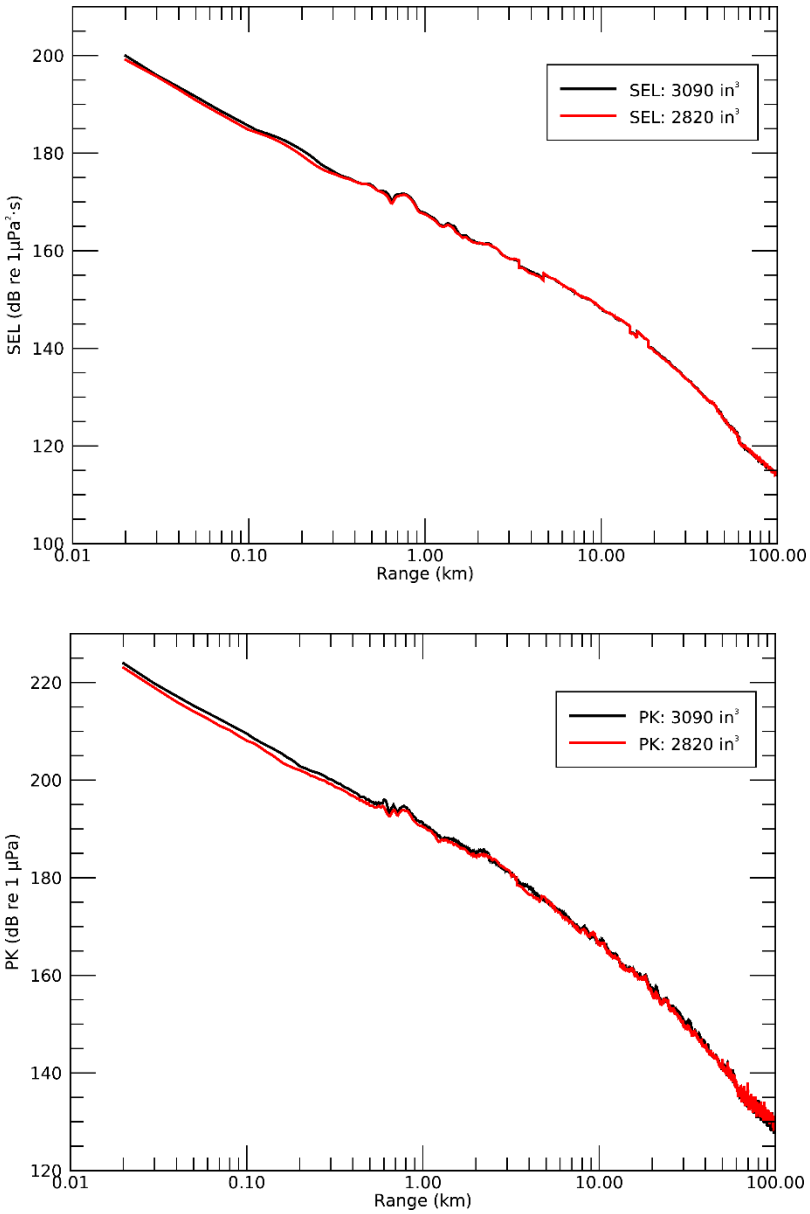


Figure 4. Site 3: Maximum-over-depth SEL (top) and PK (bottom) predicted for the 3090 and 2820 in³ sources from FWRAM. Levels are the maximum over all the broadside and endfire directions.

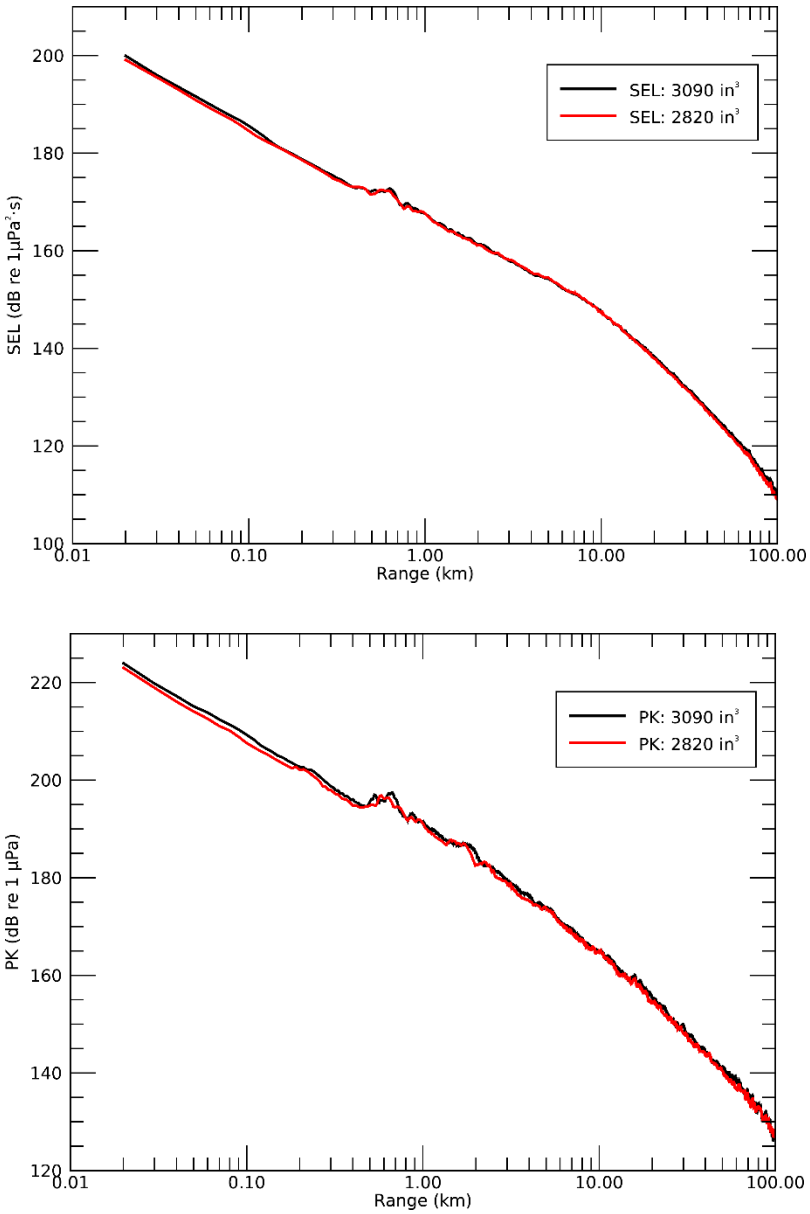


Figure 5. Site 4: Maximum-over-depth SEL (top) and PK (bottom) predicted for the 3090 and 2820 in^3 sources from FWRAM. Levels are the maximum over all the broadside and endfire directions.

3. Discussion and Conclusion

3.1. Acoustic Source Levels and Per-Pulse Sound Levels

A comparison between far-field source level specifications for the 3090 and the 2820 in^3 sources with a 6 m tow depth using values in Table 2 is provided in Table 3. In all cases, the 2820 in^3 array exhibits smaller peak and SEL than the 3090 in^3 array, although the differences never exceed 0.9 dB for the peak metric, and 0.6 dB for the SEL metric.

Table 3. Peak and per-pulse SEL difference between the 3090 and the 2820 in^3 sources with a 6 m tow depth using values in Table 2..

Total volume (in^3)	Direction	Difference in peak source pressure level ($L_{S,pk}$; dB re 1 µPa m)	Difference in per-pulse source SEL ($L_{S,E}$; dB 1 µPa^{2}m^{2}s)
			10-25000 Hz
3090 vs 2820	Broadside	-0.6	-0.6
	Endfire	-0.9	-0.3
	Vertical	-0.1	-0.3

3.2. Per-Pulse Sound Fields

The per-pulse source levels in Table 2 are free-field levels which do not incorporate environmental effect like sea-surface or seabed reflections and interference. The maximum-over-depths curves in Section 2.2 provide a better comparison of the sources when environmental effects are considered. These figures show that either the 3320 in^3 and 2820 in^3 arrays will result in similar distances to thresholds, and that the sound fields are practically indistinguishable from each other.

3.3. Qualitative Assessment of SEL 24h Sound Fields

The parameters relevant to the acoustic modelling for both the original 3D Oil survey and the current alternative CGG version of the survey are provided and contrasted in Table 4. The modelling scenario for the original 3D Oil survey accounted for 13280 impulses within the modelled scenario. The new CGG configuration will result in a reduction of the original 3D Oil survey ensonified area, due to the following factors:

- The 2820 in^3 array yields sound fields (PK, SEL, and SPL) that are marginally smaller compared to those from the 3090 in^3, as shown in this memo. If the survey parameters (vessel speed, distance between consecutive survey lines, shooting interval) remain the same, the 2820 in^3 array will result in almost the same distances to thresholds.
- Additional reductions in ensonified area/distances to SEL 24h thresholds are expected. This can be illustrated with an example: in Figure 1, consider the SEL 24h sound field at Site 4, which is the summation of the fields from line 1 (the line Site 4 is located on) and from line 2. If the separation between lines increases, and line 2 shifts to the west, the SEL 24h sound field extents as measured at Site 4 will be reduced due to the additional propagation loss from a longer distance.

- If the survey vessel speed remains the same, the increased distance between surveys will also result in less time for acquisition (active source operations) within a 24h period as the turns are longer, thereby reducing the accumulated sound field even further.

The assessment above is applicable as long as the array parameters remain unaltered. If the vessel speed increases, the line separation decreases or the tow depth increases, additional modelling would be required to assess the impact on sound levels, frequency content, and directivity.

Table 4. Sauropod survey parameters influencing acoustic modelling.

Survey Parameter	CGG Survey	3D Oil Survey
Length of sail lines	83 km	83 km
Time to traverse a sail line	~10 hours	~10 hours
Orientation of sail lines	North–south	North–south
Distance between sail lines	675 m – 716 m	450 m
Turn radius	5200 m	3500 m
Seismic vessel sail line speed	4.5 knots	Modelled at 4.4 knots
Seismic source discharge interval	Approximately every 12.5 m (approximately every 5.4 seconds) along survey lines	
Seismic Source		
Type	Airgun / three arrays, which will be discharged alternately	
Size	2820 in^3	3090 in^3
Pressure	2,000 psi	
Sound source tow depth	Modelled at 6 m	Modelled at 6 m
Streamers		
Number	12	12
Streamer length	7050 m	7000 m
Distance from seismic vessel bow to tail buoy	7800 m	7525 m
Distance between streamers	112.5 m	75 m

References

Quijano, J.E. and C.R. McPherson. 2019. *3-D Oil Sauropod 3-D Marine Seismic Survey: Acoustic Modelling for Assessing Marine Fauna Sound Exposures*. Document Number 01781, Version 1.0. Technical report by JASCO Applied Sciences for Environmental Resources Management (ERM). Appendix E *In* 3D OIL Sauropod 3D Marine Seismic Survey (WA-527-P): Environment Plan. https://docs.nopsema.gov.au/A683046

Unit 1, 14 Hook Street
Capalaba, Queensland, 4157

Tel: +61 7 3823 2620
www.jasco.com

Appendix A. Seismic Sources

The layouts of the 3090 in^3 and 2820 in^3 seismic sources considered in this study are detailed as follows:

- 3090 in^3 seismic source: layout is shown in Figure A-1, and details of the airgun parameters are provided in Table A-1.
- 2820 in^3 seismic source: layout is shown in Figure A-2, and details of the airgun parameters are provided in Table A-2.

A.1. 3090 in^3 Source Details

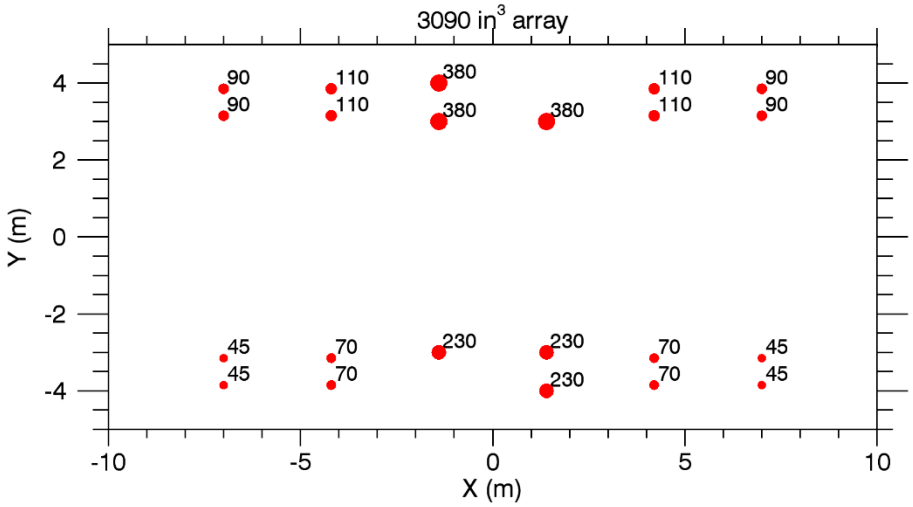


Figure A-1. Layout of the modelled 3090 in^3 array. Tow depth is 6 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table A-1.

Table A-1. Layout of the modelled 3090 in³ seismic source array. Tow depth is 6 m. Firing pressure for all guns is 2000 psi. Also see Figure A-1.

Gun	x (m)	y (m)	z (m)	Volume (in³)	Gun	x (m)	y (m)	z (m)	Volume (in³)
1	7.00	−3.85	6.00	45	12	7.00	3.15	6.00	90
2	7.00	−3.15	6.00	45	13	7.00	3.85	6.00	90
3	4.20	−3.85	6.00	70	14	4.20	3.15	6.00	110
4	4.20	−3.15	6.00	70	15	4.20	3.85	6.00	110
5	1.40	−4.00	6.00	230	16	1.40	3.00	6.00	380
6	1.40	−3.00	6.00	230	17	−1.40	3.00	6.00	380
7	−1.40	−3.00	6.00	230	18	−1.40	4.00	6.00	380
8	−4.20	−3.85	6.00	70	19	−4.20	3.15	6.00	110
9	−4.20	−3.15	6.00	70	20	−4.20	3.85	6.00	110
10	−7.00	−3.85	6.00	45	21	−7.00	3.15	6.00	90
10	−7.00	−3.15	6.00	45	22	−7.00	3.85	6.00	90

A.2. 2820 in³ Source Details

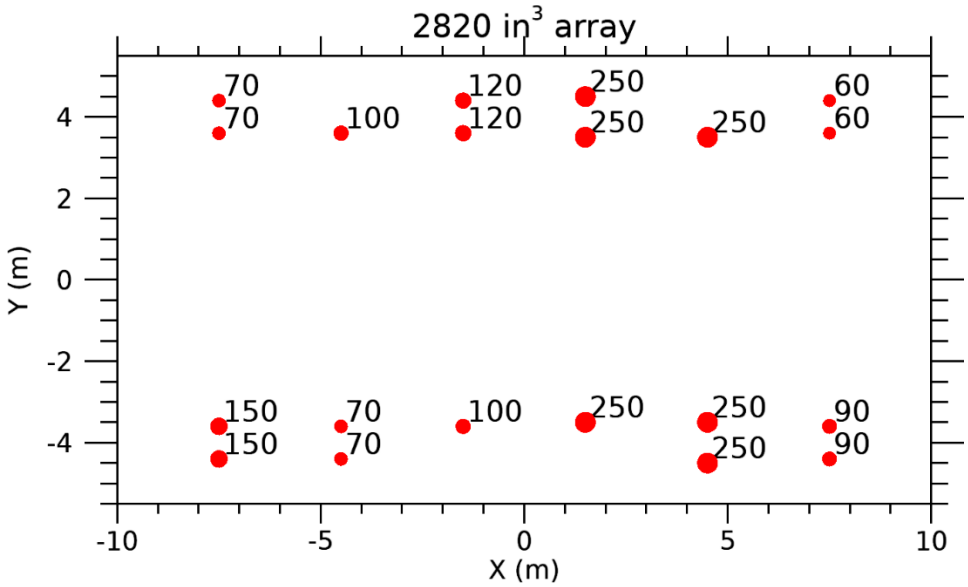


Figure A-2. Layout of the modelled 2820 in³ array. Tow depth is 6 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table A-2.

Table A-2. Layout of the modelled 2820 in^3 array. Tow depth is 6 m. Firing pressure for all guns is 2000 psi. Also see Figure A-2.

Gun	x (m)	y (m)	z (m)	Volume (in^3)
1	0	-4.4	6	90
2	0	-3.6	6	90
3	3	-4.5	6	250
4	3	-3.5	6	250
6	6	-3.5	6	250
8	9	-3.6	6	100
9	12	-4.4	6	70
10	12	-3.6	6	70
11	15	-4.4	6	150
12	15	-3.6	6	150

Gun	x (m)	y (m)	z (m)	Volume (in^3)
13	0	3.6	6	60
15	0	4.4	6	60
16	3	3.5	6	250
17	6	3.5	6	250
18	6	4.5	6	250
19	9	3.6	6	120
20	9	4.4	6	120
21	12	3.6	6	100
22	15	3.6	6	70
23	15	4.4	6	70

A.3. Array Source Levels and Directivity

Figure A-3 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction) and vertical overpressure signature and corresponding power spectrum levels for the 3090 in^3 array. Horizontal decidecade-band source levels are shown as a function of band centre frequency and azimuth (Figure A-5). Figure A-4 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction) and vertical overpressure signature and corresponding power spectrum levels for the 2820 in^3 array. Horizontal decidecade-band source levels are shown as a function of band centre frequency and azimuth (Figure A-6).

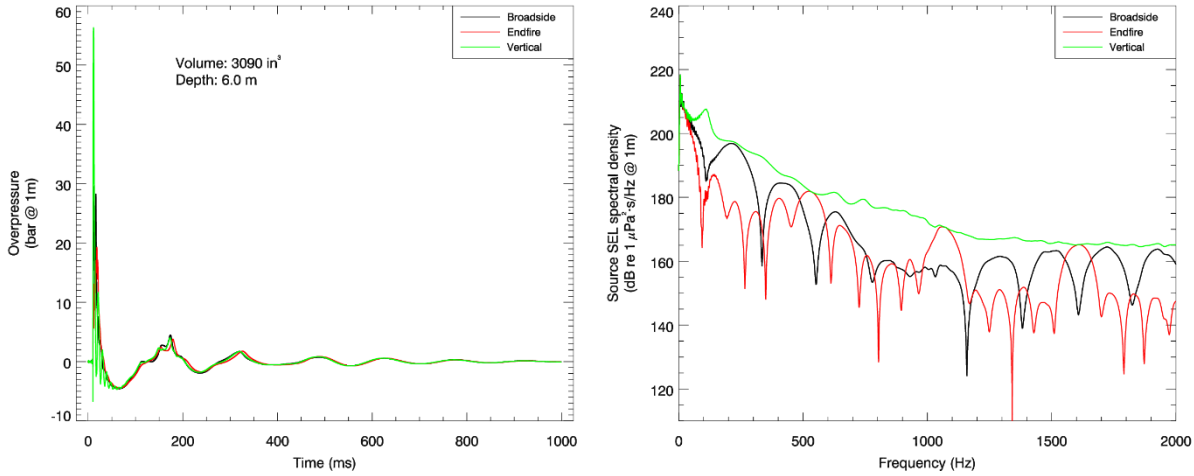


Figure A-3. Predicted source level details for the 3090 in^3 array at 6 m towed depth.(Left) the overpressure signature and (right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost).

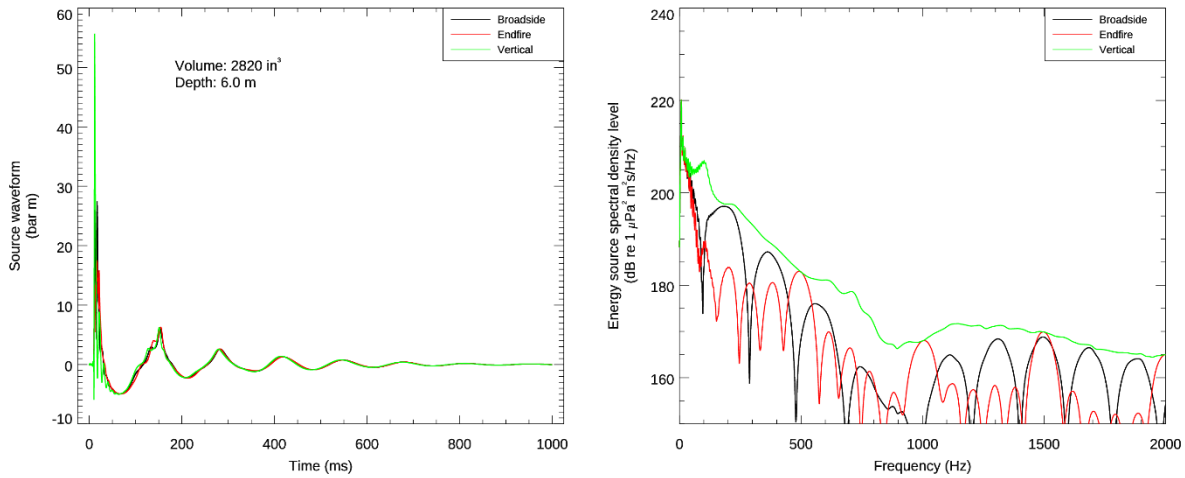


Figure A-4. Predicted source level details for the 2820 in^3 array at 6 m towed depth. (Left) the overpressure signature and (right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost).

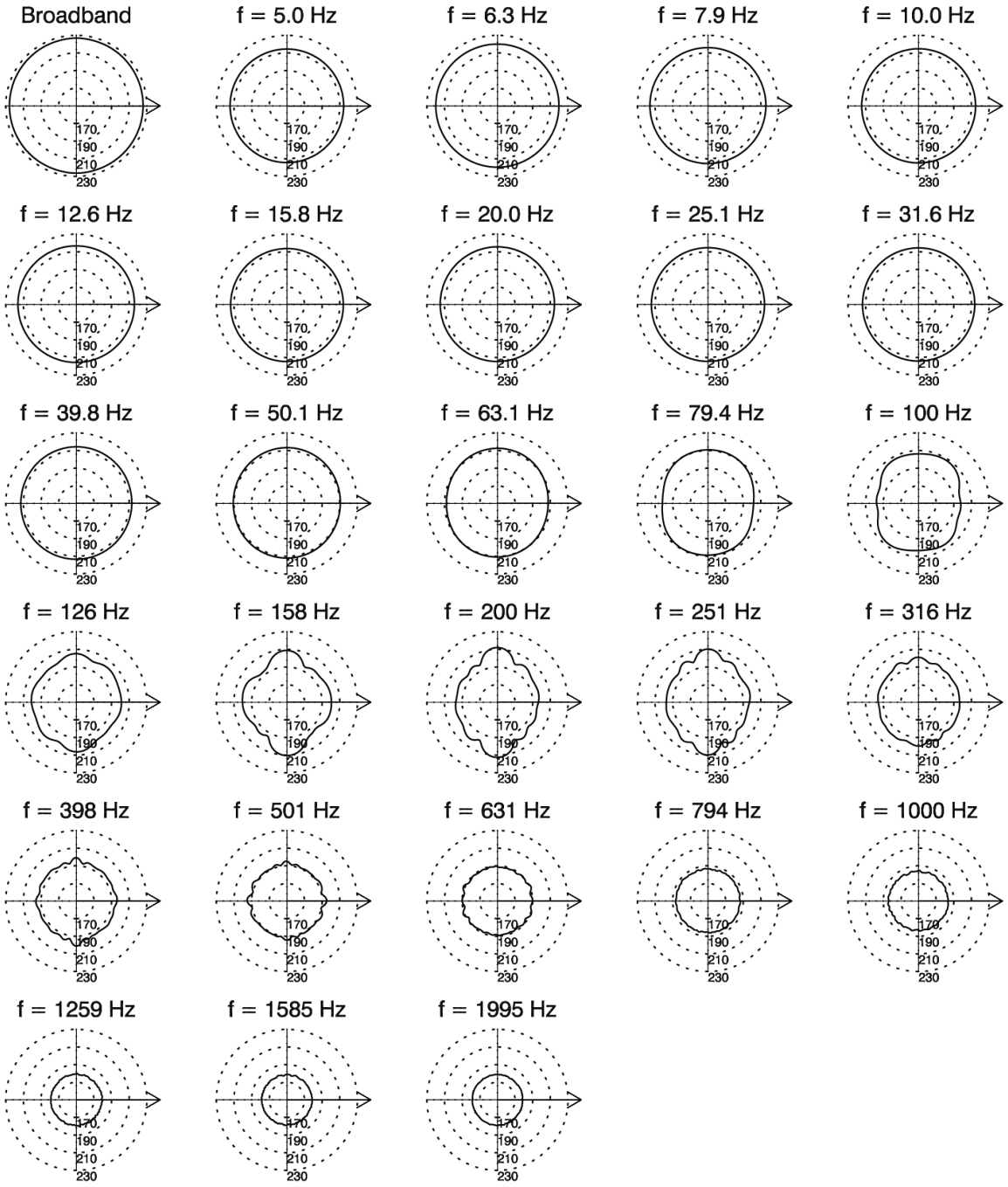


Figure A-5. Directionality of the predicted horizontal source levels for the 3090 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 $\mu Pa^2 \cdot s\ m^2$) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 6 m (see Figure A-1).

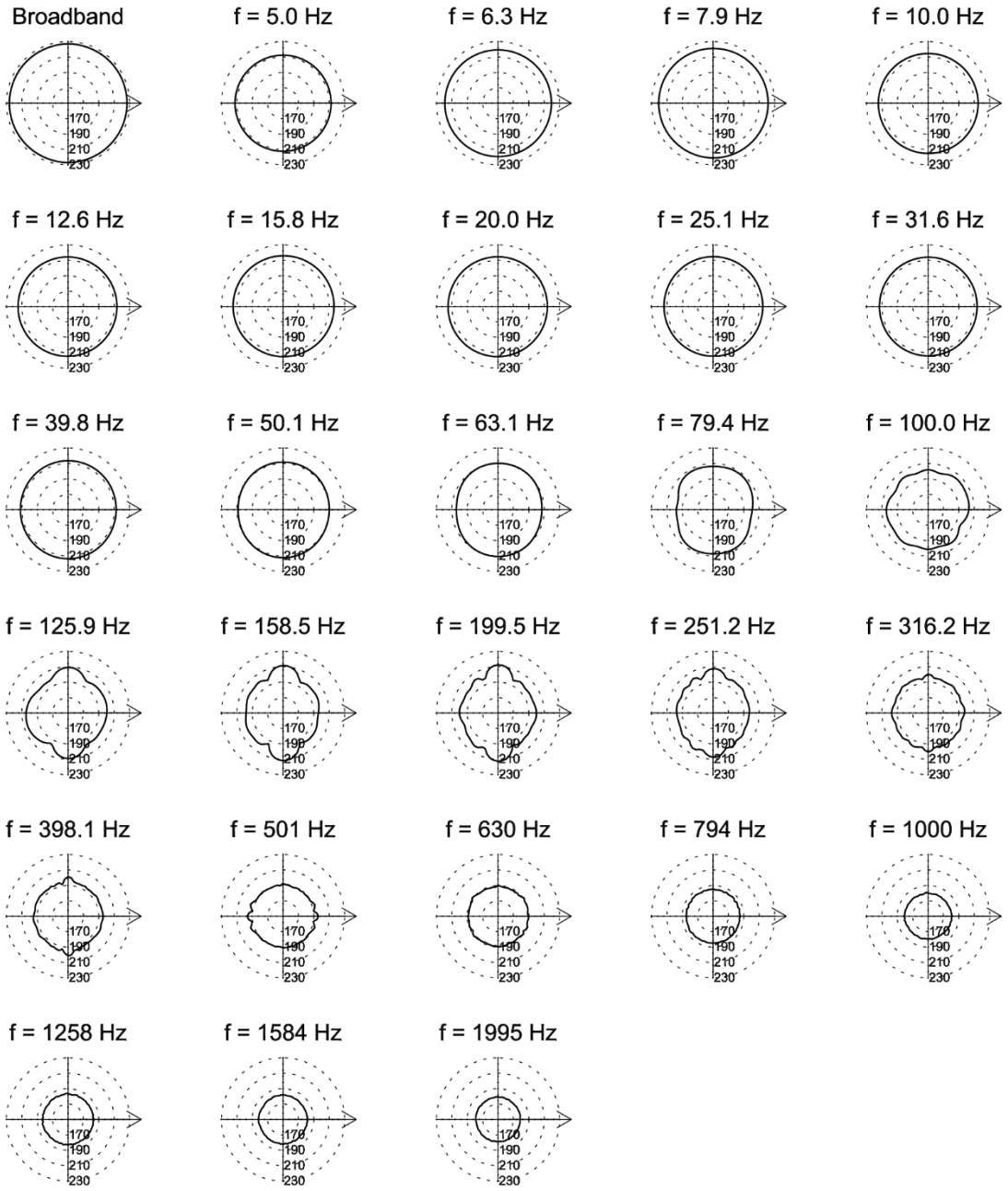


Figure A-6. Directionality of the predicted horizontal source levels for the 2820 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 $\mu Pa^2 \cdot s\ m^2$) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 6 m (see Figure A-2).

Appendix F: Cetacean Species Verification Process

SAUROPOD 3D MSS WHALE VERIFICATION

A Pygmy Blue Whale (PBW) or potential Pygmy Blue Whale sighting is defined as an observed whale that is either:

a) positively identified as a Pygmy Blue Whale, or

b) cannot be positively identified as a Pygmy Blue Whale but is potentially a Pygmy Blue Whale (i.e. a large baleen whale), or

c) a whale species cannot be positively identified*.

*A whale sighting that cannot be positively identified could be ruled out as being a potential Pygmy Blue Whale if there is high certainty it is not a large baleen whale.

Where MMO's are unable to positively identify the whale species, species verification may occur following a shutdown using the process below.

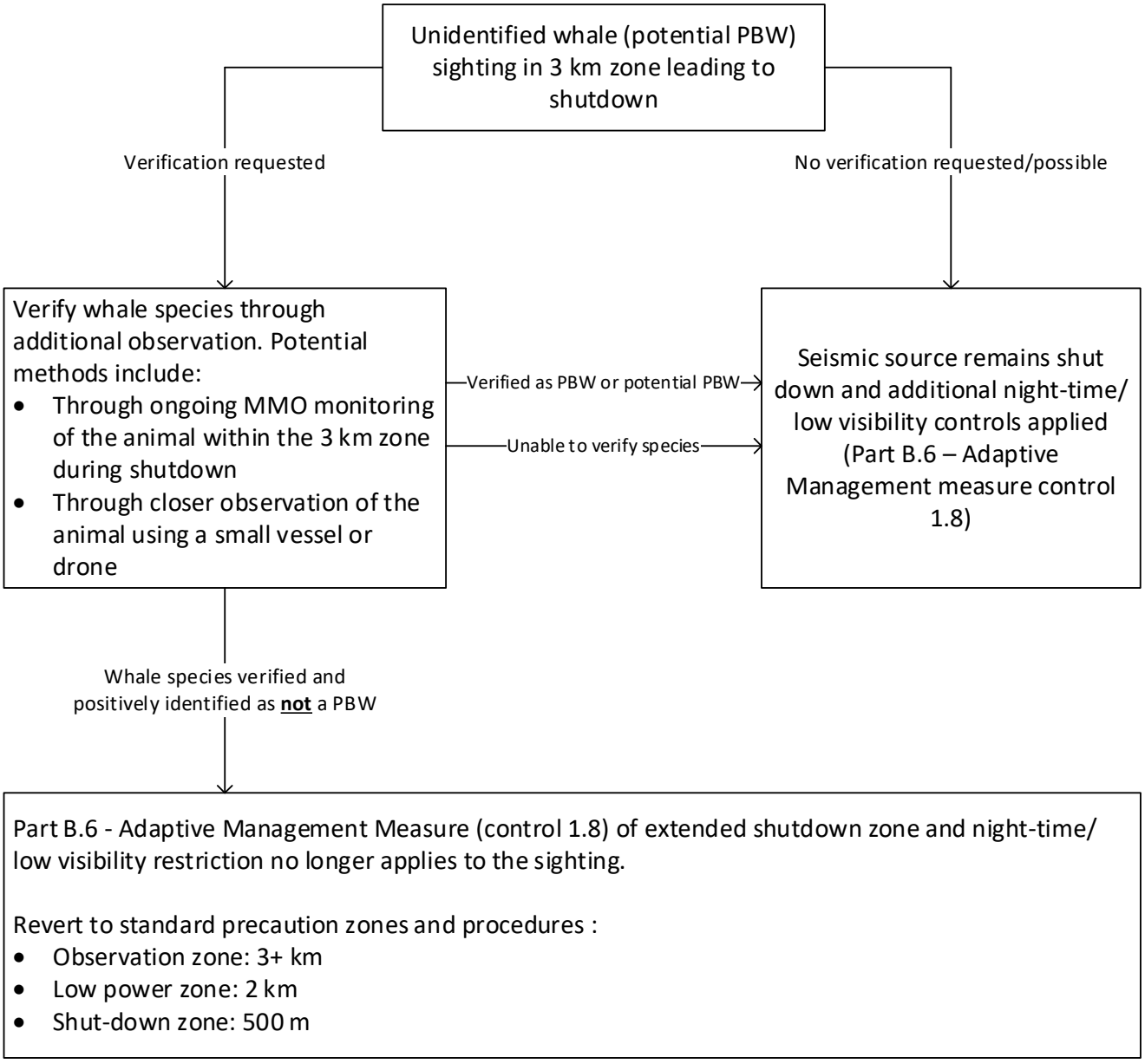


Figure F-1: Sauropod 3D MSS whale verification process

Appendix G: Hydrocarbon Spill Modelling

Report

RPS

29 MAY 2019

3D Oil WA-527-P

Oil Spill Modelling

RPS

Document status

Version	Purpose of document	Authored by	Reviewed by	Review date
Rev0	Draft issued for client review	Jeremie Bernard	Nathan Benfer	29 April 2019
Rev1	Final report	Jeremie Bernard	Fernando Alvarez	29 May 2019

Approval for issue

Name	Signature	Date
Nathan Benfer		29 May 2019

This report was prepared by RPS Australia West Pty Ltd ('RPS') within the terms of its engagement and in direct response to a scope of services. This report is strictly limited to the purpose and the facts and matters stated in it and does not apply directly or indirectly and must not be used for any other application, purpose, use or matter. In preparing the report, RPS may have relied upon information provided to it at the time by other parties. RPS accepts no responsibility as to the accuracy or completeness of information provided by those parties at the time of preparing the report. The report does not take into account any changes in information that may have occurred since the publication of the report. If the information relied upon is subsequently determined to be false, inaccurate or incomplete then it is possible that the observations and conclusions expressed in the report may have changed. RPS does not warrant the contents of this report and shall not assume any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report howsoever. No part of this report, its attachments or appendices may be reproduced by any process without the written consent of RPS. All enquiries should be directed to RPS.

Prepared by: **RPS AUSTRALIA WEST PTY LTD**
Suite E1, Level 4
140 Bundall Road
Bundall, QLD 4217
Australia

T: +61 7 5574 1112

E: Jeremie.bernard@rpsgroup.com.au

Prepared for: **ERM AUSTRALIA**
Level 2
5 Mill Street
Perth WA 6000 Australia

T: +61 8 64671654

E: christopher.thomson@erm.com

W: www.erm.com

Author: Jeremie Bernard

Reviewed: Nathan Benfer

Approved: Nathan Benfer

No.: MAQ0793J

Version: Rev1

Date: 29 May 2019

RPS

Contents

TERMS AND ABBREVIATIONS ..... **VII**

EXECUTIVE SUMMARY ..... **IX**
Background ..... **ix**
Methodology ..... **ix**
Oil Properties ..... **ix**
Key Findings ..... **ix**

1 INTRODUCTION **1**

2 SCOPE OF WORK **2**

3 REGIONAL CURRENTS **1**
3.1 Tidal Currents **3**
3.1.1 Grid Setup 3
3.1.2 Tidal Conditions 5
3.1.3 Surface Elevation Validation 5
3.2 Ocean Currents **9**
3.3 Surface Currents at the release site **9**

4 WIND DATA **12**

5 WATER TEMPERATURE AND SALINITY **17**

6 OIL SPILL MODEL – SIMAP **19**
6.1 Stochastic Modelling **19**
6.2 Sea surface, Shoreline and In-Water Exposure Thresholds **20**
6.3 Oil Properties **20**
6.3.1 Marine Diesel Oil 20
6.4 Model Settings **22**

7 PRESENTAITON AND INTERPRETATION OF MODEL RESULTS **23**
7.1 Seasonal Analysis **23**
7.1.1 Figures 23
7.1.2 Statistics 23
7.2 Receptors Assessed **24**

8 RESULTS: 280 M^3 SURFACE RELEASE OF MARINE DIESEL OIL **28**
8.1 Stochastic Analysis **28**
8.1.1 Sea Surface Exposure 28
8.2 Water Column Exposure **42**
8.2.1 Dissolved Hydrocarbons 42
8.2.2 Entrained Hydrocarbons 47

9 REFERENCES **56**

Tables

Table 1 Location of the release site. 1
Table 2 Statistical comparison between the observed and predicted surface elevations. 6
Table 3 Predicted monthly average and maximum surface current speeds adjacent to the release location. Data derived by combining the HYCOM ocean data and HYDROMAP high resolution tidal data from 2008-2012 (inclusive). 10
Table 4 Predicted monthly average and maximum winds for the wind node adjacent to the release location. Data derived from CFSR hindcast model from 2008-2012 (inclusive). 13
Table 5 Monthly average sea surface temperature and salinity in the 0–5 m depth layer near the release site 17
Table 6 Exposure threshold values requested by ERM 20
Table 7 Physical properties of Marine Diesel Oil 20
Table 8 Boiling point ranges of Marine Diesel Oil 21
Table 9 Summary of the oil spill model settings 22
Table 10 Summary of receptors used to assess surface, shoreline and in-water exposure to hydrocarbons 25
Table 11 Maximum distance and direction travelled on the sea surface by a single trajectory from the release location to oil exposure thresholds. 29
Table 12 Summary of the potential sea surface exposure to receptors 29
Table 13 Predicted maximum instantaneous and time-averaged (48 hr) dissolved hydrocarbon exposure to receptors in the 0–10 m depth layer. Results are based on a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories per season. 43
Table 14 Predicted maximum instantaneous and time-averaged (48 hr) entrained hydrocarbon exposure to receptors in the 0–10 m depth layer. Results are based on a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories per season. 48

RPS

Figures

Figure 1 Locality map 1
Figure 2 Schematic of ocean currents along the Northwest Australian continental shelf. Image adapted from DEWHA (2008). 1
Figure 3 Typical ocean current circulation pattern during the summer months. 2
Figure 4 Typical ocean current circulation pattern during the winter months. 2
Figure 5 Map showing the regions of sub-gridding for the study area. 4
Figure 6 Bathymetry defined throughout the tidal model domain. 4
Figure 7 Tide stations used to calibrate surface elevation within the model. 6
Figure 8 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation. 7
Figure 9 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation. 8
Figure 10 Monthly surface current rose plots near the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2008 – 2012 inclusive). 11
Figure 11 Sample of the CFSR modelled wind data 12
Figure 12 Monthly wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site. 14
Figure 13 Seasonal wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site. 15
Figure 14 Annual wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site. 16
Figure 15 Monthly water temperature and salinity profiles near the release site. 18
Figure 16 Weathering of MDO under three static winds conditions (5, 10 and 15 knots). The results are based on a 280 m^3 surface release of MDO over 6 hours and tracked for 30 days. 21
Figure 17 Receptor map illustrating Marine Parks 25
Figure 18 Receptor map illustrating the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) 26
Figure 19 Receptor map illustrating the Interim Biogeographic Regionalisation for Australia (IBRA) 26
Figure 20 Receptor map illustrating Key Ecological Features (KEF) 27
Figure 21 Receptor map illustrating the Reefs, Shoals and Banks 27
Figure 22 Zones of potential oil exposure on the sea surface, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions. 30
Figure 23 Zones of potential oil exposure on the sea surface, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions. 31
Figure 24 Zones of potential oil exposure on the sea surface, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions. 32
Figure 25 Minimum time for oil exposure on the sea surface at the low (1 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions. 33
Figure 26 Minimum time for oil exposure on the sea surface at the moderate (10g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions. 34
Figure 27 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions. 35

RPS

Figure 28 Minimum time for oil exposure on the sea surface at the low (1 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions. 36
Figure 29 Minimum time for oil exposure on the sea surface at the moderate (10 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions. 37
Figure 30 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions. 38
Figure 31 Minimum time for oil exposure on the sea surface at the low (1 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions. 39
Figure 32 Minimum time for oil exposure on the sea surface at the moderate (10 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions. 40
Figure 33 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions. 41
Figure 34 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions. 44
Figure 35 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions. 45
Figure 36 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions. 46
Figure 37 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions. 50
Figure 38 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions. 51
Figure 39 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions. 52
Figure 40 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions. 53
Figure 41 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions. 54
Figure 42 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions. 55

Terms and Abbreviations

°	Degrees
‘	Minutes
“	Seconds
Actionable oil	Oil which is thick enough for effective use of mitigation strategies, such as mechanical clean up (e.g. skimmers), booms, dispersed, or burned
AMP	Australian marine parks
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
API	American Petroleum Institute gravity (A measure of how heavy or light a petroleum liquid in comparison to water)
ASTM	American Society for Testing and Materials
Bonn Agreement Oil Appearance Code	An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union
°C	Degree Celsius (unit of temperature)
cP	Centipoise (unit of viscosity)
CFSR	Climate Forecast System Reanalysis
cm	Centimetre (unit of length)
Decay	The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions
Dissolved aromatic hydrocarbons	Dissolved hydrocarbons within the water column with alternating double and single bonds between carbon atoms forming rings, containing at least one six-membered benzene ring
g/m^2	Grams per square meter (unit of surface or area density)
EIA	Environmental impact assessment
Entrained oil	Droplets or globules of oil that are physically mixed (but not dissolved) into the water column. Physical entrainment can occur either during pressurised release from a subsurface location, or through the action of breaking waves (>12 knots)
EP	Environmental plan
EEZ	Exclusive Economic Zone
Evaporation	The process whereby components of the oil mixture are transferred from the sea-surface to the atmosphere
GODAE	Global Ocean Data Assimilation Experiment
HYCOM	Hybrid Coordinate Ocean Model is a data-assimilative, three-dimensional ocean model
HYDROMAP	Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction
IOA	Index of Agreement gives a non-dimensional measure of model accuracy or performance
IBRA	Interim Biogeographic Regionalisation for Australia
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
Isopycnal layers	Water column layers with corresponding water densities

ITOPF	The International Tanker Owners Pollution Federation
KEF	Key Ecological Feature
km	Kilometre (unit of length)
km^2	Square Kilometres (unit of area)
KEF	Key ecological feature
Knot	unit of wind speed (1 knot = 0.514 m/s)
LC_{50}	Median lethal dose. The dose required for mortality of 50% of a tested population after a specified test duration
LGA	Local Government Area
m	Meters (unit of length)
m^2	Meters squared (unit of area)
m^3	Meters cubed (unit of volume)
m/s	Meters per Second (unit of speed)
MAE	Mean Absolute Error is the average of the absolute values of the difference between model predicted and observed data (e.g. surface elevations)
MB	Marine boundary
MNP	Marine National Park
MS	Marine Sanctuary
NASA	National Aeronautics and Space Administration
NCEP	National Centres for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
nm	nautical mile (unit of distance; 1 nm = 1.852 km)
NP	National Parks
Ocean current	Large scale and continuous movement of seawater generated by forces such as breaking waves, wind, the Coriolis effect, and temperature and salinity gradients. It is the main flow of ocean waters
OECD	Organisation for Economic Co-operation and Development
P&A	Plug and abandon
PFW	Produced formation water
PNEC	Predicted no-effect concentration
ppb	Parts per billion (concentration)
ppb.hrs	ppb multiplied for hours (concentration x time)
PSU	Practical salinity units
Ramsar site	A wetland site designated of international importance under the Ramsar Convention
RAMSAR Convention	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
Sea surface exposure	Floating oil on the sea surface equal to or above reporting threshold (e.g. 0.5 g/m^2)
Shoreline contact	Stranded oil on the shoreline equal to or above reporting threshold (e.g. 10 g/m^2)
SIMAP	Spill Impact Mapping Analysis Program
US EPA	United States Environmental Protection Agency
Visible oil	Floating oil on the sea surface equal to or above reporting threshold (e.g. 0.5 g/m^2)

RPS

EXECUTIVE SUMMARY

Background

3D Oil is seeking approval to undertake a work program consisting of the acquisition and processing of 3-dimensional seismic survey data in permit area WA-527-P, in the offshore Roebuck Basin. In order to obtain environmental approvals for the planned marine seismic survey operations, ERM Australia (ERM) commissioned RPS, on behalf of 3D Oil to undertake a comprehensive oil spill modelling study.

The study considered the following hypothetical, yet plausible scenario:

- A 280 m^3 release of marine diesel oil resulting from a vessel collision incident at the closest point of the operational area to the Rowley Shoals.

SIMAP's stochastic model was used to quantify the probability of exposure to the sea surface and in the water column as well as the probability of shoreline contact from hypothetical spill scenarios. The SIMAP system, the methods and analysis presented herein use modelling algorithms which have been anonymously peer reviewed and published in international journals. Further, RPS warrants that this work meets and exceeds the ASTM Standard F2067-13 "*Standard Practice for Development and Use of Oil Spill Models*".

Methodology

The modelling study was carried out in several stages. Firstly, a five-year current dataset (2008–2012) that includes the combined influence of three-dimensional ocean and tidal currents was developed. Secondly, the currents, spatial winds and then detailed hydrocarbon properties were used as inputs in the oil spill model to simulate the drift, spread, weathering, entrainment and fate of the spilled hydrocarbons.

As spills can occur during any set of wind and current conditions, a total of 100 spill trajectories for the scenario described above and per season (e.g. summer, transitional and winter) were initiated at random times within a 5-year period (2008–2012) to enable a robust statistical analysis.

Each simulation was configurated with the same spill information (i.e. spill volume, duration and oil type) except for the start time and date which in turn, ensures that the predicted transport and weathering of an oil slick is subject to a wide range of current and wind conditions.

Oil Properties

For this oil spill modelling study, a marine diesel oil (MDO) was used to represent the containment loss from a vessel collision scenario. This oil has a density of 829.1 kg/m^3 (API of 37.6), a pour point (-14°C) and a viscosity of 4cP which indicate that this oil will spread quickly when released on the sea surface and will form a thin to low thickness film, increasing the rate of evaporation. The oil is categorised as a group II oil (light-persistent) based on categorisation and classification derived from AMSA (2015a) guidelines.

Key Findings

Scenario: Containment loss from a vessel collision

- No shoreline contact above the low (10 g/m^2) threshold was predicted for the scenario;
- Modelling results demonstrated that surface oil at low (1 g/m^2), moderate (10 g/m^2) and high (25 g/m^2) exposure levels could potentially travel greater distances during the transitional period, compared to the summer and winter periods. The maximum distance travelled by surface oil for the low, moderate and high threshold was 66 km, 14 km and 7km, respectively.
- While the low exposure surface oil was predicted to travel in any directions from the release site, surface oil above the moderate and high exposure levels remained along the northwest to southeast axis across all seasons.

- The evaporative nature of MDO and environmental conditions in the area resulted in short-lived surface hydrocarbon exposure, with surface exposure reduced to less than 10 g/m^2 after approximately 12-24 hours.
- The modelling results demonstrated a low likelihood (1-2%) of low surface oil exposure to the Argo-Rowley Terrace Australian Marine Park.
- The maximum time-averaged exposure to dissolved hydrocarbon over 48 hours remained less than 1 ppb for the winter and transitional seasons while reaching 4 ppb for the summer and winter seasons for various receptors. These concentrations are below the defined low threshold for dissolved hydrocarbons.
- The maximum instantaneous exposure to dissolved hydrocarbons ranged from 6 ppb to 73 ppb for the transitional and summer seasons, respectively. None of the receptors was exposed at the moderate (50 ppb) or high (400 ppb) thresholds or above for instantaneous exposure with the exception of the IMCRA – North West Shelf. This receptor had a 1 % probability of exposure to instantaneous dissolved hydrocarbon during the summer season.
- The maximum time-averaged exposure over 48 hours to entrained hydrocarbons ranged from 4 ppb to 499 ppb for the transitional and winter seasons respectively.
- The maximum instantaneous exposure to entrained hydrocarbon was 6,287 ppb for the Northwest Shelf IMCRA during the summer.

1 INTRODUCTION

3D Oil is seeking approval to undertake a work program consisting of the acquisition and processing of 3-dimensional seismic survey data in permit area WA-527-P, in the offshore Roebuck Basin (Figure 1). In order to obtain environmental approvals for the planned marine seismic survey operations, ERM Australia (ERM) commissioned RPS, on behalf of 3D Oil to undertake a comprehensive oil spill modelling study.

The study considered the following hypothetical, yet plausible scenario:

- A 280 m^3 release of marine diesel oil resulting from a vessel collision incident at the closest point of the operational area to the Rowley Shoals.

Table 1 Location of the release site.

Release site	Latitude	Longitude	Water Depth (m)
Release site	-17°56”17.0’	119°30”14.8’	160

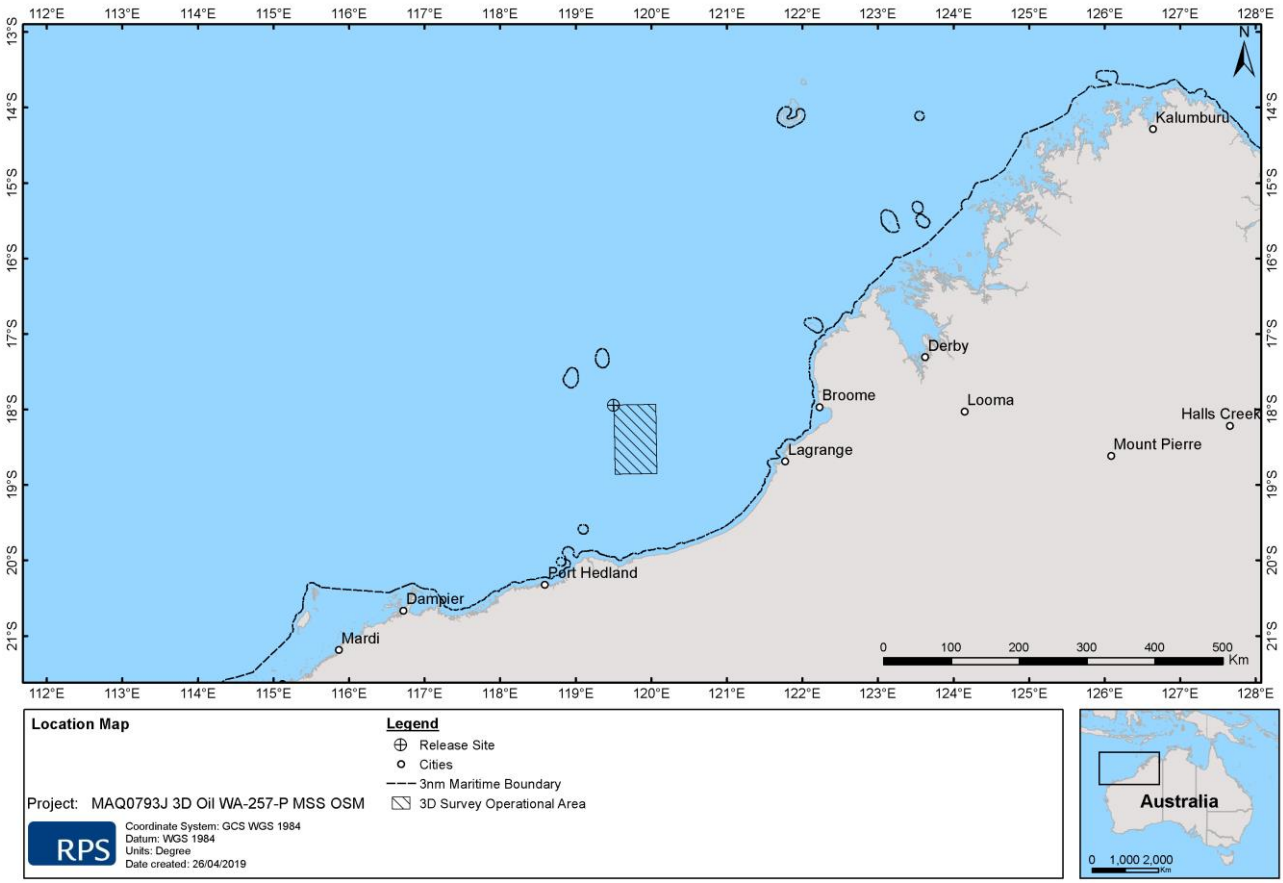


Figure 1 Locality map

2 SCOPE OF WORK

The scope of work will include the following components:

- Generate tidal current patterns of the region using the ocean/coastal model, HYDROMAP;
- Use HYCOM (Hybrid Coordinate Ocean Model) ocean currents combined with HYDROMAP tidal currents over a 5-year period (2008 to 2012) to account for large scale flows offshore and tidal flows nearshore;
- Use 5 years of high-resolution wind, aggregated current data and site-specific oil characteristics as input into the 3-dimensional oil spill model to represent the movement, spreading, entrainment, weathering of the oil over time;
- Use SIMAP's stochastic model (also known as a probability model) to calculate exposure to surrounding waters (sea surface and water column) and shorelines. This will involve running 100 randomly selected single trajectory simulations for each season, with each simulation having the same spill information (spill volume, duration and composition of hydrocarbons) but varying start times. This will ensure that each spill trajectory is subjected to unique wind and current conditions.

3 REGIONAL CURRENTS

The permit area is located within the offshore Roebuck Basin, on the central North West Shelf, a shallow (generally <100 m) waterbody bordered by the Indian Ocean and Timor Sea. The North West Shelf is characterised by complex geomorphological features such as shoals, valleys and terraces and is dominated by high-amplitude tides and seasonally-dependant wind driven currents (DEWHA, 2007).

Although the Indonesian Throughflow and Holloway current generate south-westerly flows all year-round, warm and less saline waters originating from the tropics can generate internal gyres that typically migrate through the area and result in large variation in the speed and direction of local currents. The Holloway current generally intensifies during April to July due to increased wind forcing.

A comprehensive description of the circulation patterns of the Northwest Shelf and Bonaparte Gulf is provided in a review by Condie and Andrewartha (2008) and a schematic of the ocean currents along the Northwest Australian continental shelf is shown in Figure 2.

While, tidal currents are generally weaker in the deeper waters, its influence is greatest along the near shore and around islands. Therefore, to accurately account for the movement of an oil spill, which can move between the offshore and near shore region, ocean and tidal currents were combined as part of the study.

Figure 3 and Figure 4 present summer and winter current trends within the Roebuck Basin and the southern section of the North West Shelf.

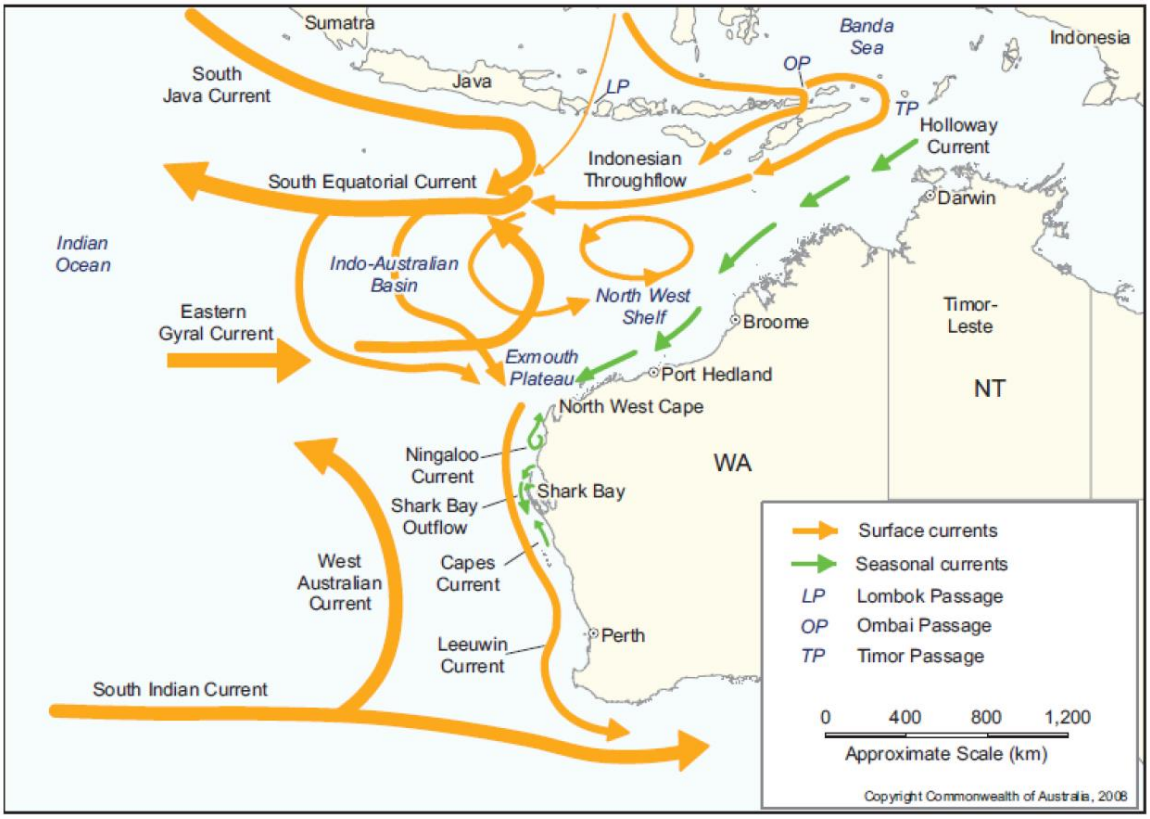


Figure 2 Schematic of ocean currents along the Northwest Australian continental shelf. Image adapted from DEWHA (2008).

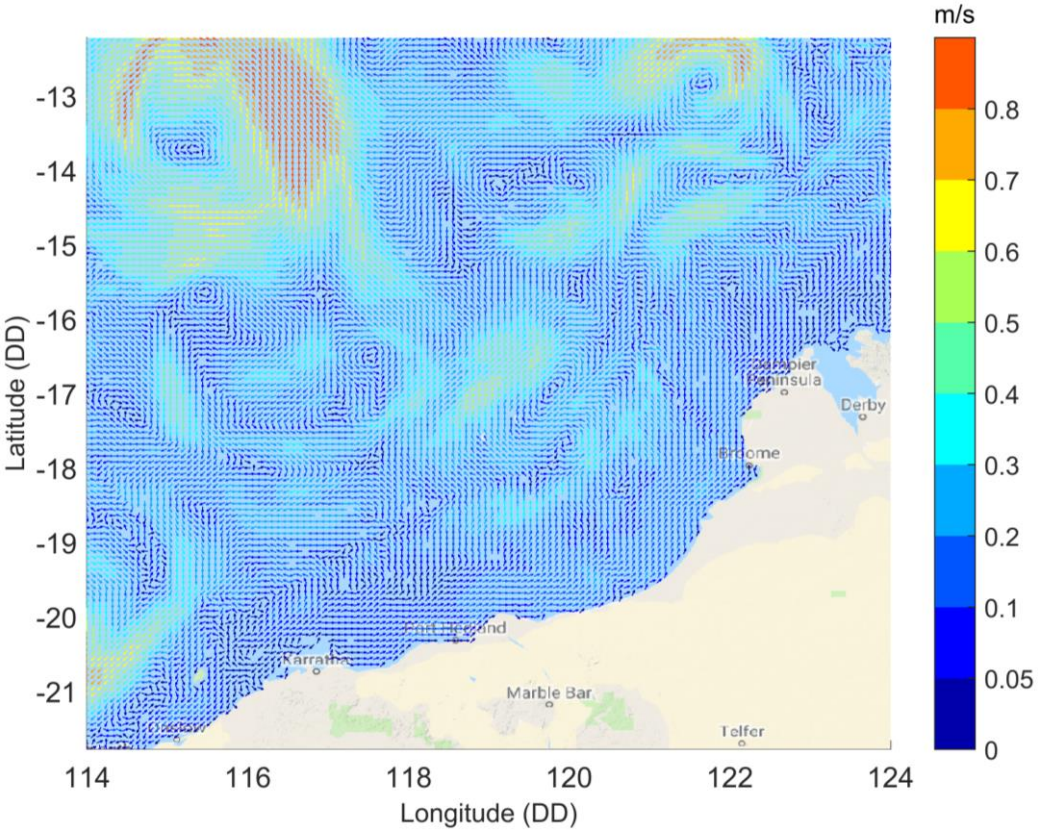


Figure 3 Typical ocean current circulation pattern during the summer months.

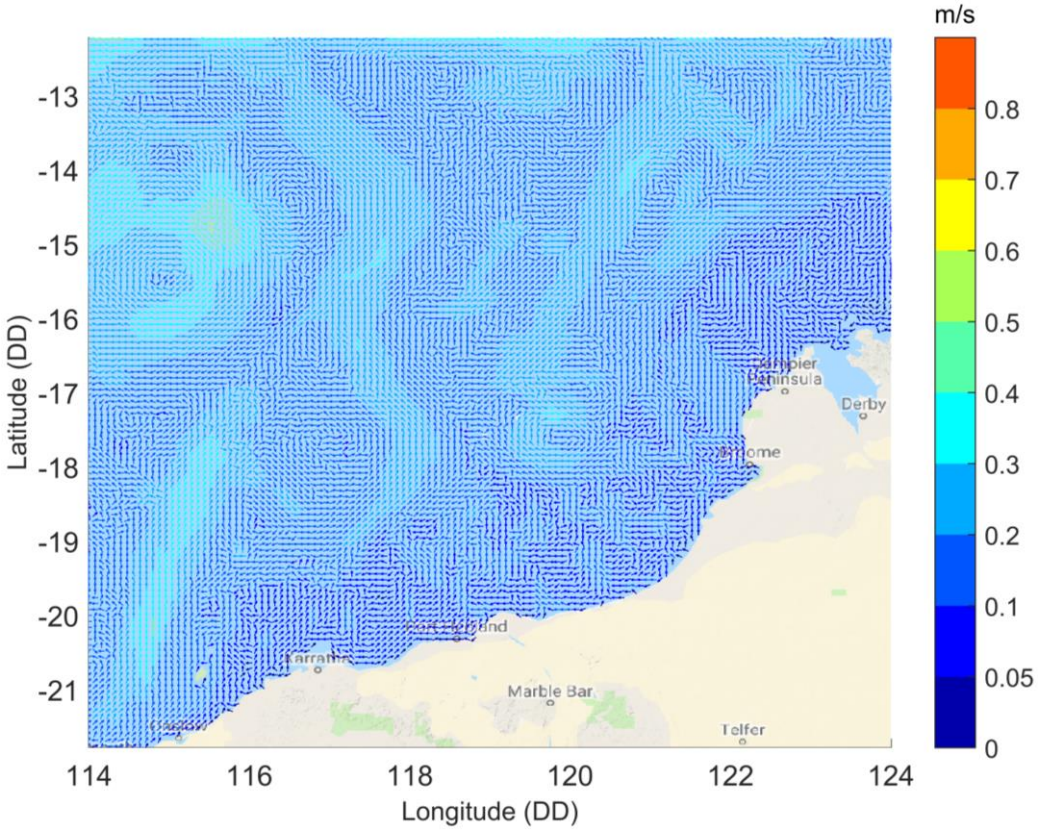


Figure 4 Typical ocean current circulation pattern during the winter months.

3.1 Tidal Currents

Tidal current data was generated using RPS's advanced ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world over the past 32 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP tidal current data has been used as input to forecast (in the future) and hindcast (in the past) pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (Australian Maritime Safety Authority).

HYDROMAP employs a sophisticated sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. The sub-gridding allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, and/or of particular interest to a study.

The numerical solution methodology follows that of Davies (1977a and 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji and Spaulding (1984) and Isaji et al. (2001).

3.1.1 Grid Setup

RPS has a seamless global tidal model calibrated to modelled and measured (when available) tidal data around the world. The tidal domains are sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids were allocated in a step-wise fashion to more accurately resolve flows along the coastline, around islands and over regions with more complex bathymetry. Figure 5 shows the tidal model grid covering the study domain.

A range of datasets were sourced and merged to describe the shape of the seabed within the grid domain. These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

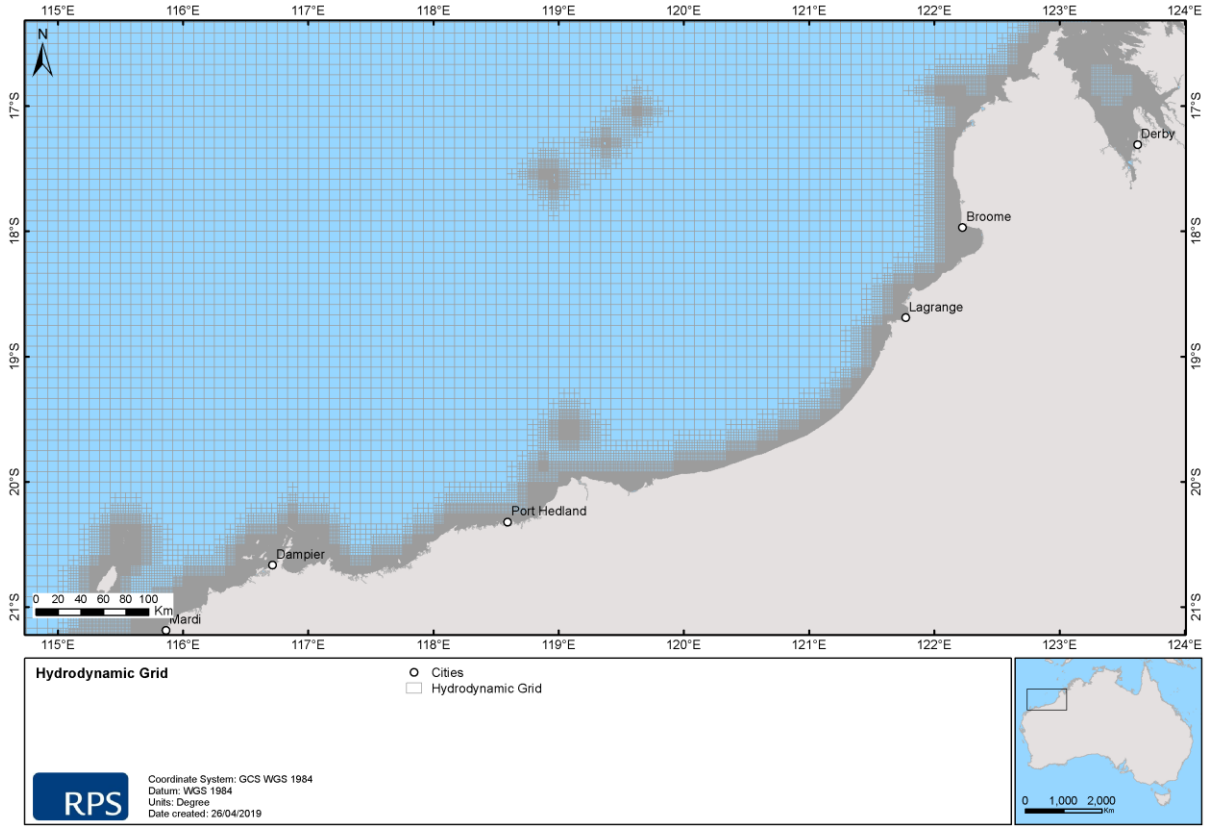


Figure 5 Map showing the regions of sub-gridding for the study area.

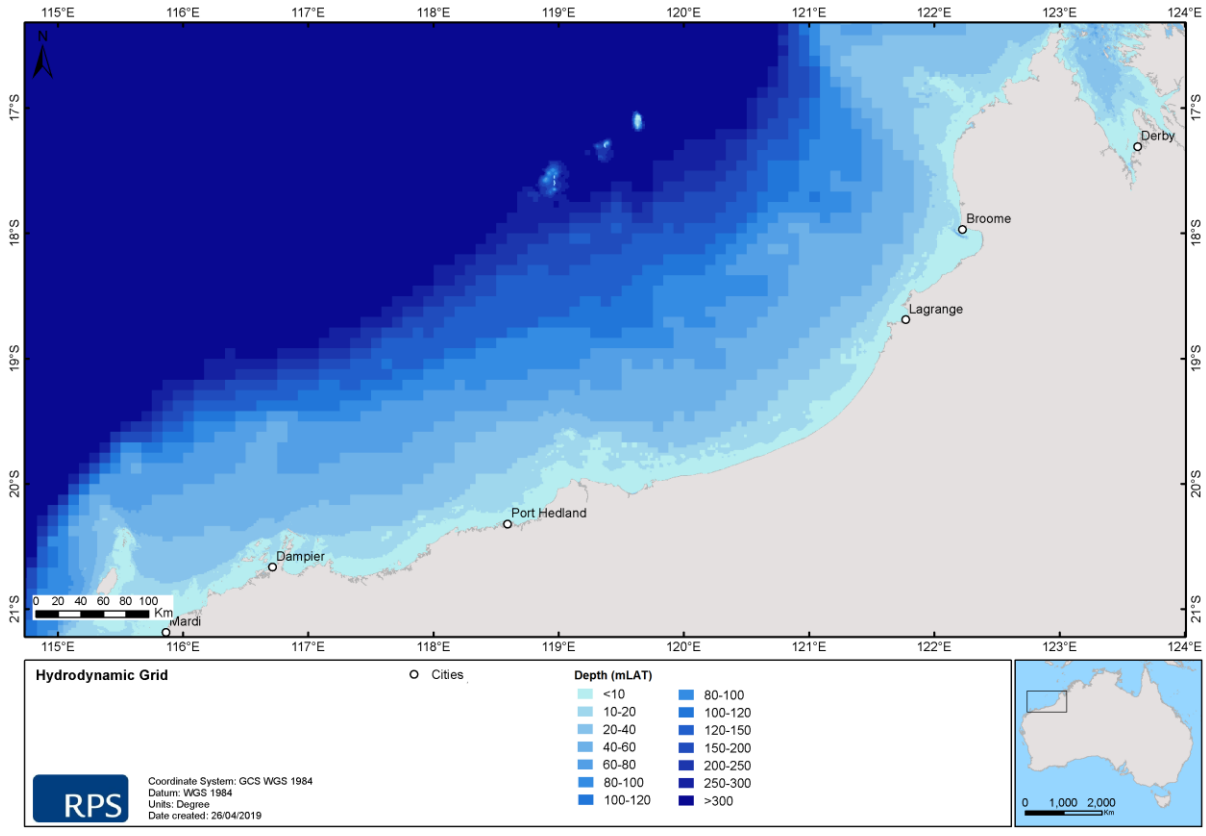


Figure 6 Bathymetry defined throughout the tidal model domain.

3.1.2 Tidal Conditions

The ocean boundary data for the regional model was obtained from satellite measured altimetry data (TOPEX/Poseidon 7.2) which provided estimates of the eight dominant tidal constituents at a horizontal scale of approximately 0.25 degrees. The eight major tidal constituents used were K_2, S_2, M_2, N_2, K_1, P_1, O_1 and Q_1. Using the tidal data, surface heights were firstly calculated along the open boundaries, at each time step in the model.

The TOPEX/Poseidon satellite data has a global resolution of 0.25 degrees and is produced and quality controlled by NASA (National Aeronautics and Space Administration). The satellites equipped with two highly accurate altimeters and capable of taking sea level measurements with an accuracy of ± 5 cm measured oceanic surface elevations (and the resultant tides) for over 13 years (1992–2005). In total, these satellites carried out 62,000 orbits of the planet.

The TOPEX/Poseidon tidal data has been widely used amongst the oceanographic community, being included in more than 2,100 research publications (e.g. Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk and Tangdong, 2004; Qiu and Chen 2010). As such the TOPEX/Poseidon tidal data is considered suitably accurate for this study.

3.1.3 Surface Elevation Validation

To ensure that tidal predictions were accurate, predicted surface elevations were compared to data observed at eight locations (see Figure 7).

To provide a statistical measure of the model performance, the Index of Agreement (IOA - Willmott (1981)) and the Mean Absolute Error (MAE - Willmott (1982) and Willmott and Matsuura (2005)) were used.

The MAE (Eq.1) is simply the average of the absolute values of the difference between the model-predicted (P) and observed (O) variables. It is a more natural measure of the average error (Willmott and Matsuura, 2005) and more readily understood. The MAE is determined by:

$$MAE = N^{-1}\sum_{i=1}^{N}|P_i - O_i| \qquad \text{Eq.1}$$

Where: N = Number of observations

P_i = Model predicted surface elevation

O_i = Observed surface elevation

The Index of Agreement (IOA; Eq. 2) in contrast, gives a non-dimensional measure of model accuracy or performance. A perfect agreement between the model predicted and observed surface elevations exists if the index gives an agreement value of 1, and complete disagreement between model and observed surface elevations will produce an index measure of 0 (Wilmott, 1981). Willmott et al (1985) also suggests that values larger than 0.5 may represent good model performance. The IOA is determined by:

$$IOA = 1 - \frac{\sum|X_{model} - X_{obs}|^2}{\sum(|X_{model} - \overline{X_{obs}}| + |X_{obs} - \overline{X_{obs}}|)^2} \qquad \text{Eq.2}$$

Where: X_{model} = Model predicted surface elevation

X_{obs} = Observed surface elevation

Clearly, a greater IOA and lower MAE represent a better model performance.

Figure 8 and Figure 9 illustrate a comparison of the predicted and observed surface elevations for each location for January 2014. As shown on the graph, the model accurately reproduced the phase and amplitudes throughout the spring and neap tidal cycles.

Table 2 Statistical comparison between the observed and predicted surface elevations.

Tide Station	IOA	MAE (m)
Broome	0.90	1.11
Lagrange Bay	0.96	0.71
Lynher Bank	0.98	0.31
Port Hedland	0.98	0.33
Port Walcott	0.99	0.20
Red Bluff	0.98	0.46

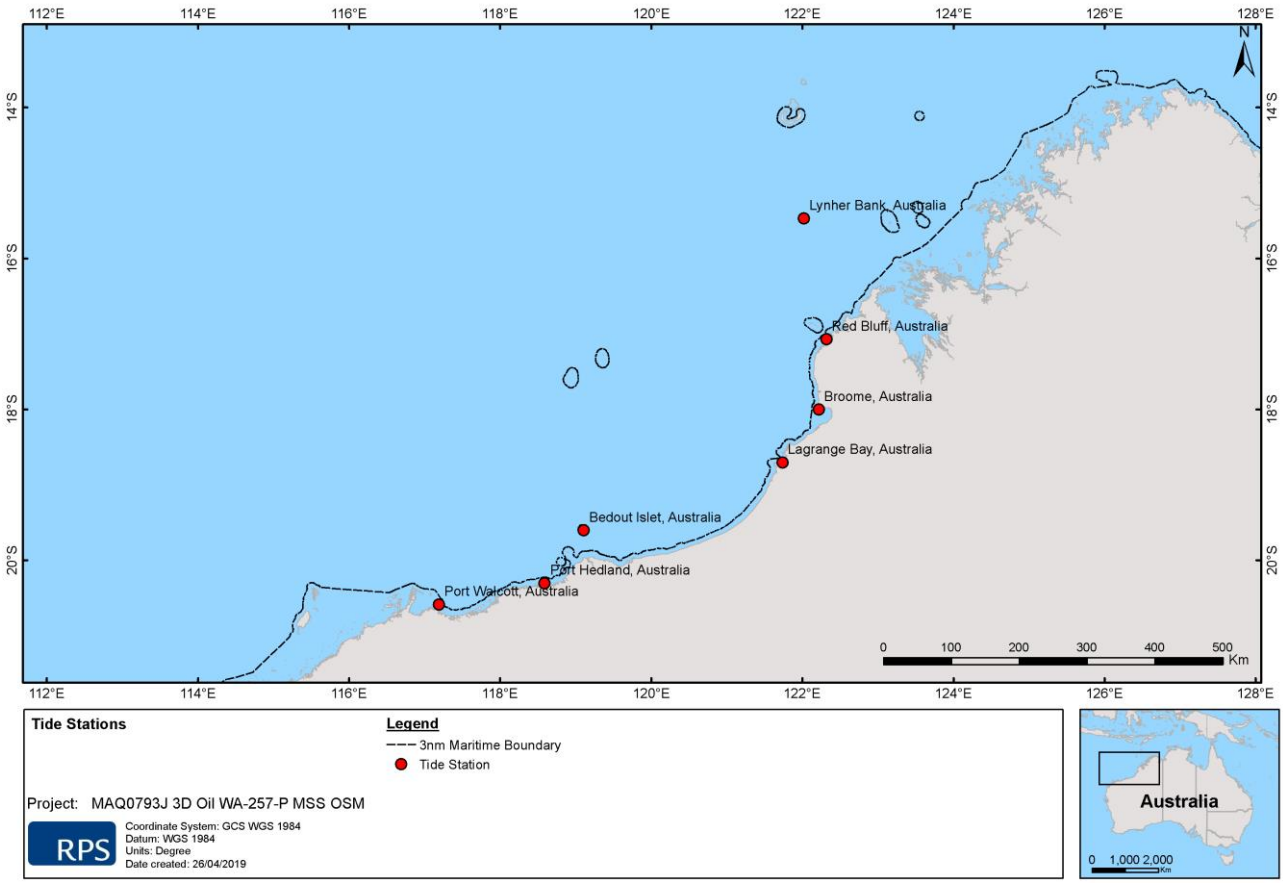


Figure 7 Tide stations used to calibrate surface elevation within the model.

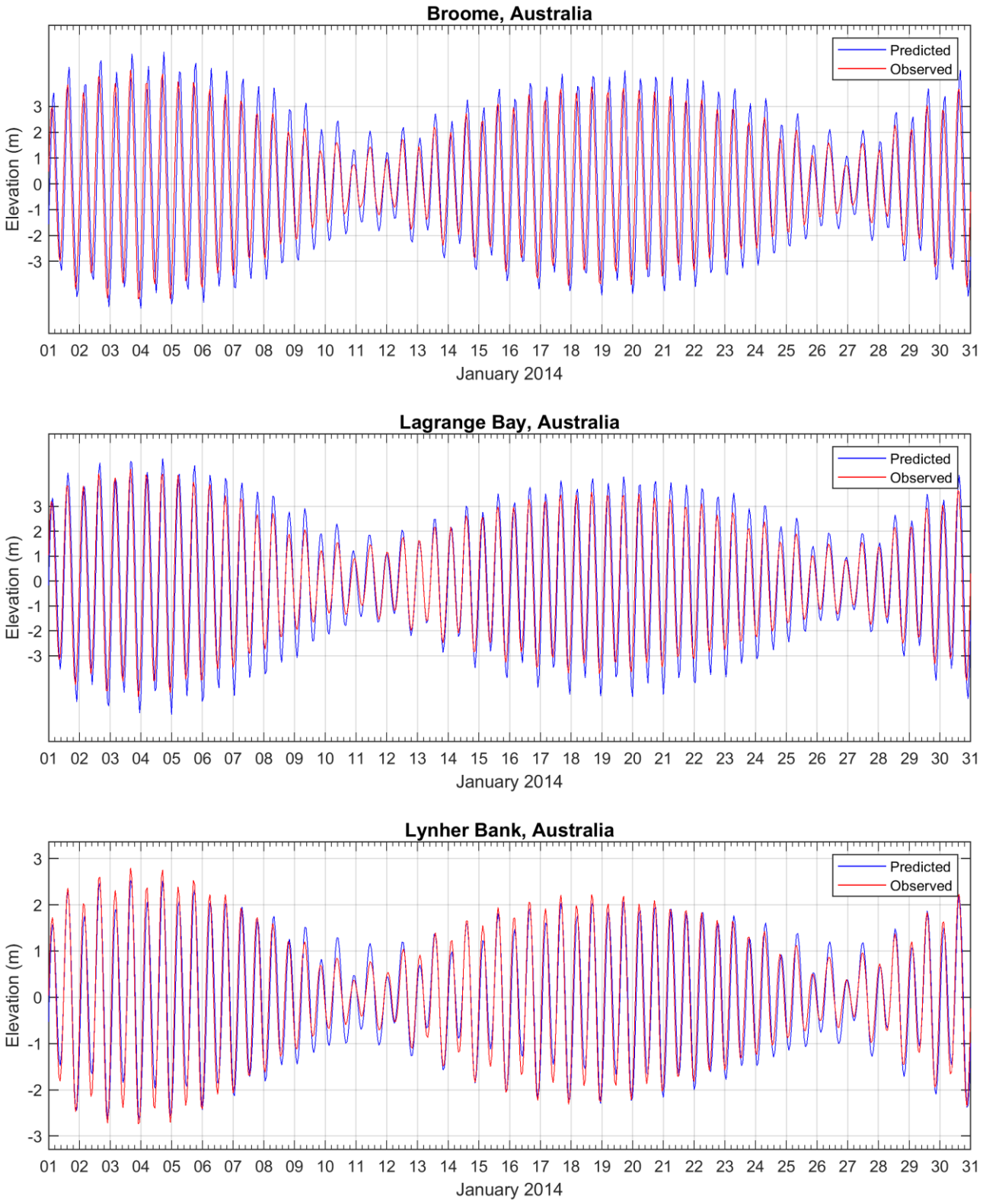


Figure 8 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation.

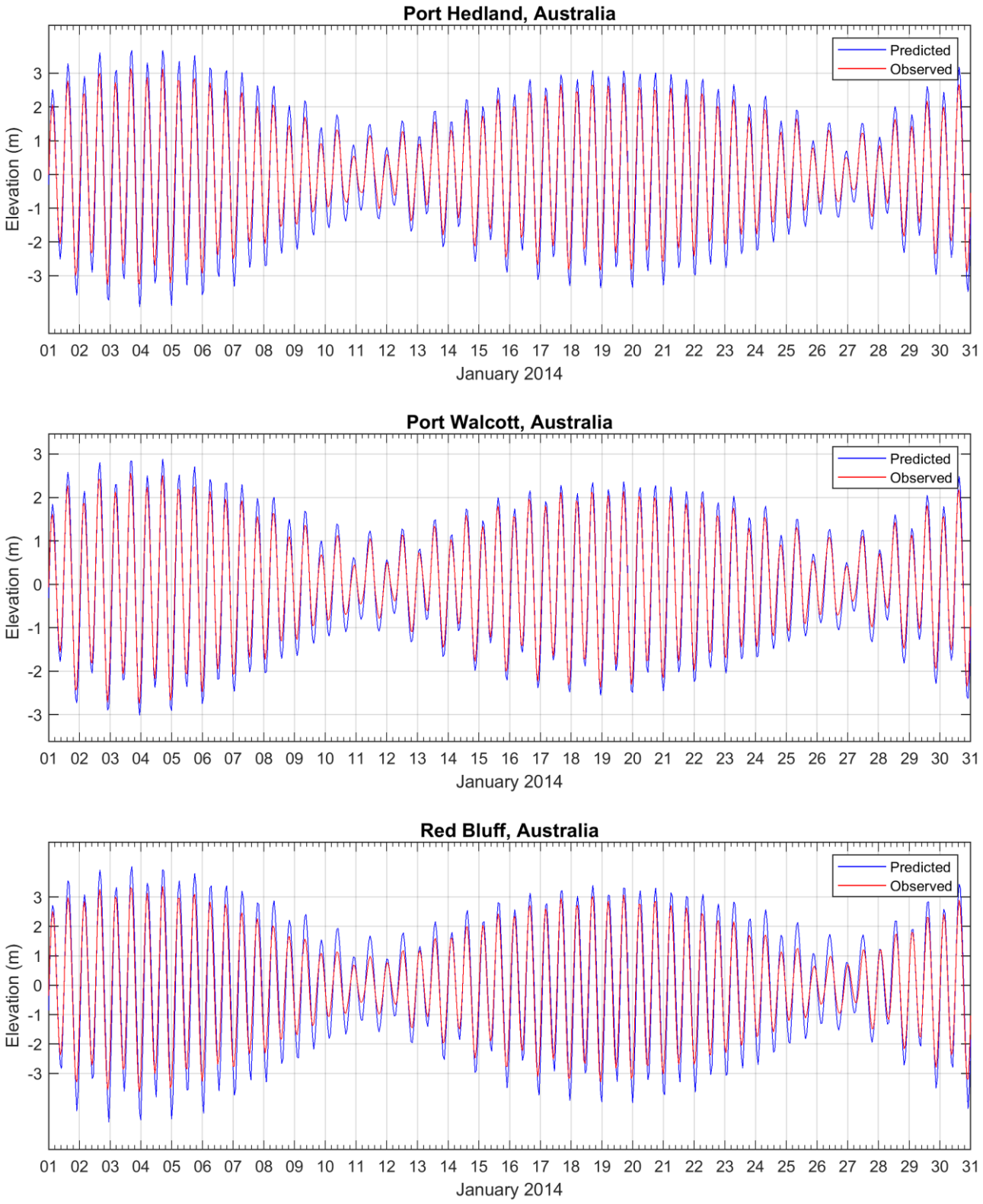


Figure 9 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation.

3.2 Ocean Currents

Data describing the flow of ocean currents was obtained from HYCOM (Hybrid Coordinate Ocean Model, (Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, three-dimensional ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12th of a degree) over the region, at a frequency of once per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas.

For this study, the HYCOM reanalysis hindcast currents were obtained for the years 2008 to 2012 (inclusive).

3.3 Surface Currents at the release site

Table 3 displays the predicted average and maximum surface current speed near the release site. Figure 10 illustrates the monthly current rose distributions (2008-2012 inclusive) derived from combining HYCOM ocean current data and HYDROMAP tidal data.

Note the convention for defining current direction is the direction the current flows towards, which is used to reference current direction throughout this report. Each branch of the rose represents the currents flowing to that direction, with north to the top of the diagram. Sixteen bins of 22.5° each are used to describe the current direction. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are predominantly used in these current roses. The length of each coloured segment is relative to the proportion of currents flowing within the corresponding speed and direction.

The combined current data (ocean plus tides) demonstrated that the release site is situated in a dynamic environment, with waters flowing along a predominant northwest to southeast axis all year-round. Monthly average surface current speed ranged between 0.30 m/s (December) and 0.38 m/s (March, May and September) while maximum surface current speed peaked at 1.26 m/s in February.

Table 3 **Predicted monthly average and maximum surface current speeds adjacent to the release location. Data derived by combining the HYCOM ocean data and HYDROMAP high resolution tidal data from 2008-2012 (inclusive).**

Month	Average current speed (m/s)	Maximum current speed (m/s)	General direction (towards)
January	0.34	0.95	NNW – SE
February	0.36	1.26	NNW – SE
March	0.38	1.24	NW – SSE
April	0.37	0.95	NW – SSE
May	0.38	1.15	WNW – SSE
June	0.32	0.80	WNW – SSE
July	0.35	0.93	NW – SW
August	0.36	1.03	NW – SE
September	0.38	1.04	NW – SE
October	0.35	1.06	NW – SE
November	0.32	0.84	NNW – SE
December	0.30	0.87	NW – SE
Minimum	**0.30**	**0.80**	
Maximum	**0.38**	**1.26**	

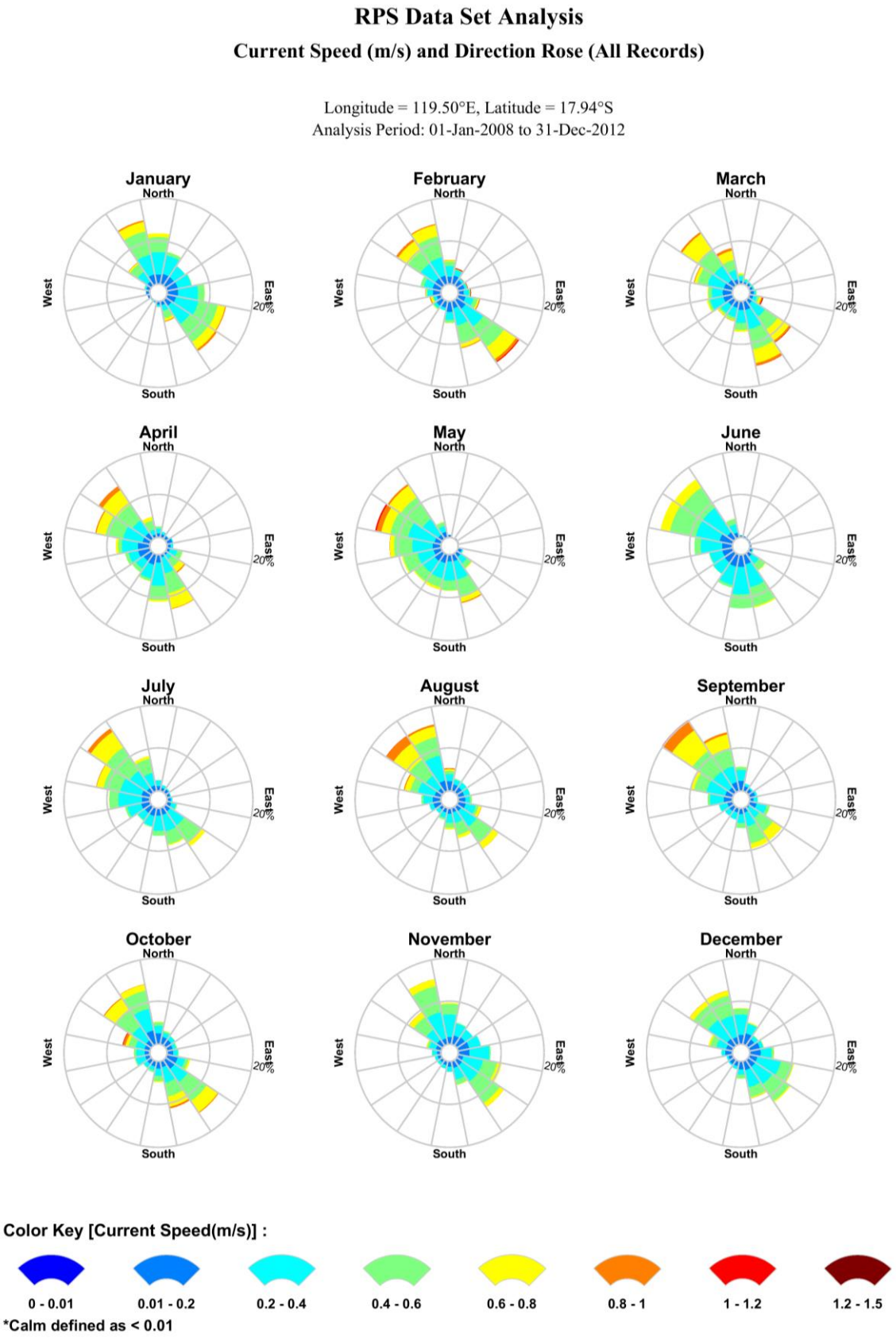


Figure 10 Monthly surface current rose plots near the release location (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2008 – 2012 inclusive).

4 WIND DATA

High resolution wind data was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR; see Saha et al., 2010) from 2008 to 2012 (inclusive).The CFSR wind model includes observations from many data sources; surface observations, upper-atmosphere air balloon observations, aircraft observations and satellite observations and is capable of accurately representing the interaction between the earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals. Figure 11 shows the spatial resolution of the wind field used as input into the oil spill model. Table 4 shows the monthly average and maximum winds derived from the CFSR node located adjacent to the release site. Figure 12 to Figure 14 show the monthly, seasonal and annual wind rose distributions, respectively.

Note that the atmospheric convention for defining wind direction, that is, the direction the wind blows from, is used to reference wind direction throughout this report. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Sixteen bins of 22.5° each are used to describe the wind direction. The branches are divided into segments of different colour, which represent wind speed ranges from that direction. Speed ranges of 3 knot intervals, excluding the calm and near calm conditions are used in these wind roses. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

Table 4 illustrates predicted average and maximum wind velocities as well as general direction for each month. The data indicated that winds are generally stronger during the summer months as a result of easterly trade winds, reaching a maximum of 58 knots in March. Monthly average wind velocities oscillated between 8 knots (April) and 13 knots (July).

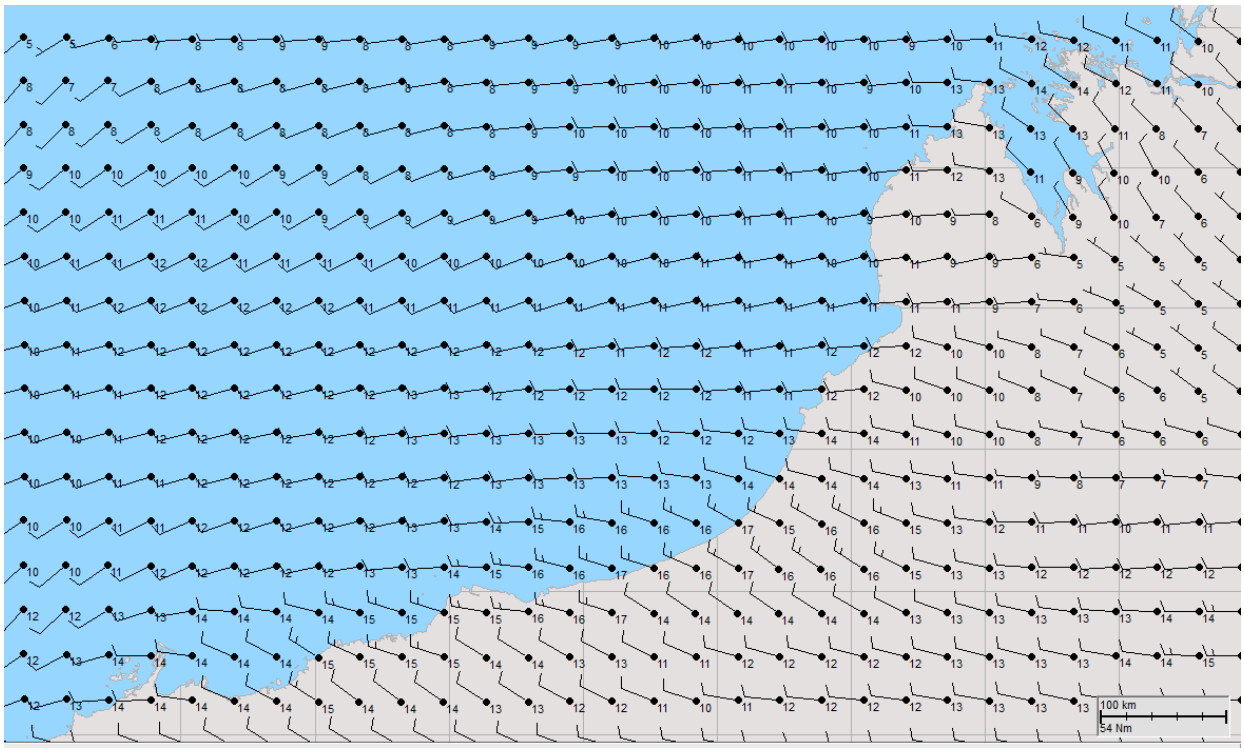


Figure 11 Sample of the CFSR modelled wind data

Table 4 Predicted monthly average and maximum winds for the wind node adjacent to the release location. Data derived from CFSR hindcast model from 2008-2012 (inclusive).

Month	Average wind (knots)	Maximum wind (knots)	General direction (from)
January	11	35	W
February	11	47	W
March	9	58	Variable
April	8	27	Variable
May	13	32	ESE
June	13	30	ESE
July	13	29	ESE
August	11	29	ESE
September	11	31	Variable
October	10	25	WSW
November	10	27	WSW
December	11	36	W
Minimum	**8**	**25**	
Maximum	**13**	**58**	

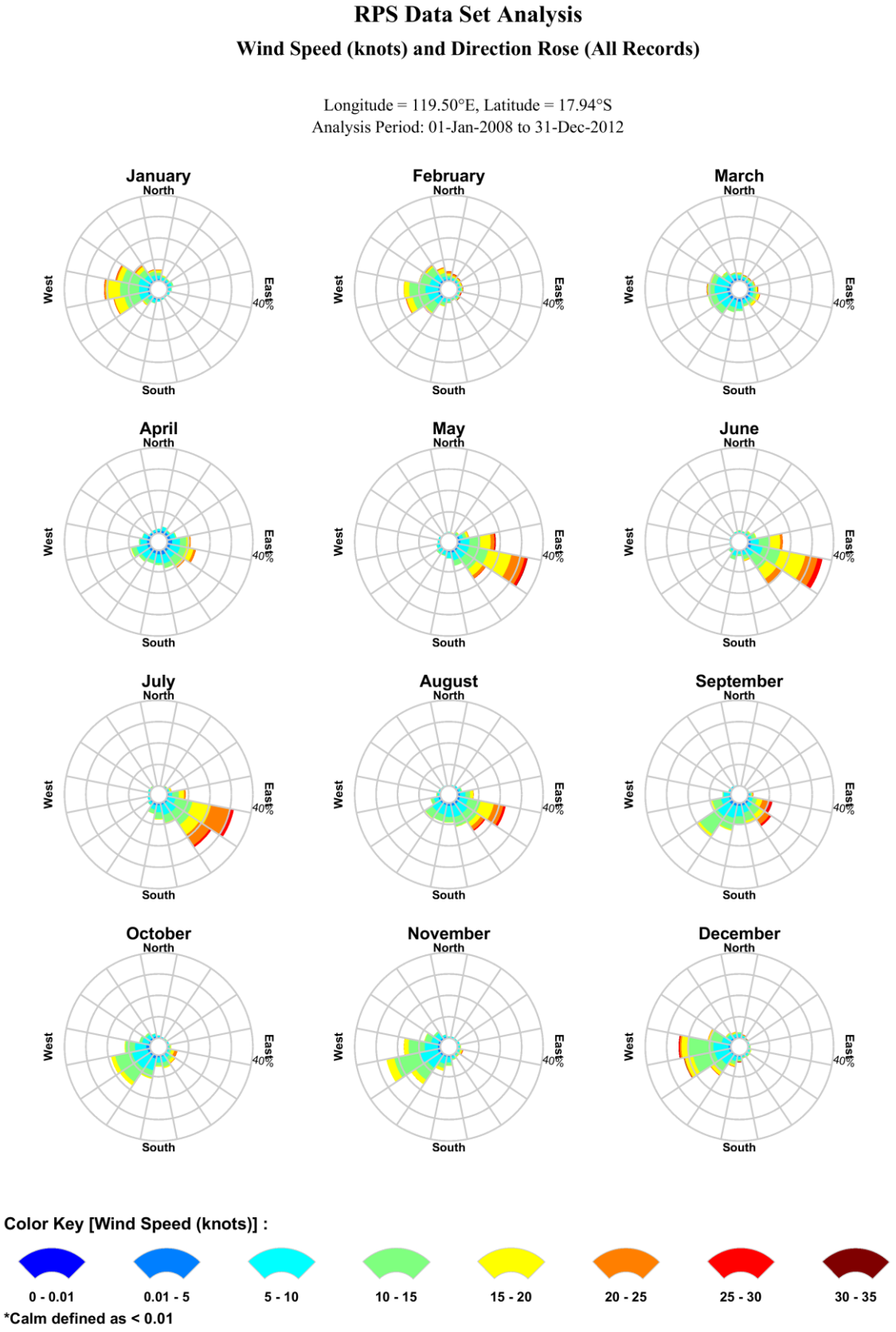


Figure 12 Monthly wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site.

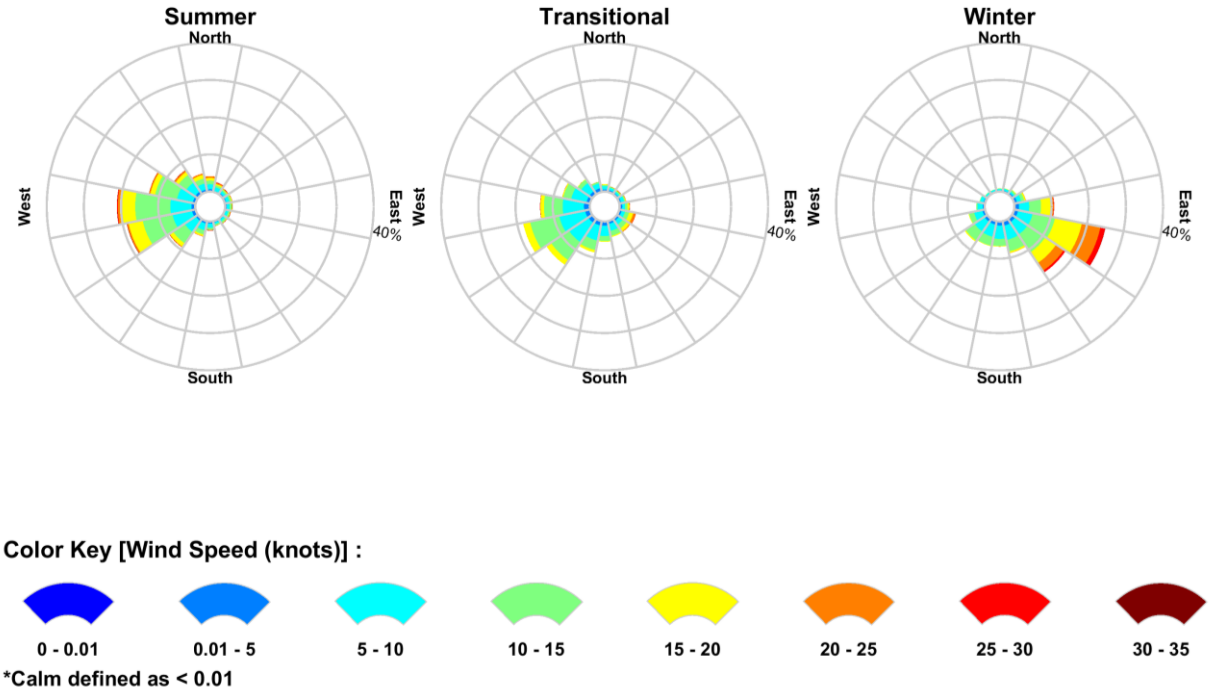


Figure 13 Seasonal wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site.

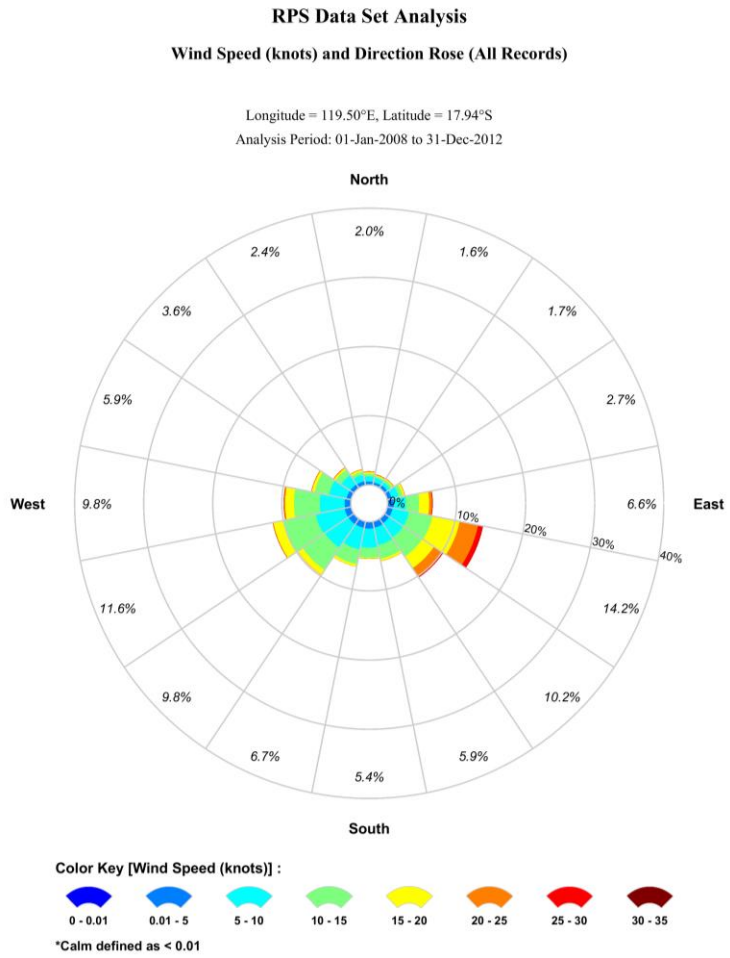


Figure 14 Annual wind rose distributions derived from the CFSR model from 2008–2012 (inclusive), for the nearest wind node to the release site.

5 WATER TEMPERATURE AND SALINITY

The monthly sea temperature and salinity profiles of the water column adjacent to the release site was obtained from the World Ocean Atlas 2013 (WOA13) produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) (see Levitus et al., 2013).

To account for depth-varying sea temperature and salinity the modelling used monthly average sea temperature and salinity profiles at 5 m intervals through the water column (refer to Figure 15).

Table 5 details the monthly average sea surface temperatures and salinity (0-5 m depth layer). Monthly average sea surface temperatures were shown to range from 25.2°C (September) and 30.2°C (March). Salinity remained consistent throughout the year ranging from 34.3 to 35.0 psu.

Table 5 Monthly average sea surface temperature and salinity in the 0–5 m depth layer near the release site

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	30.0	29.9	30.2	29.5	27.7	28.1	25.4	25.3	25.2	26.7	28.1	28.8
Salinity (psu)	34.8	34.6	34.6	34.8	34.5	34.8	34.3	34.7	34.6	34.7	35.0	34.9

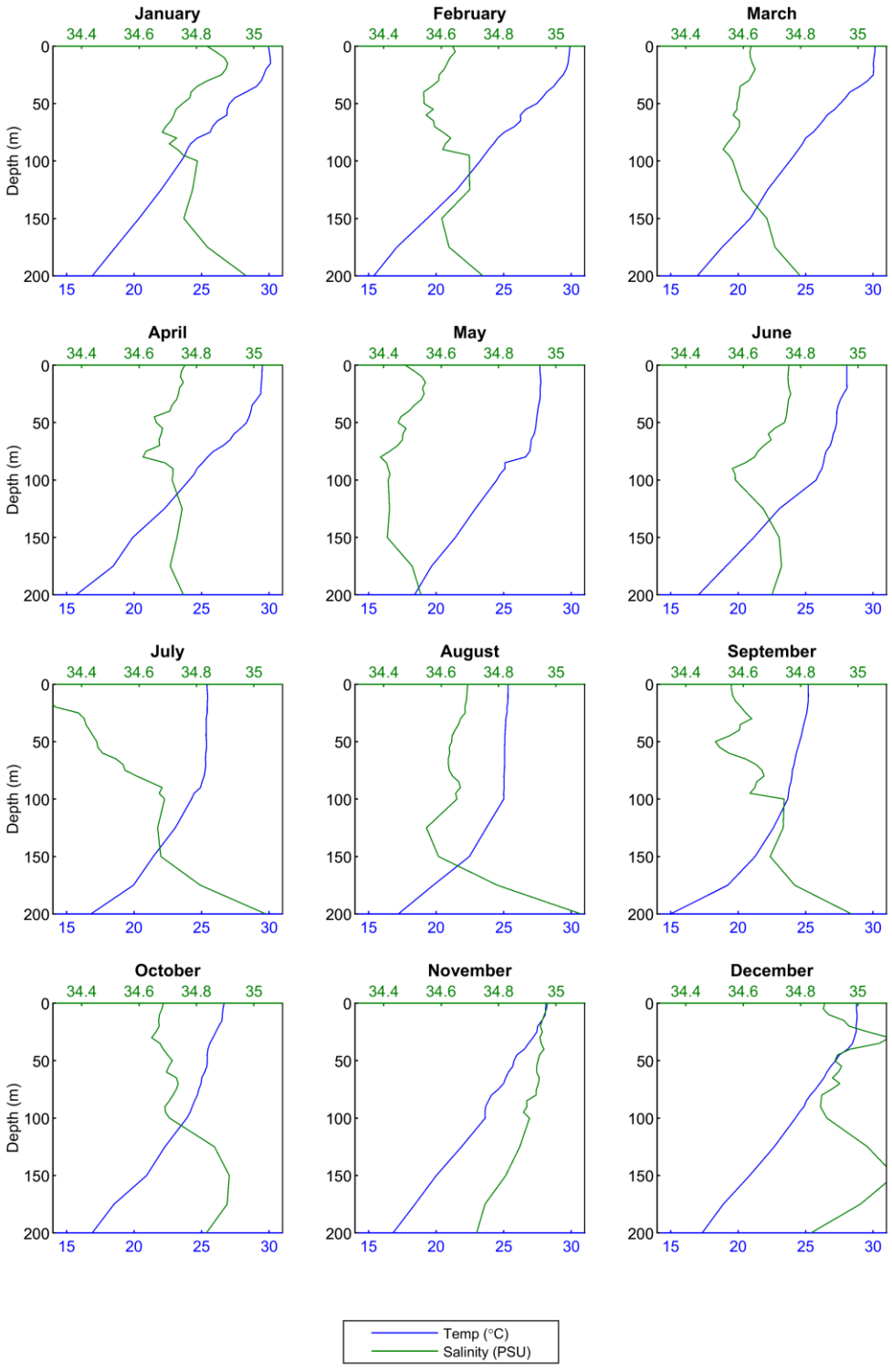


Figure 15 Monthly water temperature and salinity profiles near the release site.

6 OIL SPILL MODEL – SIMAP

The oil spill modelling was performed using SIMAP. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface releases (Spaulding et al., 1994; French et al., 1999; French-McCay, 2003; French-McCay, 2004; French-McCay et al., 2004; Spaulding, et al., 2015).

The SIMAP model calculates two components: (i) the transport, spreading, entrainment, evaporation and decay of surface oil slicks and, (ii) the entrained and dissolved hydrocarbons released from the slicks into the water column. Input specifications for oil-types include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges.

The SIMAP trajectory model separately calculates the movement of the material that: (i) is on the water surface (as surface slicks), (ii) in the water column (as either entrained whole oil droplets or dissolved hydrocarbon), (iii) has stranded on shorelines, or (iv) that has precipitated out of the water column onto the seabed. The model calculates the transport of surface slicks from the combined forces exerted by surface currents and wind acting on the oil. Transport of entrained oil (oil that is below the water surface) is calculated using the currents only.

6.1 Stochastic Modelling

SIMAP's stochastic model was used to quantify the probability of exposure to the sea surface and in-water and probability of shoreline contact from hypothetical spill scenarios.

As spills can occur during any set of wind and current conditions, a total of 100 spill per season (e.g. summer, transitional and winter) were initiated at random times within a 5-year period (2008–2012) to enable a robust statistical analysis.

Each simulation was configurated with the same spill information (i.e. spill volume, duration and oil type) except for start the time and date. This approach ensures that the predicted transport and weathering of an oil slick is subject to a wide range of current and wind conditions.

During each spill trajectory, the model records the grid cells exposed to hydrocarbons, as well as the time elapsed. Once all the spill trajectories have been run, the model then combines the results from the individual simulations to determine the following:

- Maximum exposure (or load) observed on the sea surface;
- Minimum time before sea surface exposure;
- Probability of contact to any shorelines;
- Probability of contact to individual sections of shorelines;
- Maximum volume of oil that may contact shorelines from a single simulation;
- Maximum load that an individual shoreline may experience;
- Maximum exposure from entrained hydrocarbons observed in the water column; and
- Maximum exposure from dissolved aromatic hydrocarbons observed in the water column.

The stochastic model output does not represent the extent of any one spill trajectory (which would be significantly smaller) but rather provides a summary of all trajectories run for the scenario.

6.2 Sea surface, Shoreline and In-Water Exposure Thresholds

The sea surface, shoreline and in-water exposure thresholds used to assess the oil spill modelling results and generate statistical tables and spatial maps were communicated by the client and are summarised in Table 6.

Table 6 Exposure threshold values requested by ERM

Exposure level	Sea Surface Exposure (g/m^2)	Shoreline Contact (g/m^2)	Dissolved Hydrocarbon Concentration (ppb)[#]	Entrained Hydrocarbon Concentrations (ppb)[#]
Low	1	10	6	10
Moderate	10	100	50	100
High	25	1,000	400	1,000

[#]*These threshold values refer to a) instantaneous concentrations (i.e. exposure over a 1-hour timestep) and b) time-averaged exposure over a 48-hour window. Both sets of results are provided in the Result Section(s).*

6.3 Oil Properties

6.3.1 Marine Diesel Oil

Marine Diesel Oil (MDO) is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point (-14ºC). The low viscosity (4cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation. The oil is categorised as a group II oil (light-persistent) based on categorisation and classification derived from AMSA (2015a) guidelines. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

Table 7 details the physical properties of MDO, while Table 8 presents the boiling point ranges of the MDO used in this study.

Figure 16 shows weathering graphs for a 280 m^3 release of MDO over 6 hours (tracked for 30 days) during three static wind conditions.

The prevailing weather conditions will influence the weathering and fate of the MDO. Under lower wind-speeds (5 knots), the MDO will remain on the surface longer, spread quicker, and in turn increase the evaporative process. Conversely, sustained stronger winds (>15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate.

Table 7 Physical properties of Marine Diesel Oil

Characteristic	Marine Diesel Oil (MDO)
Density (kg/m^3)	829.1
API	37.6
Dynamic viscosity (cP)	4
Pour Point (ºC)	-14
Wax content (%)	1
Hydrocarbon property category	Group II
Hydrocarbon property classification	Light - Persistent

Table 8 Boiling point ranges of Marine Diesel Oil

Characteristic	Not Persistent			Persistent
	Volatile	Semi-volatile	Low volatility	Residual
Boiling point (ºC)	< 180	180 - 265	265 - 380	>380
Marine Diesel Oil	*6.0*	*34.6*	*54.4*	*5.0*

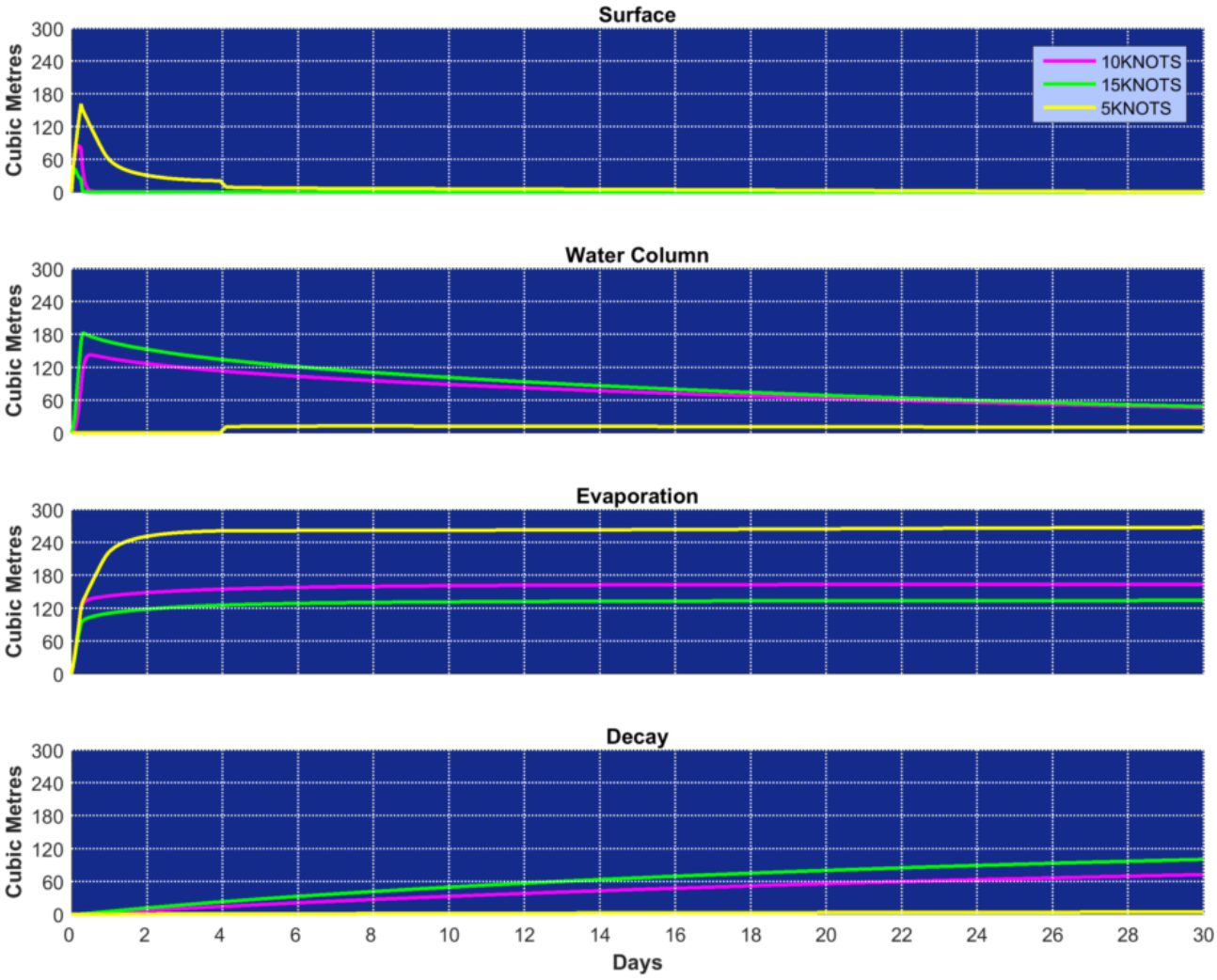


Figure 16 Weathering of MDO under three static winds conditions (5, 10 and 15 knots). The results are based on a 280 m^3 surface release of MDO over 6 hours and tracked for 30 days.

6.4 Model Settings

This oil spill modelling study quantified the seasonal risk and potential exposure to the surrounding waters and shorelines for a plausible, yet hypothetical scenario:

- 280 m^3 surface release of MDO over 6 hours resulting from a vessel collision incident at the closest point of the operational area to the Rowley Shoals.

Table 9 provides a summary of the oil spill model settings.

Table 9 Summary of the oil spill model settings

Parameter	Oil Spill Scenario
Scenario description	Vessel Collision
Model period	Summer (December to February) Transitional (March, October and November) Winter (April to September)
Number of randomly selected spill start times and locations per season	100
Oil type	MDO
Spill volume (m^3)	280
Release type	Surface
Release duration	6 hr
Simulation length (days)	30
Surface oil concentration thresholds	1 g/m^2, 10 g/m^2, >25 g/m^2
Shoreline load threshold	10 g/m^2, 100 g/m^2, >1,000 g/m^2
Dissolved aromatic exposure to assess the potential exposure (ppb)	6 ppb, potential low exposure 50 ppb, potential moderate exposure 400 ppb, potential high exposure
Entrained oil exposure to assess the potential exposure (ppb)	10 ppb, potential low exposure 100 ppb, potential moderate exposure 1,000 ppb, potential high exposure
In-water exposure duration	Instantaneous and 48 hr exposure

7 PRESENTAITON AND INTERPRETATION OF MODEL RESULTS

The results from the modelling study are presented in a number of tables and figures, which aim to provide a comprehensive understanding of the predicted sea-surface and in-water (subsurface) exposure and shoreline contact (if predicted).

7.1 Seasonal Analysis

7.1.1 Figures

The figures are based on the following principles:

- *The **potential zones of exposure (surface oil, entrained hydrocarbons and dissolved aromatics)*** – is determined by identifying the maximum loading (surface) or dosage (subsea) within a grid cell and is then classified according to identified surface or subsea thresholds.
- The ***minimum time before oil exposure on the sea surface*** **–** is determined by recording the elapsed time before sea surface exposure to a grid cell, at a specified threshold.
- The ***probability of exposure/contact (surface oil, shoreline oil, entrained hydrocarbon or dissolved aromatic)*** **–** is calculated by dividing the number of spill trajectories passing over that given cell (surface, shoreline or subsea) by the total number of spill trajectories, above the specified threshold value.
- The **Maximum potential shoreline loading** **–** is determined by identifying the maximum loading within a shoreline cell and is then classified according to the identified thresholds (i.e. 10, 100 g/m^2 and 1,000 g/m^2).

7.1.2 Statistics

The statistics are based on the following principles:

- The ***greatest distance travelled by a spill trajectory*** **–** is determined by a) recording the maximum distance travelled by a single trajectory, within a scenario, from the release location to the identified exposure thresholds.
- The ***probability of shoreline contact*** – is determined by recording the number of spill trajectories to contact the shoreline, at a specific threshold, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before oil exposure*** – is determined by recording the minimum time for a grid cell to record exposure, at a specific threshold.
- The ***average volume of oil ashore for a single spill*** – is determined by calculating the average volume of the all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum volume of oil ashore from a single spill trajectory*** – is determined by identifying the single spill trajectory within a scenario/season, that recorded the maximum volume of oil to come ashore and presenting that value.
- The ***average length of shoreline contacted by oil*** – is determined by calculating the average of the length of shoreline (measured as grid cells) contacted by oil above a specified threshold.
- The ***maximum length of shoreline contacted by oil*** – is determined by recording the maximum length of shoreline (measured as grid cells) contacted by oil above a specified threshold.
- The ***probability of oil exposure to a receptor*** **–** is determined by recording the number of spill

trajectories to reach a specified sea surface or subsea threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.

- The ***minimum time before oil exposure to a receptor*–** is determined by ranking the elapsed time before sea surface exposure, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value.
- The ***probability of oil contact to a receptor* –** is determined by recording the number of spill trajectories to reach a specified shoreline contact threshold within a receptor polygon, divided by the total number of spill trajectories within that scenario.
- The ***minimum time before shoreline contact to a receptor* –** is determined by ranking the elapsed time before shoreline contact, at a specified threshold, to grid cells within a receptor polygon and recording the minimum value.
- The ***average potential oil loading within a receptor*** – is determined taking the average of the maximum loading to any grid cell within a polygon, for all simulations within a scenario/season, that recorded shoreline.
- The ***maximum potential oil loading within a receptor*** – is determined by identifying the maximum loading to any grid cell within a receptor polygon, for a scenario.
- The ***average volume of oil ashore within a receptor*** – is determined by calculating the average volume of oil to come ashore within a receptor polygon, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum volume of oil ashore within a receptor*** – is determined by recording the maximum volume of oil to come ashore within a receptor polygon, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***average length of shoreline contacted within a receptor*** – is determined by calculating the average of the length of shoreline (measured as grid cells) contacted by oil within a receptor polygon, at a specified threshold, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.
- The ***maximum length of shoreline contacted by oil*** – is determined by recording the maximum length of shoreline (measured as grid cells) contacted by oil within a receptor polygon, at a specified threshold, from all the single spill trajectories which were predicted to make shoreline contact within a scenario.

7.2 Receptors Assessed

A range of environmental receptors summarised in Table 10 and illustrated in Figure 17 to Figure 21 were assessed for sea surface exposure, shoreline contact and water column exposure as part of the study.

Table 10 Summary of receptors used to assess surface, shoreline and in-water exposure to hydrocarbons

Receptor Category	Acronym	Hydrocarbon Exposure Reported for		
		Water column	Sea Surface	Shoreline
Marine National Park (including Australian Marine Parks and Marine Parks)	MNP, AMP, MP	✓	✓	✗
Integrated Marine and Coastal Regionalisation of Australia	IMCRA	✓	✓	✗
Interim Biogeographic Regionalisation of Australia	IBRA	✓	✓	✓
Key Ecological Feature	KEF	✓	✓	✗
Reefs, Shoals and Banks	RSB	✓	✓	✗

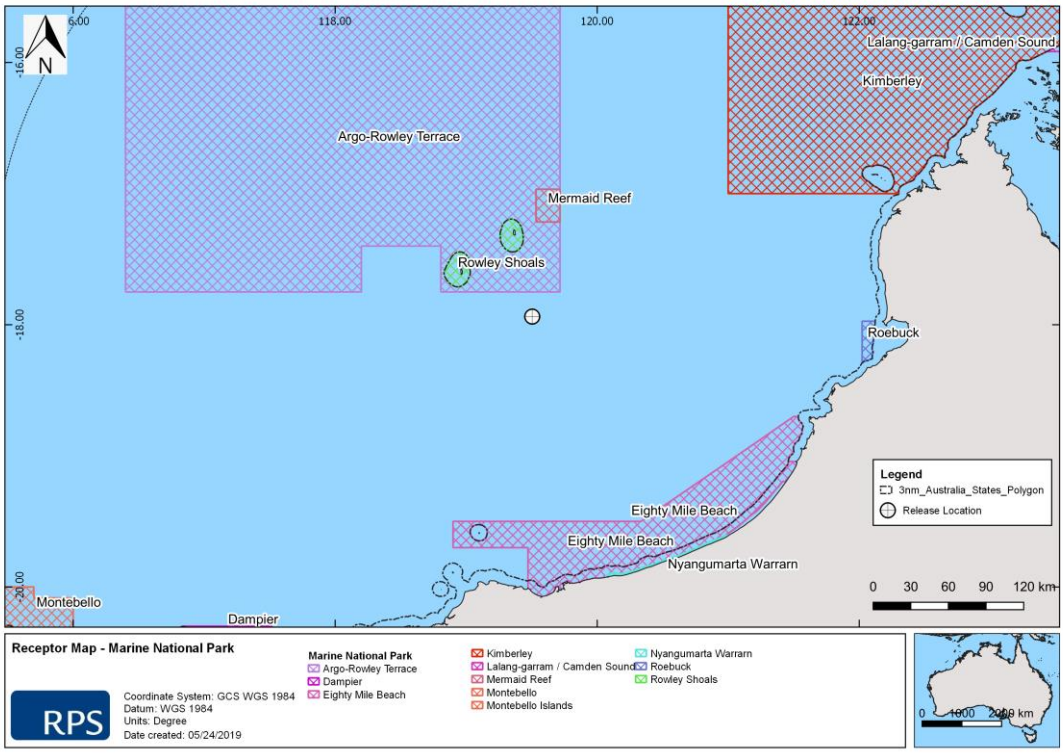


Figure 17 Receptor map illustrating Marine Parks

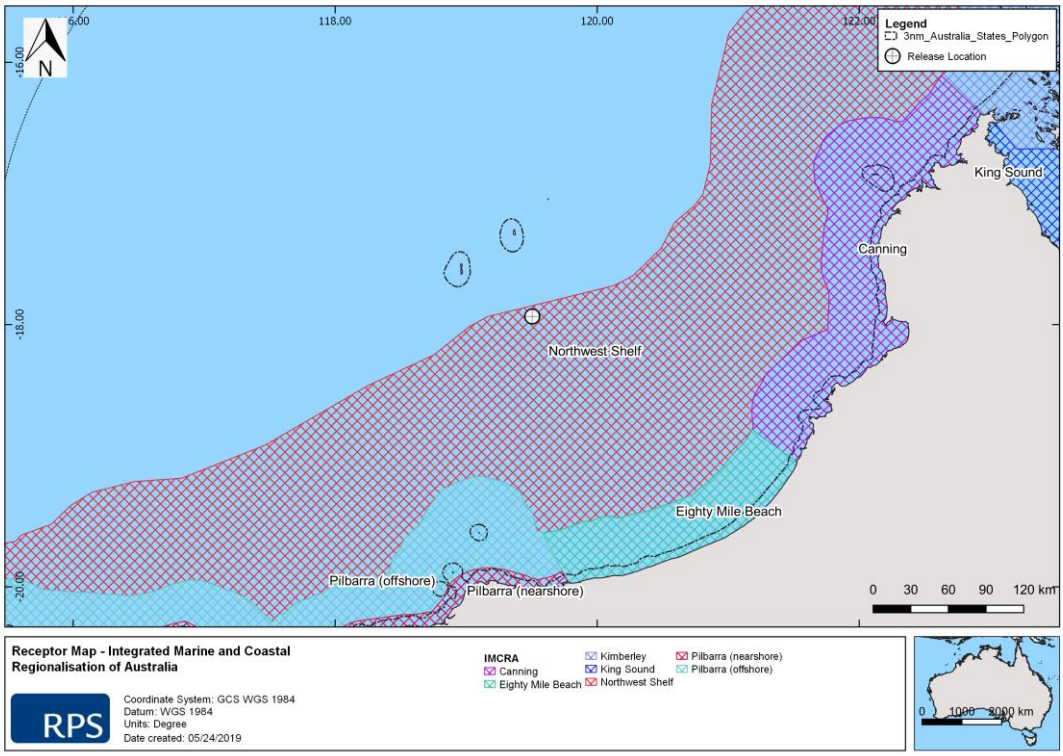


Figure 18 Receptor map illustrating the Integrated Marine and Coastal Regionalisation of Australia (IMCRA)

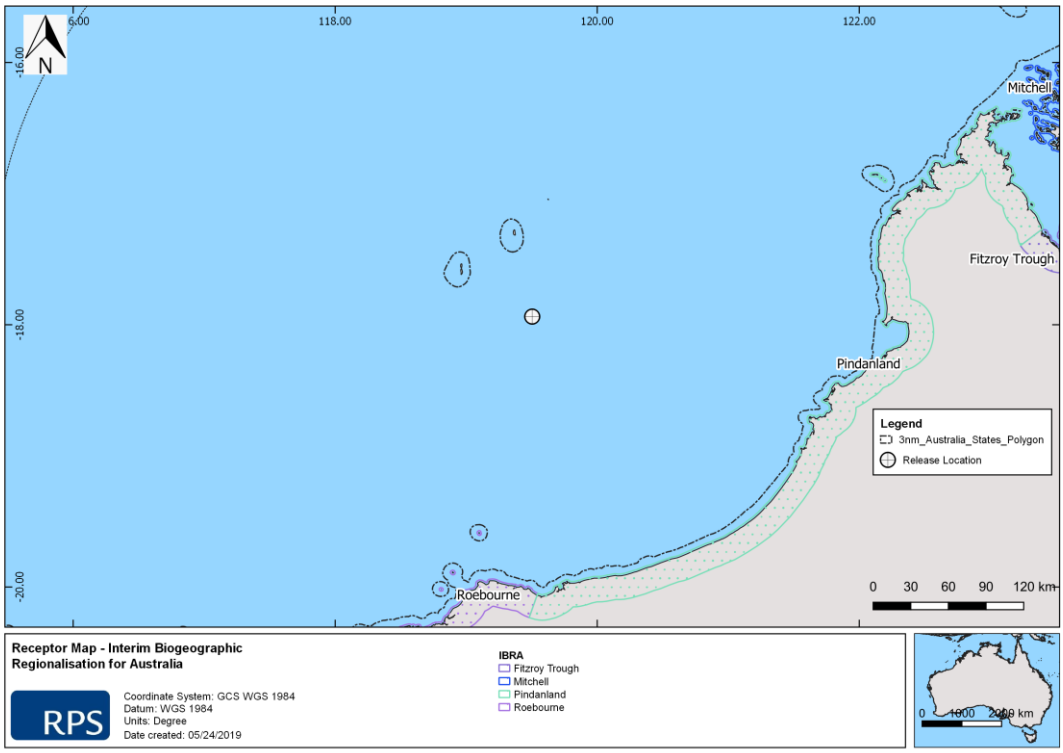


Figure 19 Receptor map illustrating the Interim Biogeographic Regionalisation for Australia (IBRA)

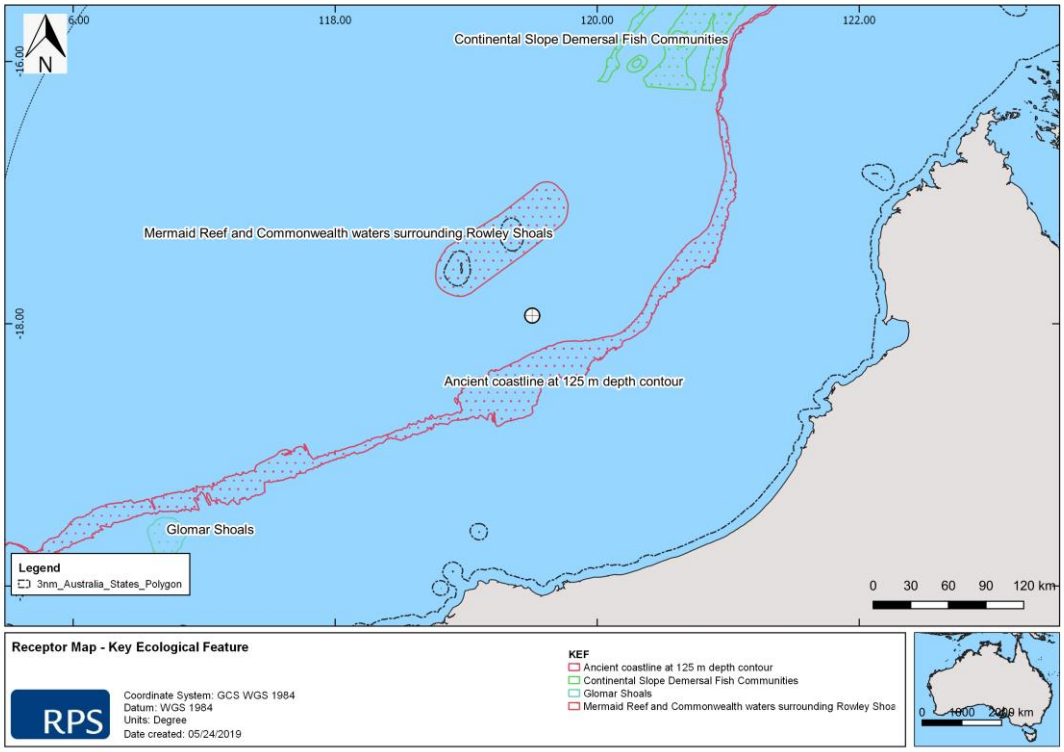


Figure 20 Receptor map illustrating Key Ecological Features (KEF)

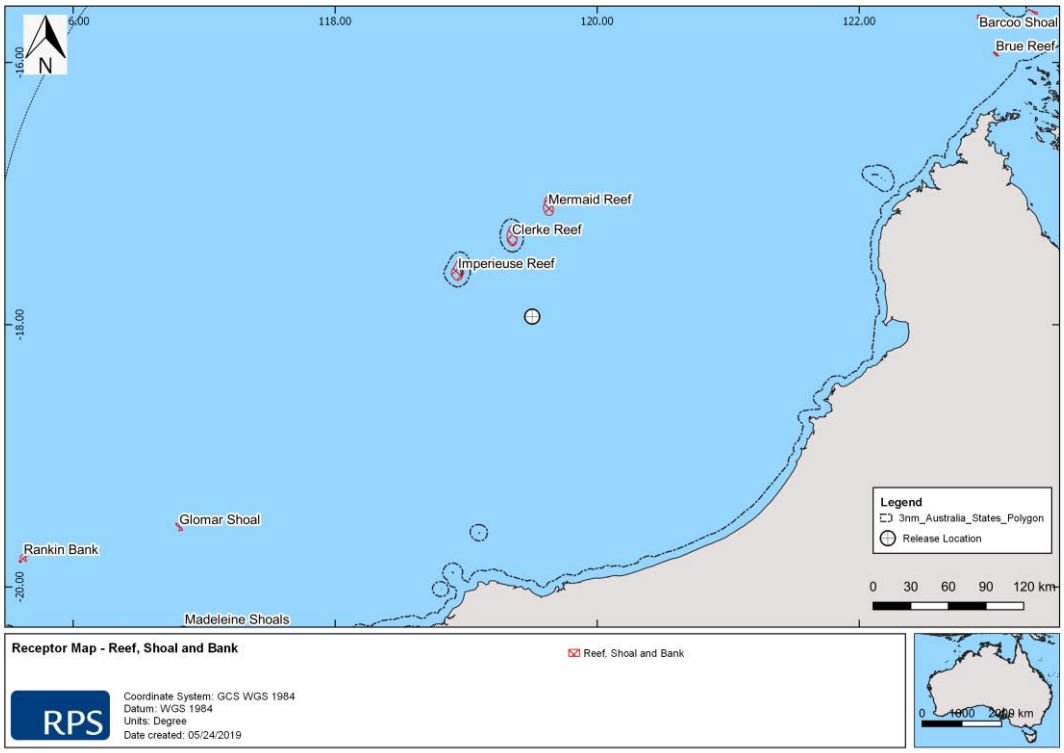


Figure 21 Receptor map illustrating the Reefs, Shoals and Banks

8 RESULTS: 280 M^3 SURFACE RELEASE OF MARINE DIESEL OIL

The scenario examined a 280 m^3 release of MDO over 6 hours, tracked for 30 days. A total of 100 spill trajectories were simulated for each of the seasons, summer, transitional and winter.

Section 8.1 presents stochastic results. Note, no shoreline contact was predicted for this scenario.

8.1 Stochastic Analysis

For the modelling study each spill trajectory was tracked to the following minimum thresholds:

- Sea surface oil – 1 g/m^2
- Shoreline contact – 10 g/m^2
- Dissolved aromatics – 6 ppb (instantaneous and over a 48-hour exposure window)
- Entrained hydrocarbons – 10 ppb (instantaneous and over a 48-hour exposure window)

8.1.1 Sea Surface Exposure

Table 11 presents a summary of the maximum distance and direction travelled by oil on the sea surface at the low (1 g/m^2), moderate (10 g/m^2) and high (>25 g/m^2) exposure thresholds for each of the three seasons considered, summer, transitional and winter. Modelling results suggested that surface oil at low, moderate and high exposure levels could potentially travel greater distances during the transitional period. The maximum distance travelled by surface oil for the low, moderate and high threshold was 66 km, 14 km and 7 km, respectively.

Figure 22 to Figure 24 show zones of sea surface exposure for the summer, transitional and winter seasons respectively. While the low exposure surface oil was predicted to travel in any directions from the release site, the moderate and high exposure levels remained along the northwest-southeast axis across all seasons.

Figure 25 to Figure 33 show minimum time to surface exposure at the low, moderate and high thresholds for the summer, transitional and winter seasons respectively. As depicted on these figures, the evaporative nature of MDO and environmental conditions in the area resulted in short-lived surface hydrocarbon exposure, with surface exposure reduced to less than 10 g/m^2 after approximately 12-24 hours.

The weathering plot illustrated in Figure 16 indicates that surface hydrocarbon would drop to negligible volumes between 1 to 4 days depending on the wind conditions.

Table 12 presents the potential sea surface exposure to individual receptors. The results demonstrated a 100% predicted probability of sea surface exposure at the low threshold (1 g/m^2) for Northwest Shelf (IMCRA). As shown in Section 7.2, the release location is situated within this area. No sensitive receptors were predicted to be exposed to surface oil at the moderate and high threshold. Argo-Rowley Terrace (AMP) was the only sensitive receptor showing potential exposure to surface oil at the low threshold, with a low likelihood of 1-2 % (during the summer and winter seasons only).

Table 11 Maximum distance and direction travelled on the sea surface by a single trajectory from the release location to oil exposure thresholds.

Season	Distance and direction	Zones of potential sea surface exposure		
		>1 g/m²	>10 g/m²	>25 g/m²
Summer	Max. distance from release site (km)	31	11	4
	Max distance from release site (km) (99th percentile)	28	11	4
	Direction	N	SSE	NW
Transitional	Max. distance from release site (km)	66	14	7
	Max distance from release site (km) (99th percentile)	56	13	7
	Direction	WSW	SSE	SE
Winter	Max. distance from release site (km)	31	12	6
	Max distance from release site (km) (99th percentile)	28	11	6
	Direction	NNE	WNW	NW

Table 12 Summary of the potential sea surface exposure to receptors

			Probability of oil exposure on the sea surface (%)			Minimum time before oil exposure on the sea surface (hours)		
Season	Receptor		>1 g/m²	>10 g/m²	>25 g/m²	>1 g/m²	>10 g/m²	>25 g/m²
Summer	IMCRA	Northwest Shelf	100	99	56	-	-	-
	AMP	Argo-Rowley Terrace	2	-	-	1	-	-
Transitional	IMCRA	Northwest Shelf	100	100	58	-	-	-
Winter	IMCRA	Northwest Shelf	100	97	45	-	-	-
	AMP	Argo-Rowley Terrace	1	-	-	1	-	-

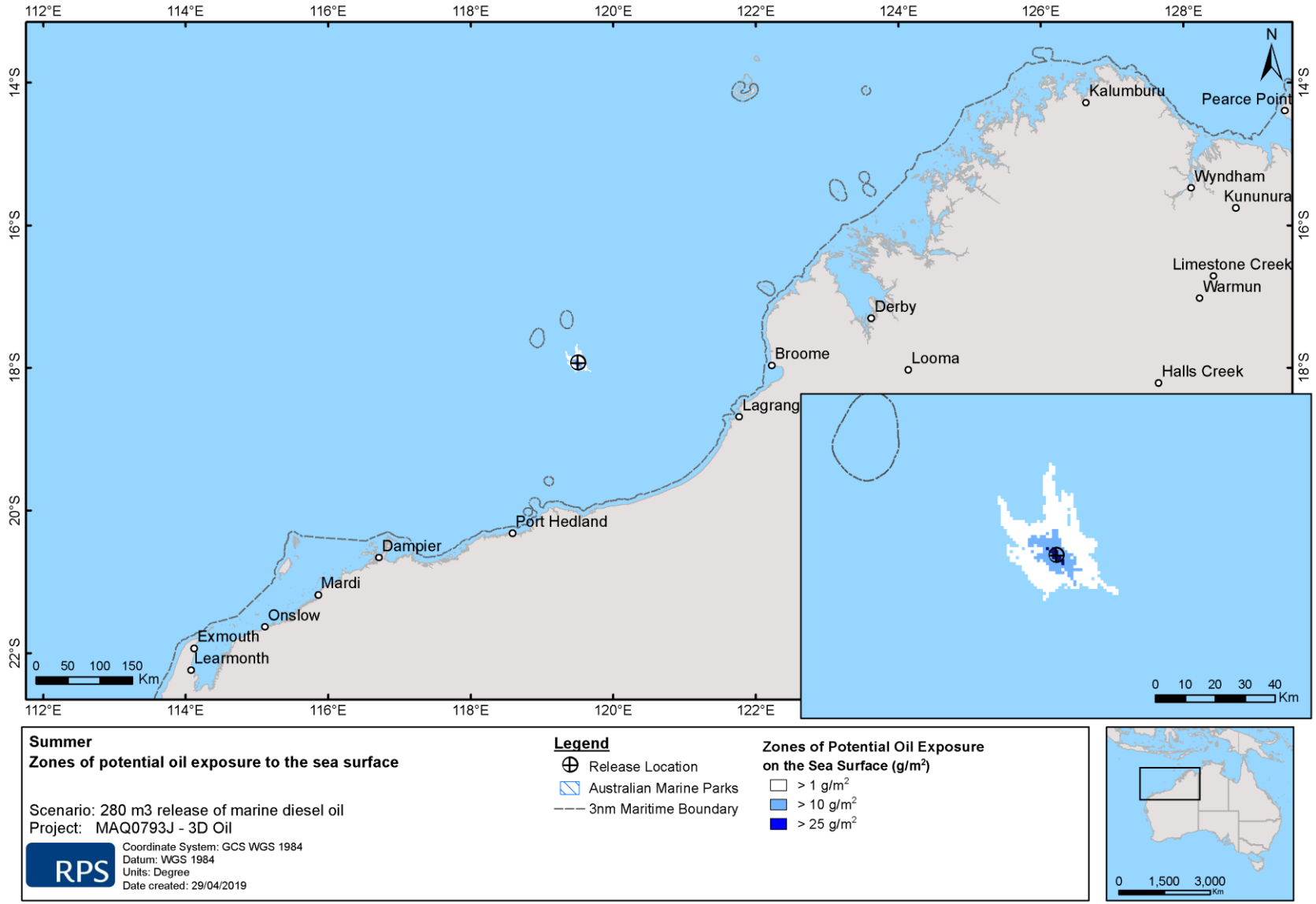


Figure 22 Zones of potential oil exposure on the sea surface, in the event of a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions.

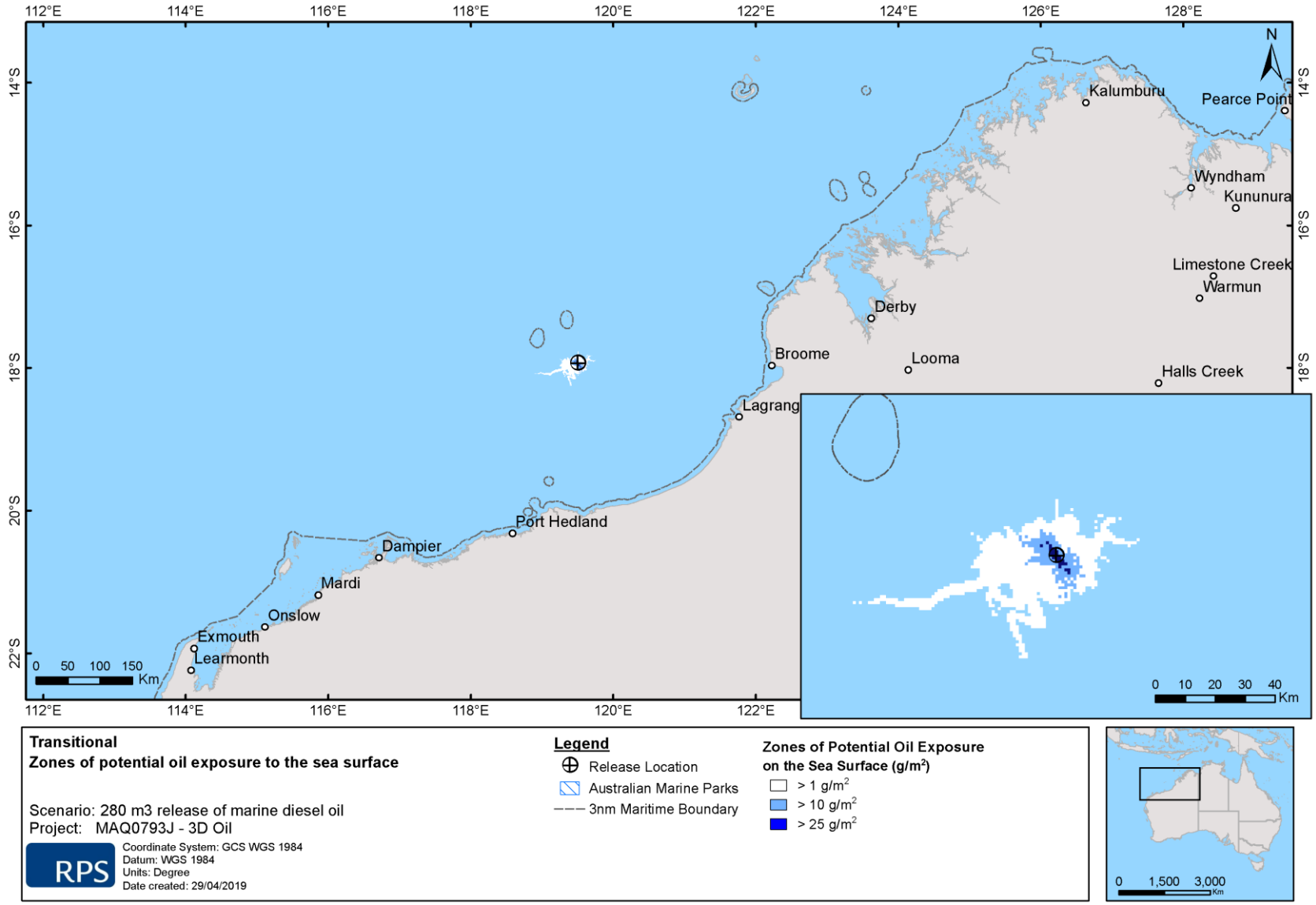


Figure 23 Zones of potential oil exposure on the sea surface, in the event of a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions.

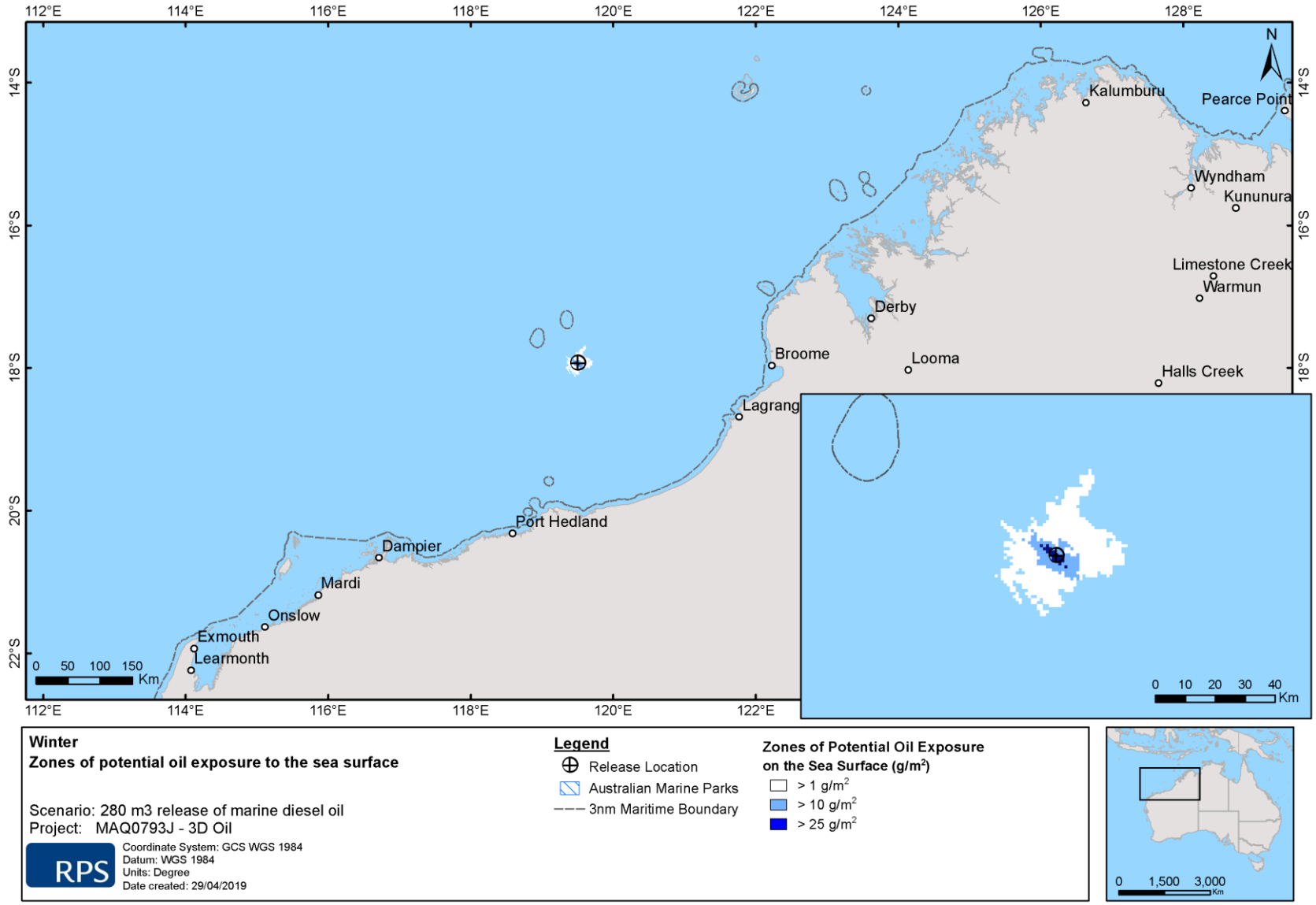


Figure 24 Zones of potential oil exposure on the sea surface, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions.

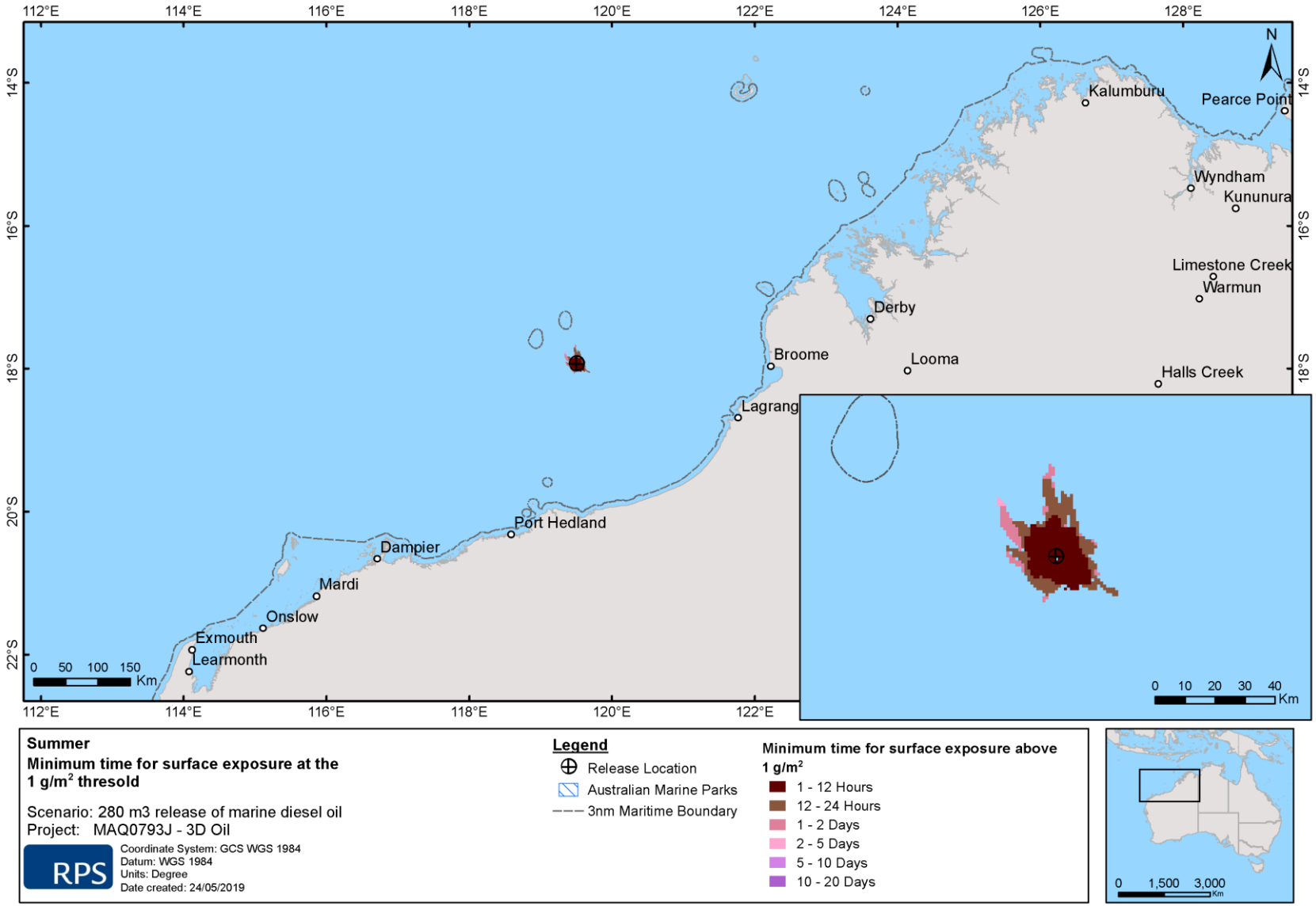


Figure 25 Minimum time for oil exposure on the sea surface at the low (1 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions.

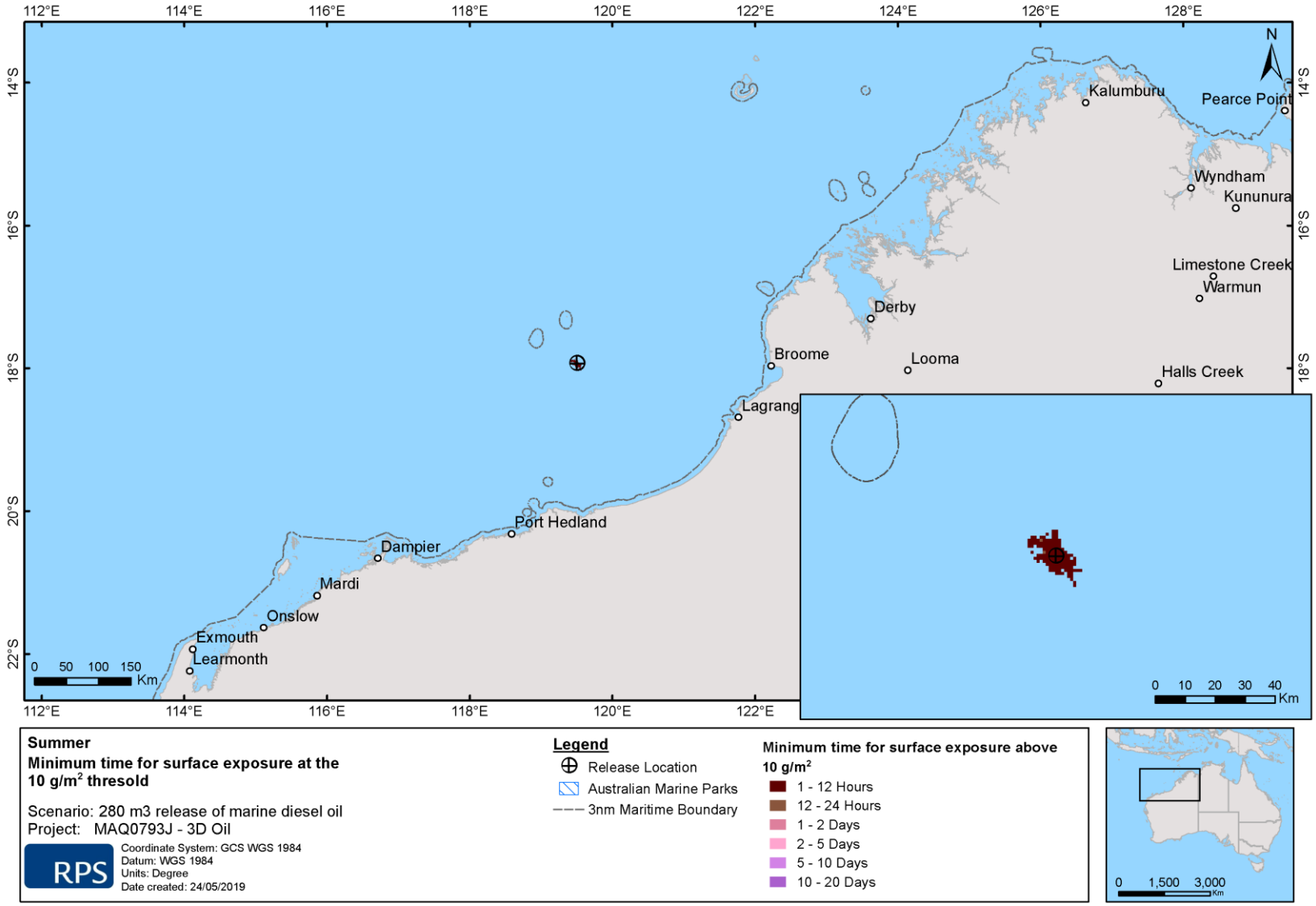


Figure 26 Minimum time for oil exposure on the sea surface at the moderate (10g/m²) threshold, in the event of a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions.

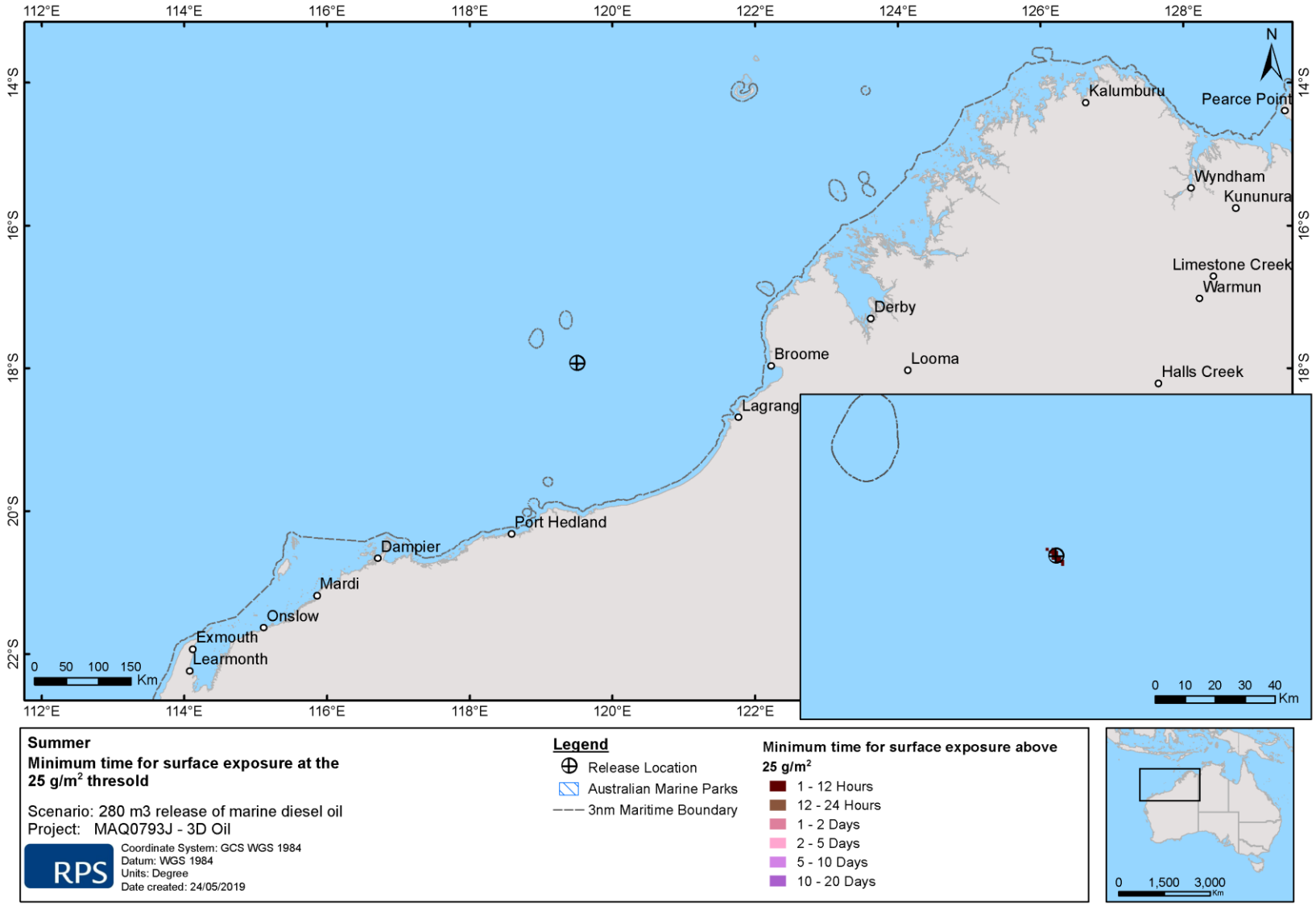


Figure 27 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer conditions.

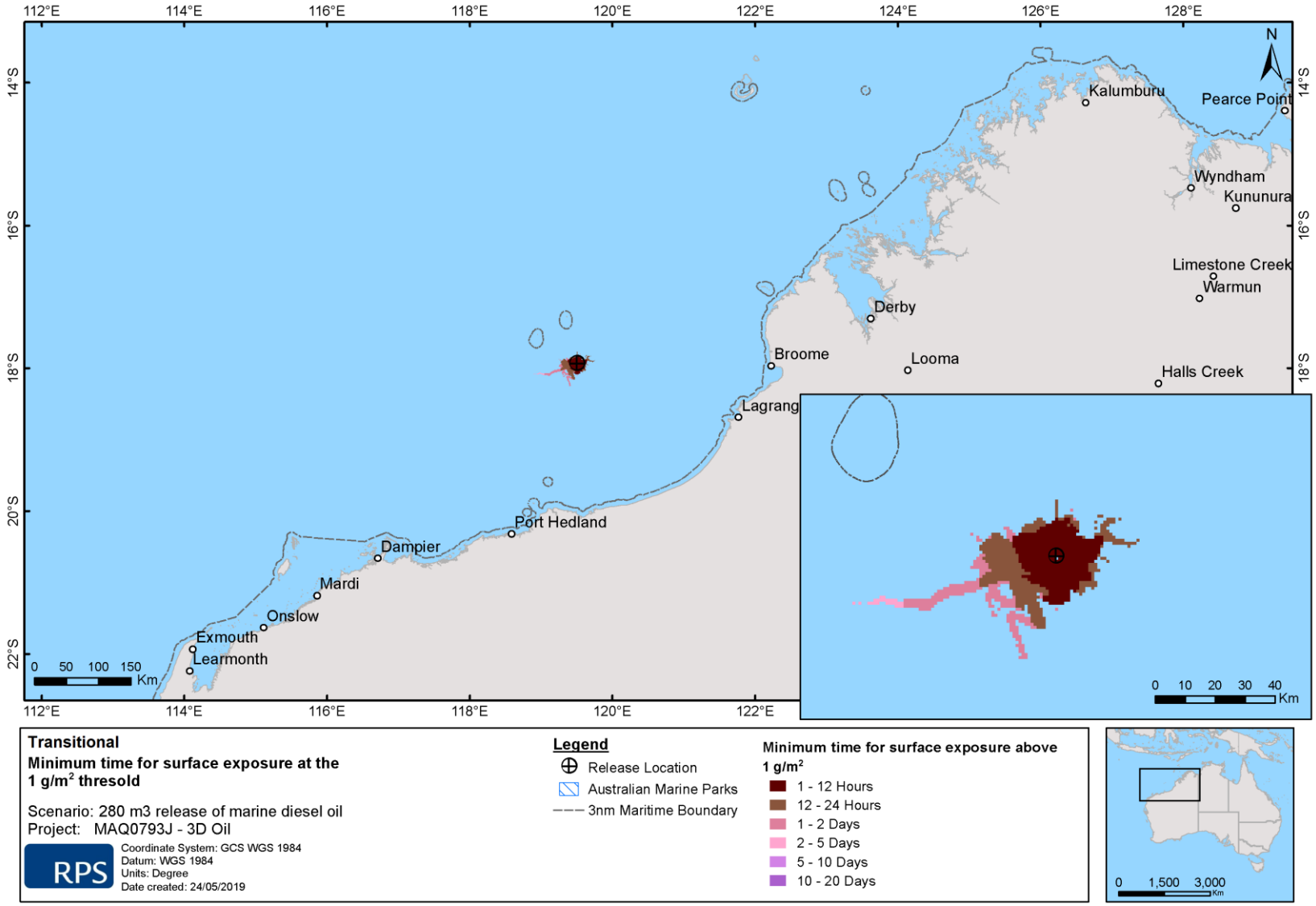


Figure 28 Minimum time for oil exposure on the sea surface at the low (1 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions.

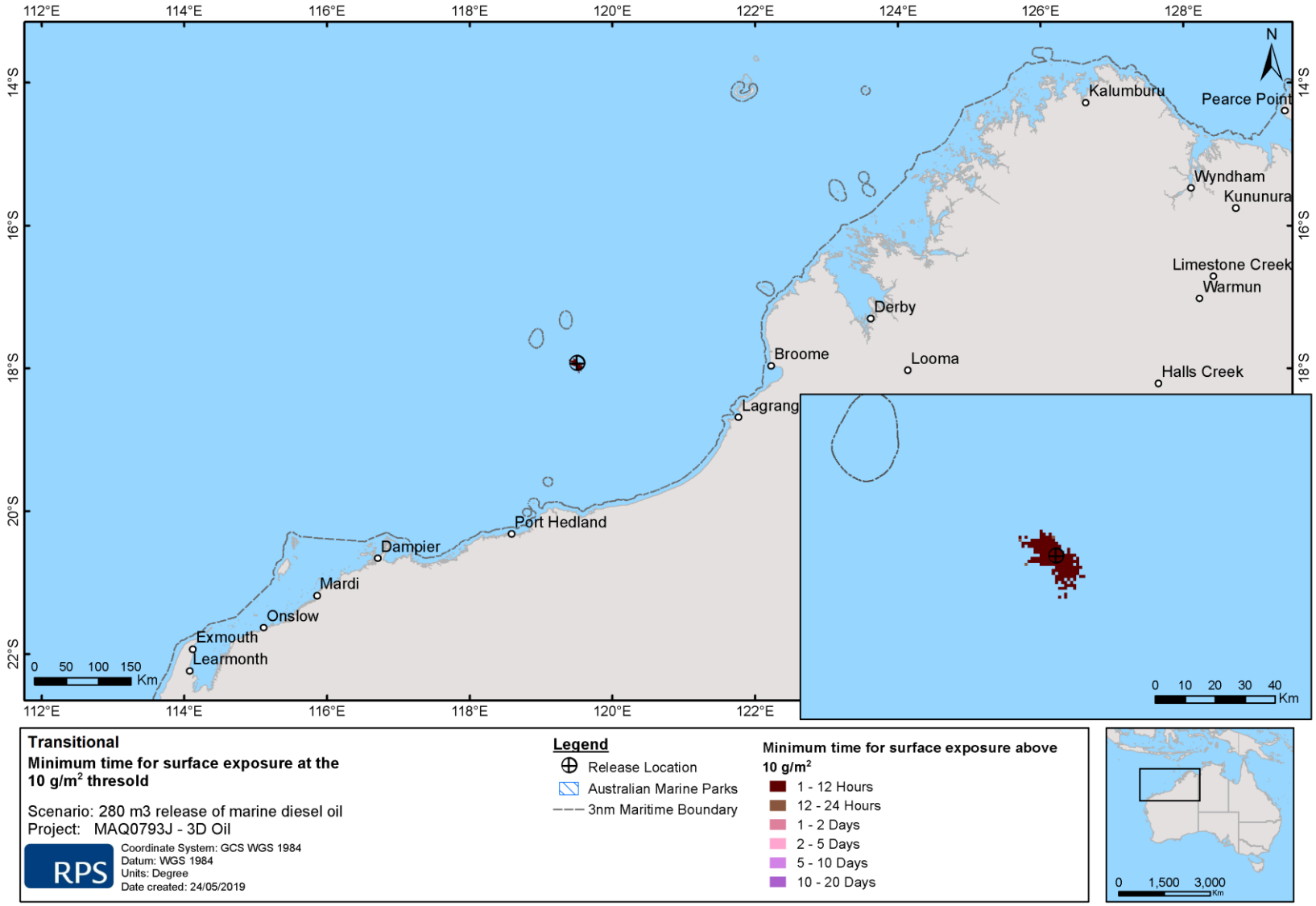


Figure 29 Minimum time for oil exposure on the sea surface at the moderate (10 g/m²) threshold, in the event of a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions.

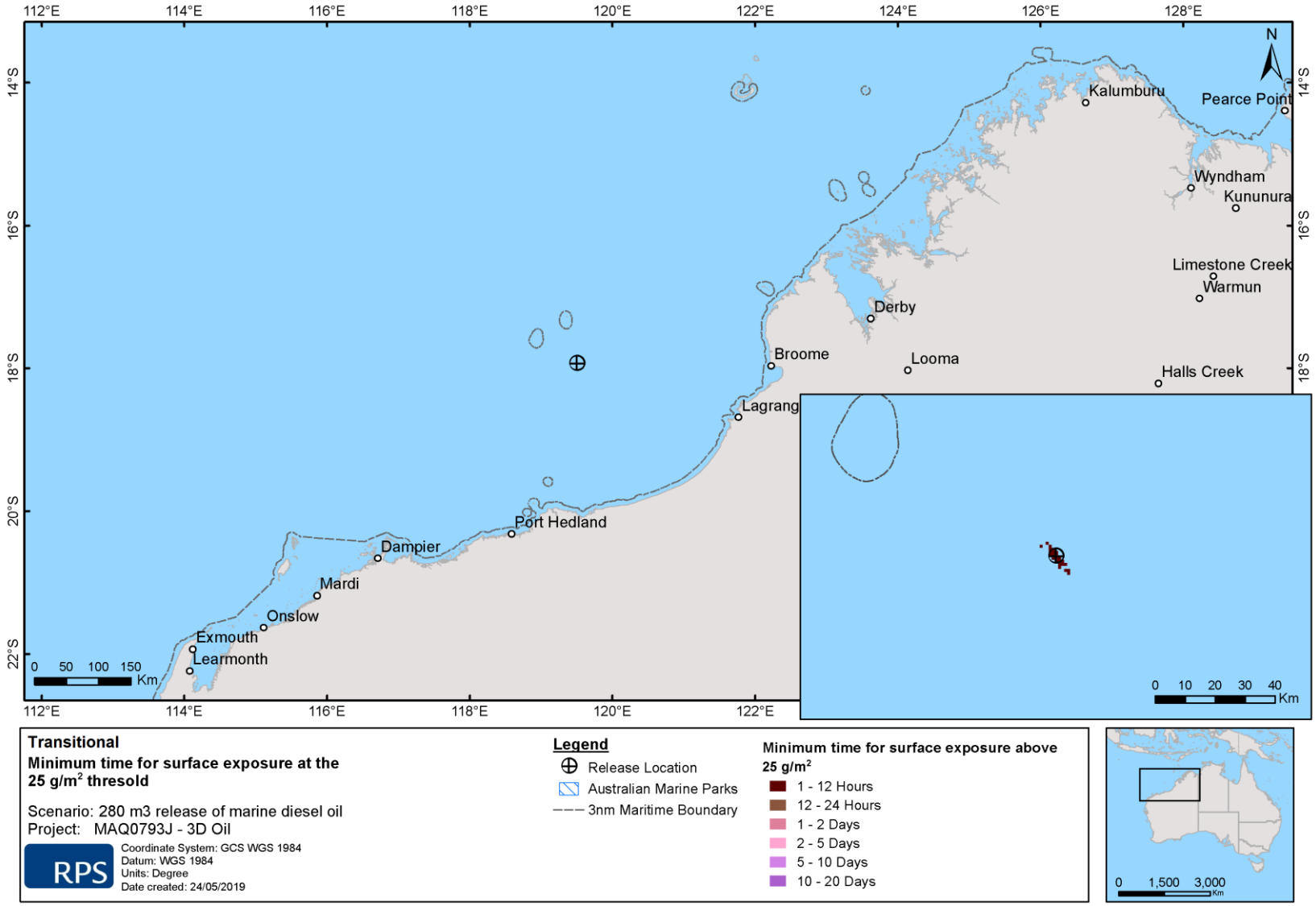


Figure 30 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period conditions.

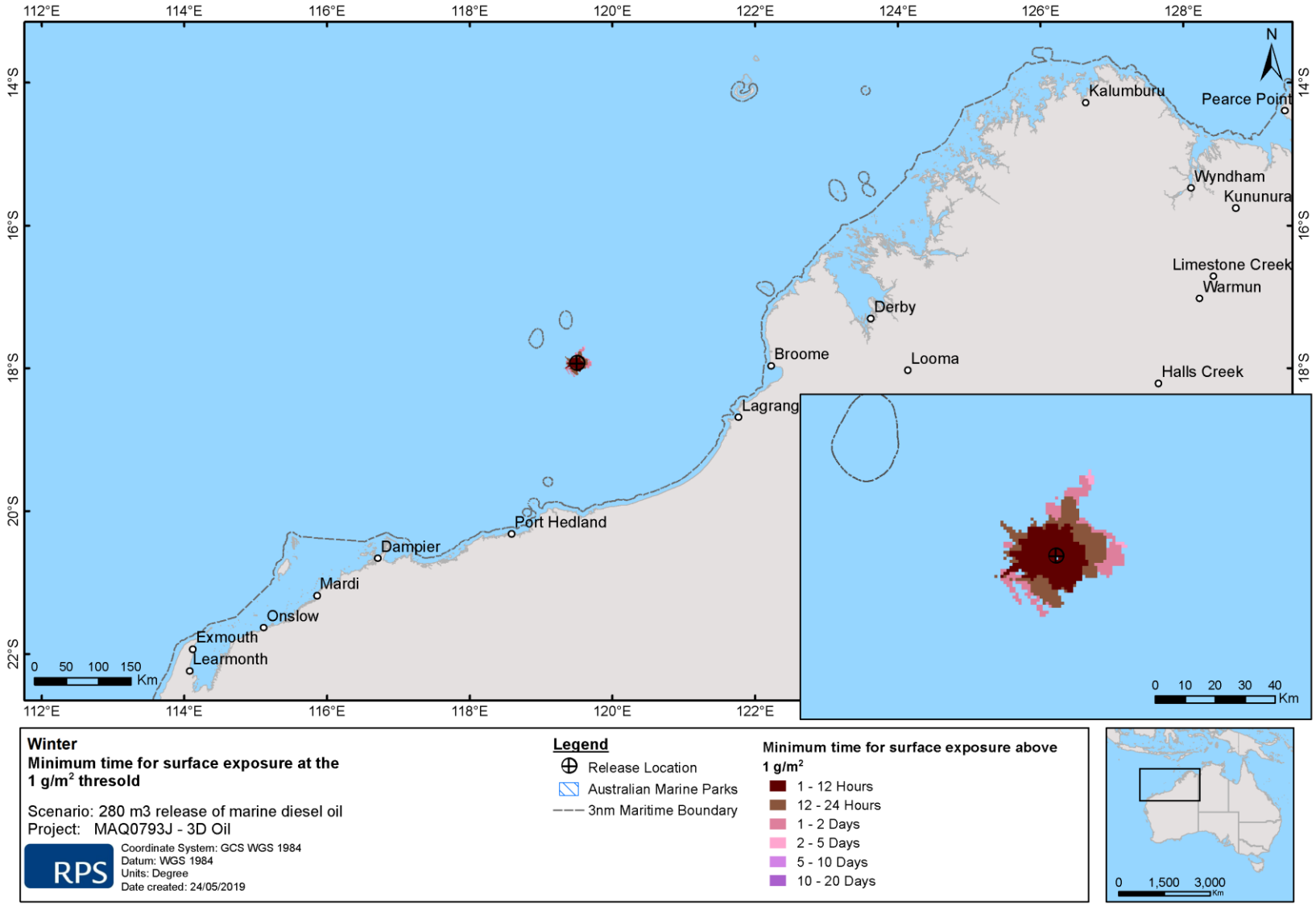


Figure 31 Minimum time for oil exposure on the sea surface at the low (1 g/m²) threshold, in the event of a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions.

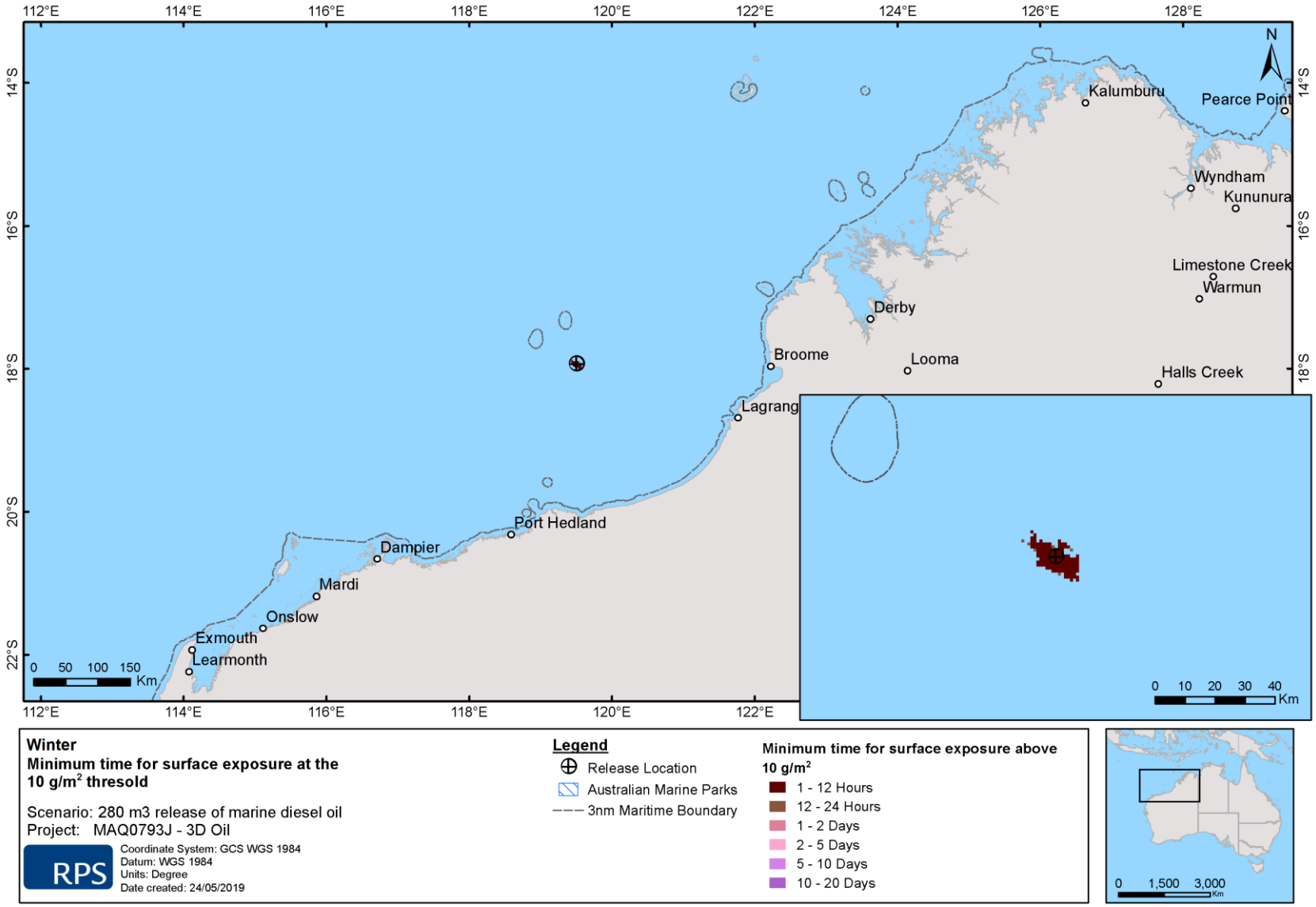


Figure 32 Minimum time for oil exposure on the sea surface at the moderate (10 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions.

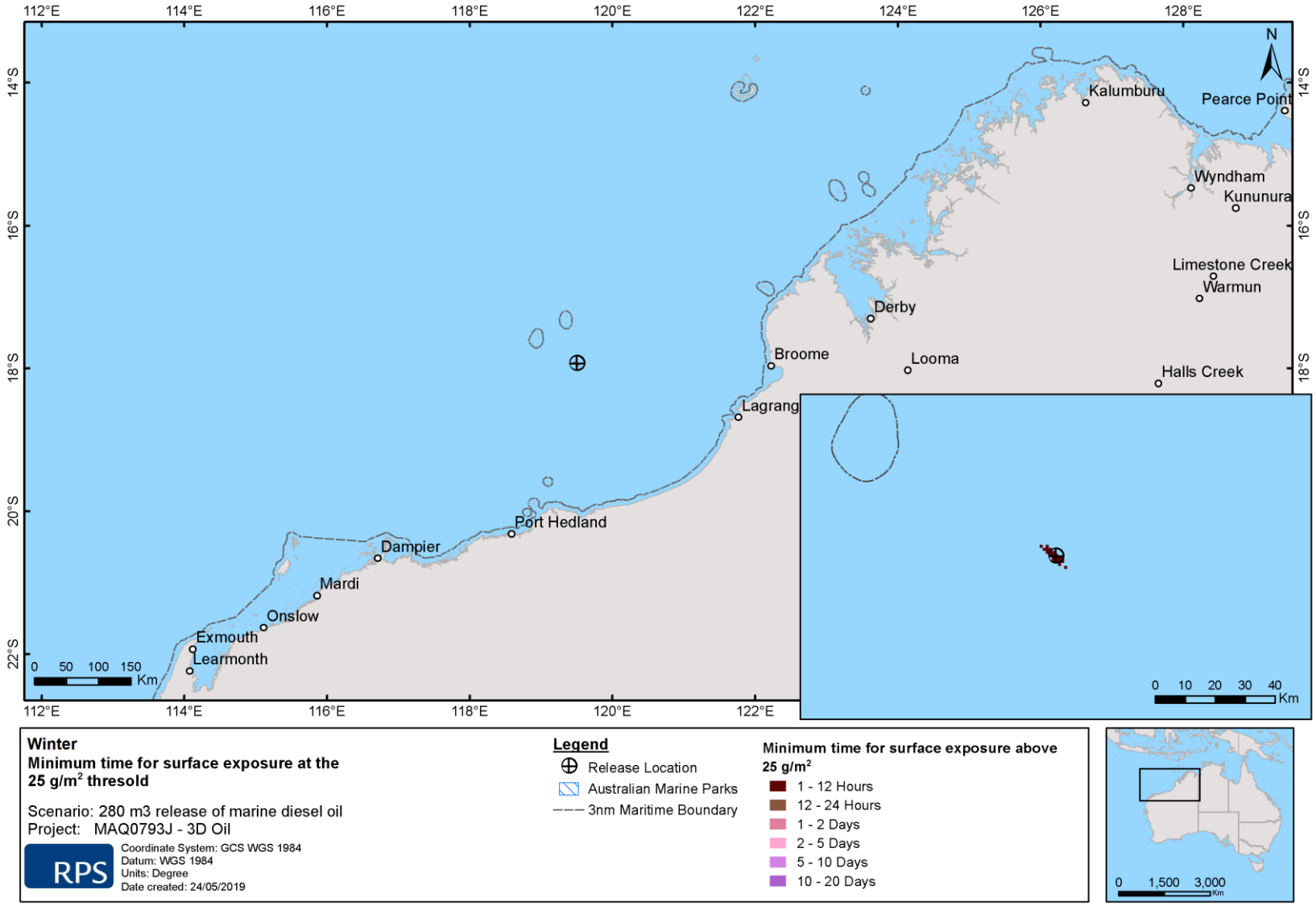


Figure 33 Minimum time for oil exposure on the sea surface at the high (25 g/m^2) threshold, in the event of a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during conditions.

8.2 Water Column Exposure

8.2.1 Dissolved Hydrocarbons

Table 13 summarises the maximum dissolved hydrocarbon exposure (time-averaged and instantaneous) to receptors in the 0–10 m depth layer at or above the exposure thresholds discussed in Section 6.2 over the seasonal assessments.

At the depths of 0-10 m, the maximum time-averaged exposure to dissolved hydrocarbon over 48 hours remained less than 1 ppb for the winter and transitional seasons while reaching 4 ppb for the summer and winter seasons for various receptors. These concentrations are below the defined low threshold for dissolved hydrocarbons. The maximum instantaneous exposure to dissolved hydrocarbons ranged from 6 ppb to 73 ppb for the transitional and summer seasons respectively. None of the receptors was exposed at the moderate (50 ppb) or high (400 ppb) thresholds or above for instantaneous exposure with the exception of the IMCRA – North West Shelf. This receptor had a 1 % probability of exposure to instantaneous dissolved hydrocarbon during the summer season.

Zones of potential dissolved hydrocarbon for instantaneous exposure are presented for each season in Figure 34 to Figure 36.

There were no zones of potential exposure above the exposure thresholds for the time-averaged exposure discussed in Section 6.2, therefore there are no figures provided in this section.

Table 13 **Predicted maximum instantaneous and time-averaged (48 hr) dissolved hydrocarbon exposure to receptors in the 0–10 m depth layer. Results are based on a 280 m^3 surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories per season.**

Season	Receptor		Maximum time-averaged dissolved hydrocarbon exposure (ppb)	Probability of time-averaged dissolved hydrocarbon exposure			Maximum instantaneous dissolved hydrocarbon exposure (ppb)	Probability of instantaneous dissolved hydrocarbon exposure		
				>6 ppb	>50 ppb	>400 ppb		>6 ppb	>50 ppb	>400 ppb
Summer	IMCRA	Northwest Shelf	4	0	0	0	73	21	1	0
	AMP	Argo-Rowley Terrace	1	0	0	0	8	1	0	0
Transitional	IMCRA	Northwest Shelf	3	0	0	0	37	16	0	0
	AMP	Argo-Rowley Terrace	<1	0	0	0	6	1	0	0
Winter	IMCRA	Northwest Shelf	4	0	0	0	48	36	0	0
	AMP	Argo-Rowley Terrace	1	0	0	0	19	2	0	0
	MP	Rowley Shoals	<1	0	0	0	13	1	0	0
	KEF	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	<1	0	0	0	14	1	0	0

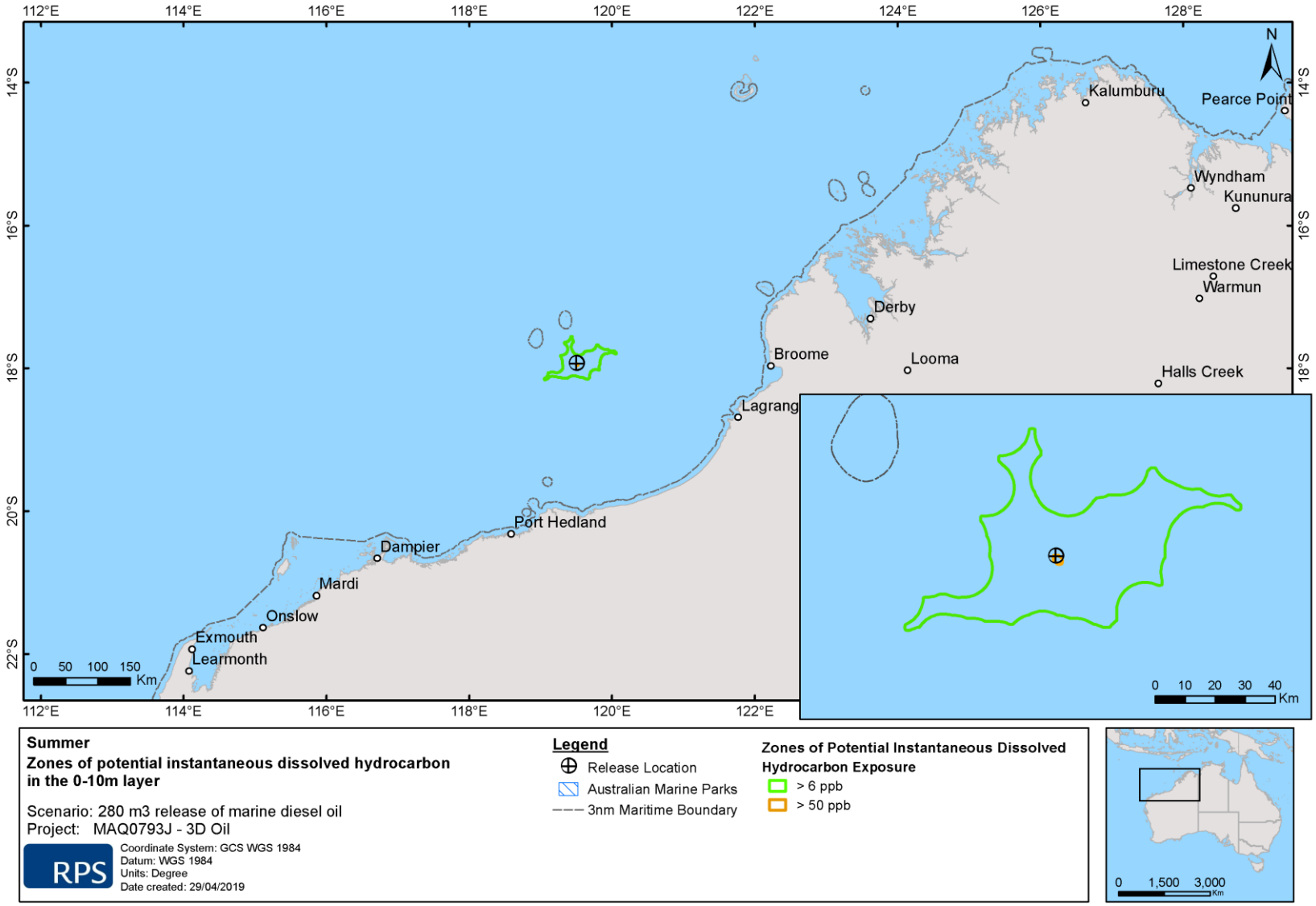


Figure 34 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m^3 of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions.

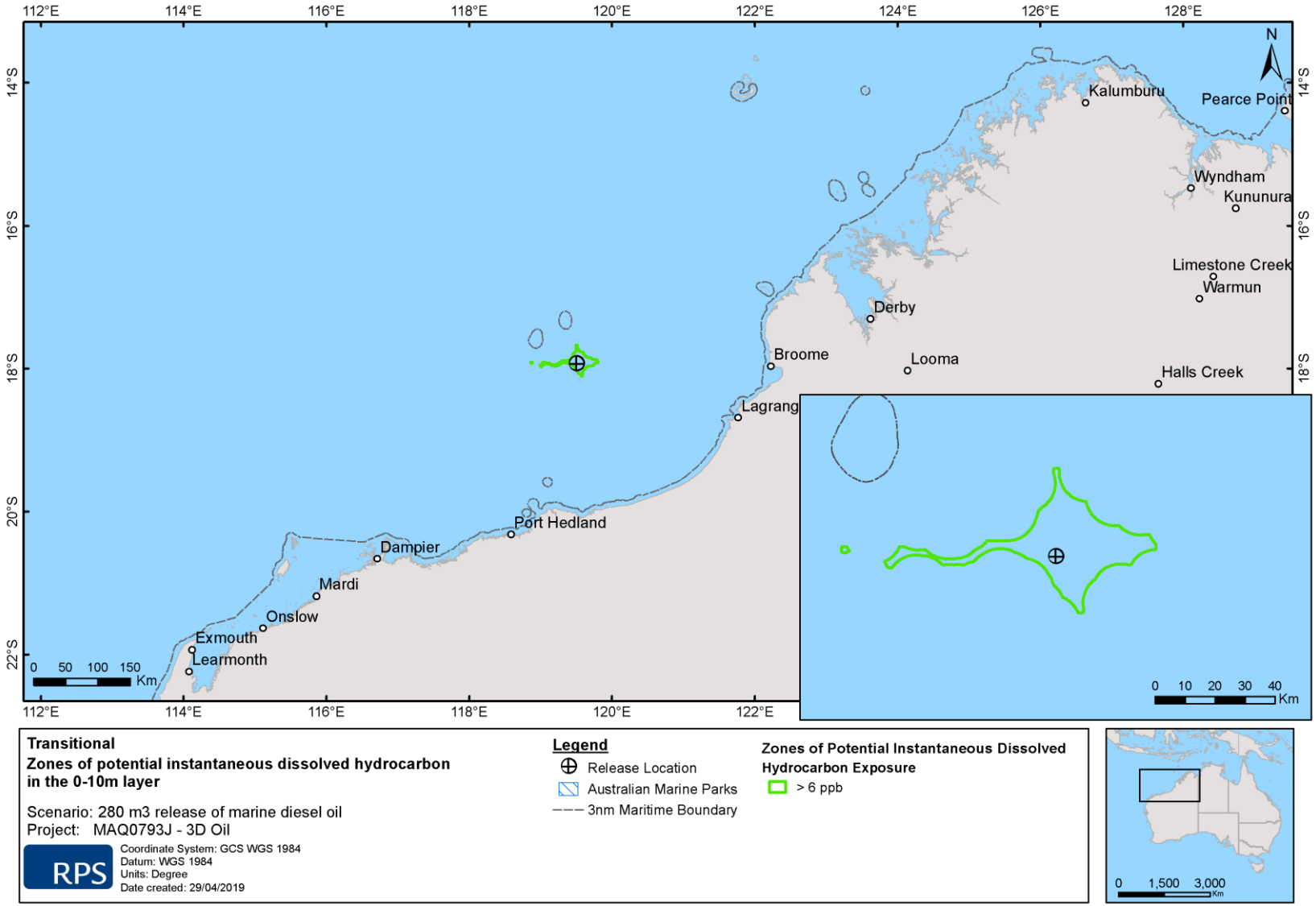


Figure 35 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions.

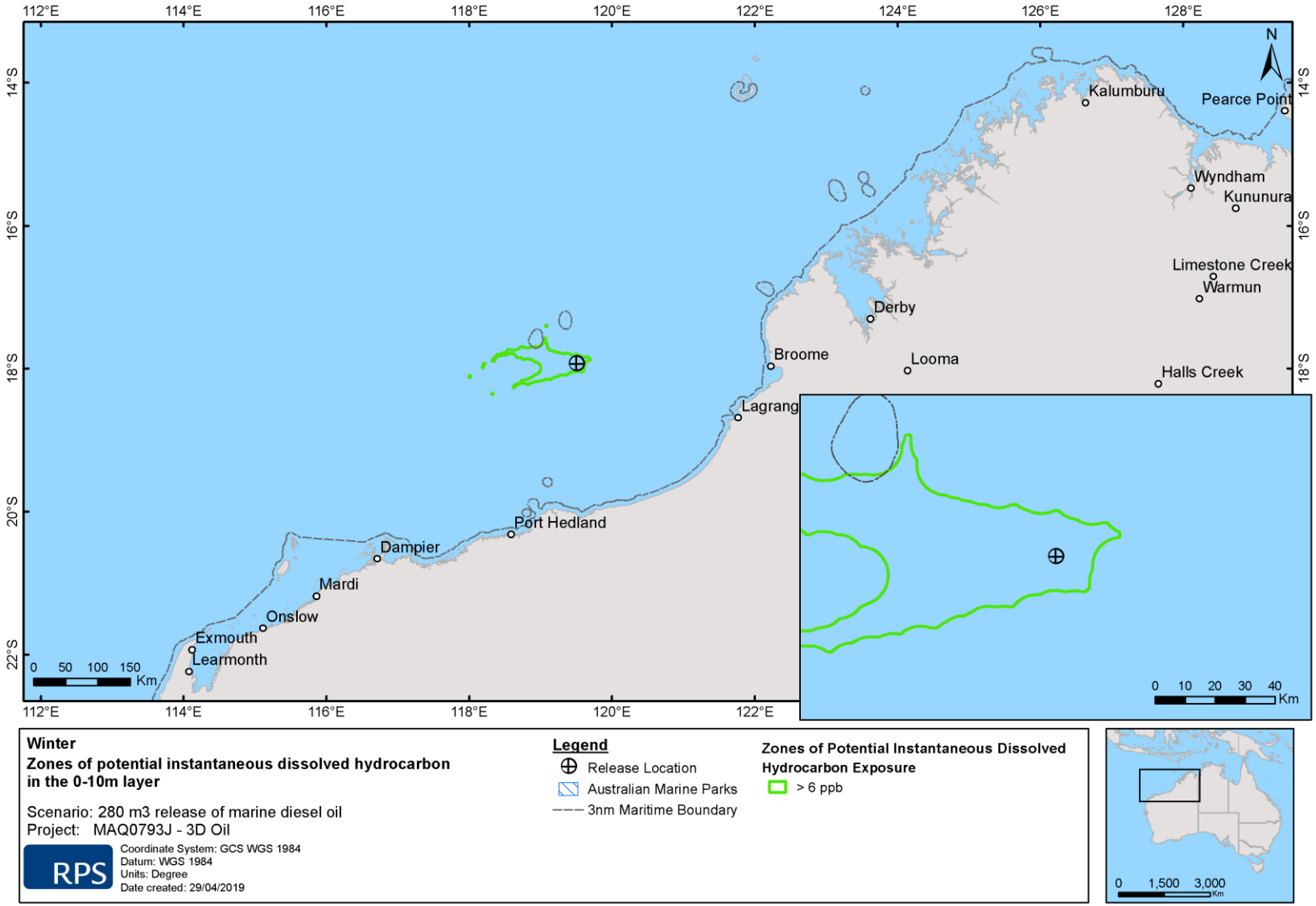


Figure 36 Zones of potential instantaneous dissolved hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions.

8.2.2 Entrained Hydrocarbons

Table 14 summarises the maximum entrained hydrocarbon exposure (time-averaged and instantaneous) to receptors in the 0–10 m depth layer at, or above the exposure thresholds discussed in Section 6.2 over the seasonal assessment.

The maximum time-averaged exposure over 48 hours to entrained hydrocarbons ranged from 4 ppb to 499 ppb for the transitional and winter seasons respectively. The maximum instantaneous exposure to entrained hydrocarbon was 6,287 ppb for the Northwest Shelf IMCRA during the summer. The IMCRA – North West Shelf was the only receptor exposed at the high threshold (1,000 ppb) or above for instantaneous exposure. Several receptors were exposed and the moderate threshold (100 ppb) or above for instantaneous exposure (i.e. AMP – Argo-Rowley Terrace, AMP – Mermaid Reef, MP – Rowley Shoals, KEF – Mermaid Reef and Commonwealth waters surrounding Rowley Shoals, KEF – Ancient coastline at 125 m depth contour and the RSB – Imperieuse Reef) during different seasons as specified in Table 14

The zone of potential time-averaged entrained hydrocarbon exposure is presented in Figure 37 to Figure 39, while Figure 40 to Figure 42 illustrate the zones of potential instantaneous entrained hydrocarbon exposure for each season.

Table 14 **Predicted maximum instantaneous and time-averaged (48 hr) entrained hydrocarbon exposure to receptors in the 0–10 m depth layer. Results are based on a 280 m³ surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories per season.**

Season	Receptor		Maximum time-averaged entrained hydrocarbon exposure (ppb)	Probability of time-averaged entrained hydrocarbon exposure			Maximum instantaneous entrained hydrocarbon exposure (ppb)	Probability of instantaneous entrained hydrocarbon exposure		
				>10 ppb	>100 ppb	>1,000 ppb		>10 ppb	>100 ppb	>1,000 ppb
Summer	SHORE	Imperieuse Reef	27	4	0	0	57	5	0	0
		Cunningham Island	28	3	0	0	61	7	0	0
		Clerke Reef	14	2	0	0	31	6	0	0
		Mermaid Reef	10	0	0	0	30	1	0	0
	IMCRA	Northwest Shelf	402	66	14	0	6,287	89	74	17
	AMP	Argo-Rowley Terrace	114	11	2	0	607	23	8	0
		Kimberley	10	1	0	0	32	4	0	0
		Mermaid Reef	21	2	0	0	66	3	0	0
	MP	Rowley Shoals	49	5	0	0	185	8	2	0
	RSB	Mermaid Reef	20	1	0	0	55	2	0	0
		Imperieuse Reef	33	4	0	0	59	7	0	0
		Clerke Reef	40	2	0	0	158	7	1	0
	KEF	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	49	5	0	0	213	12	2	0
		Ancient coastline at 125 m depth contour	109	6	1	0	646	11	5	0
Transitional	SHORE	Imperieuse Reef	9	0	0	0	36	6	0	0
		Cunningham Island	27	3	0	0	89	6	0	0
		Clerke Reef	25	6	0	0	81	12	0	0
	IMCRA	Northwest Shelf	499	49	16	0	3,251	79	54	14
	AMP	Argo-Rowley Terrace	89	14	0	0	401	21	6	0
		Kimberley	6	0	0	0	11	2	0	0
		Mermaid Reef	26	5	0	0	76	10	0	0

	MP	Rowley Shoals	30	7	0	0	94	14	0	0
	RSB	Mermaid Reef	8	0	0	0	28	3	0	0
		Imperieuse Reef	26	3	0	0	89	8	0	0
		Clerke Reef	26	6	0	0	84	14	0	0
	KEF	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	73	9	0	0	177	16	2	0
		Ancient coastline at 125 m depth contour	72	6	0		229	7	2	0
Winter	SHORE	Imperieuse Reef	23	4	0	0	76	7	0	0
		Cunningham Island	23	3	0	0	74	5	0	0
		Clerke Reef	6	0	0	0	18	1	0	0
		Mermaid Reef	4	0	0	0	11	2	0	0
	IMCRA	Northwest Shelf	398	64	21	0	4,355	84	70	29
	AMP	Argo-Rowley Terrace	95	13	0	0	338	17	6	0
		Mermaid Reef	18	1	0	0	100	6	1	0
	MP	Rowley Shoals	57	8	0	0	207	17	2	0
	RSB	Mermaid Reef	8	0	0	0	57	3	0	0
		Imperieuse Reef	42	4	0	0	105	11	1	0
		Clerke Reef	7	0	0	0	27	2	0	0
	KEF	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	57	13	0	0	261	18	6	0
		Ancient coastline at 125 m depth contour	56	2	0	0	111	4	1	0
		Continental Slope Demersal Fish Communities	11	1	0	0	16	1	0	0

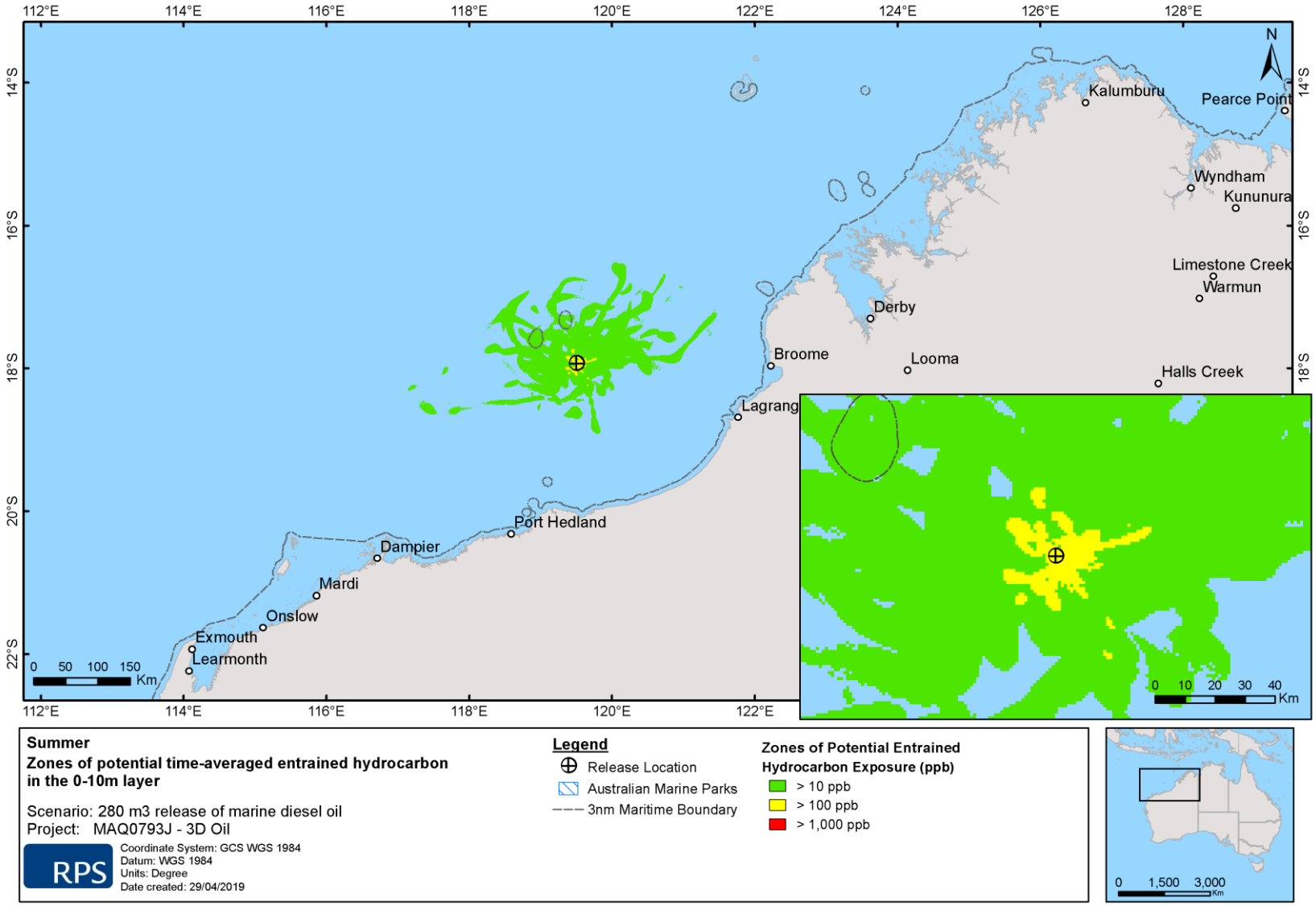


Figure 37 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions.

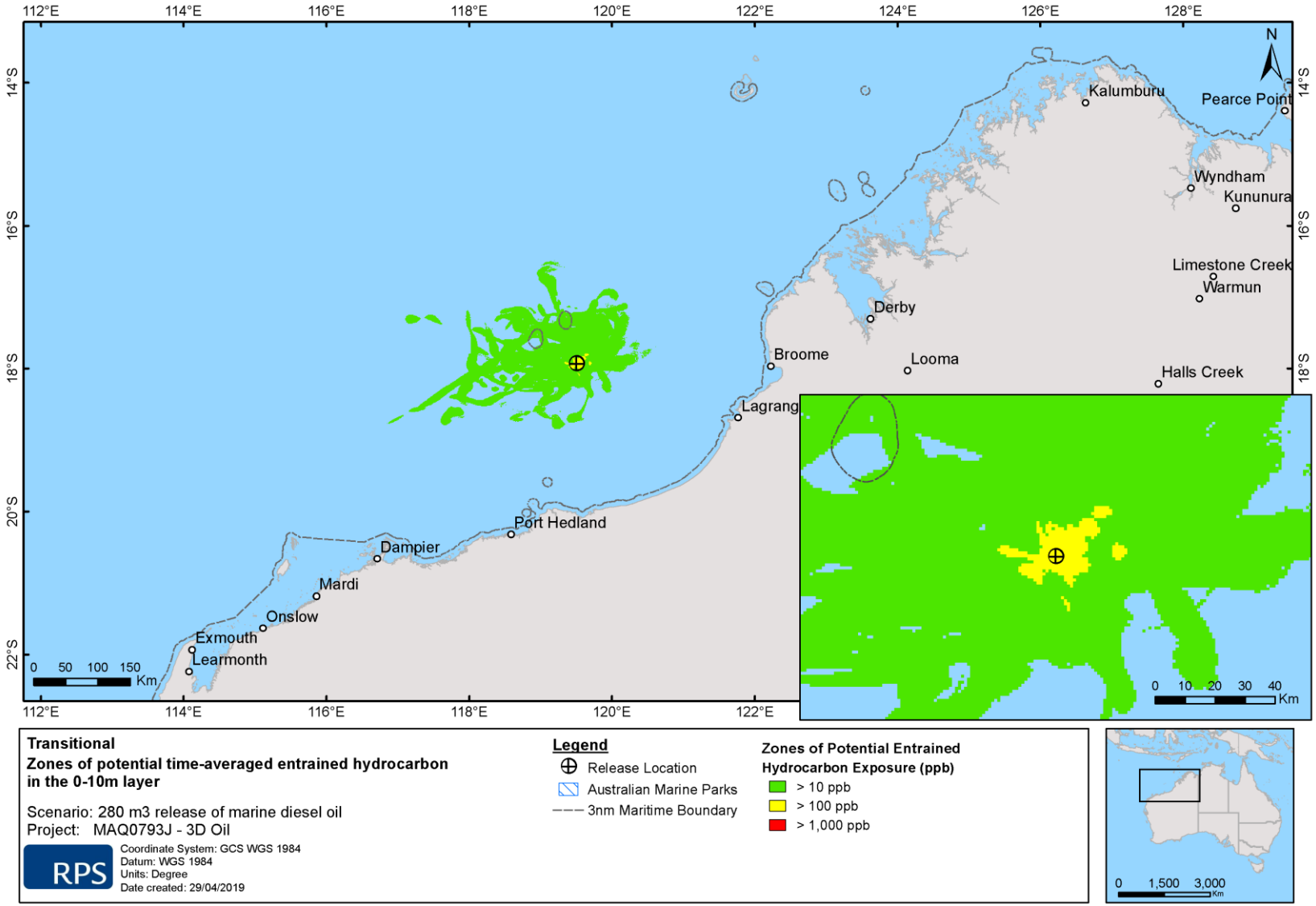


Figure 38 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions.

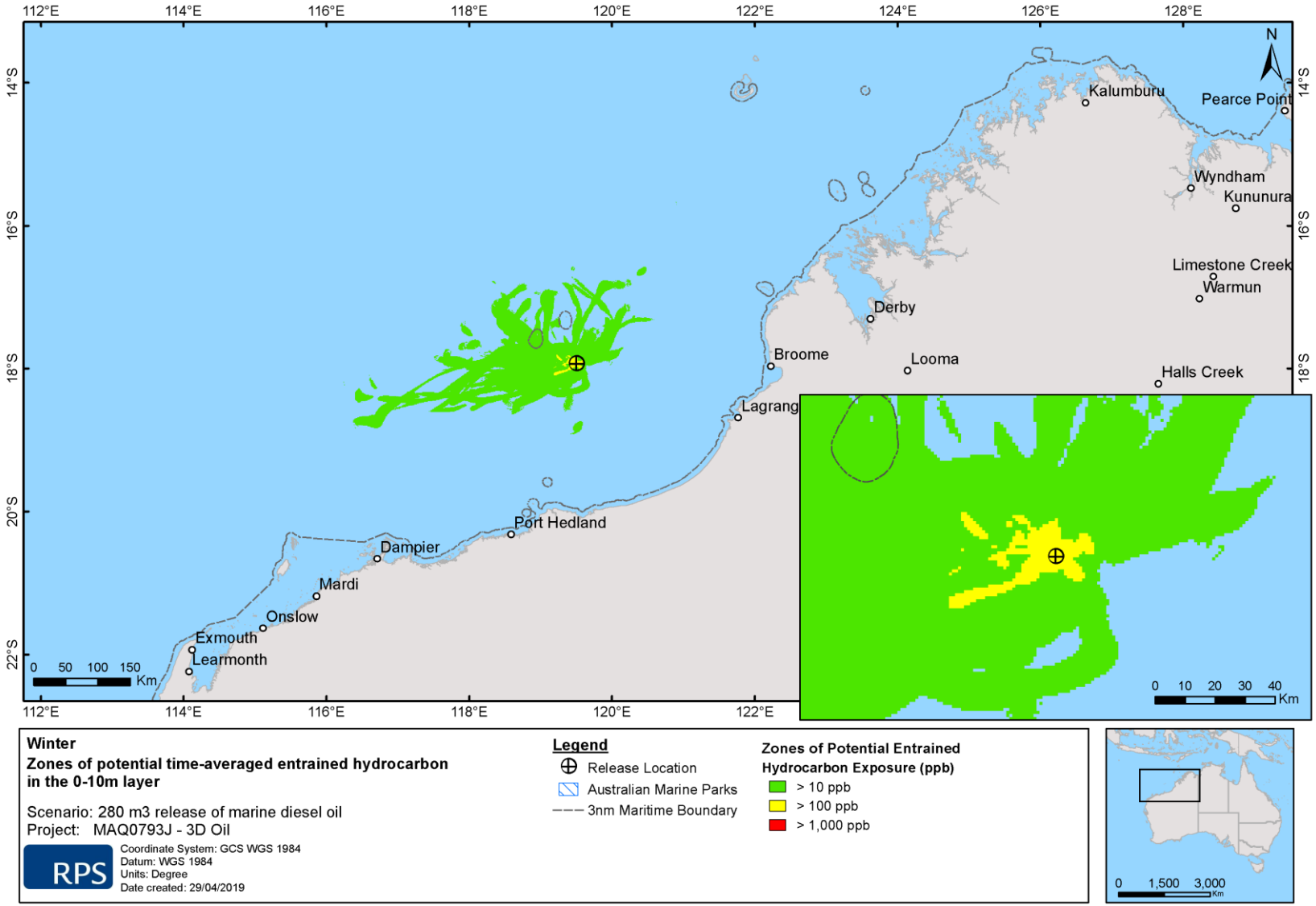


Figure 39 Zone of potential time-averaged entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions.

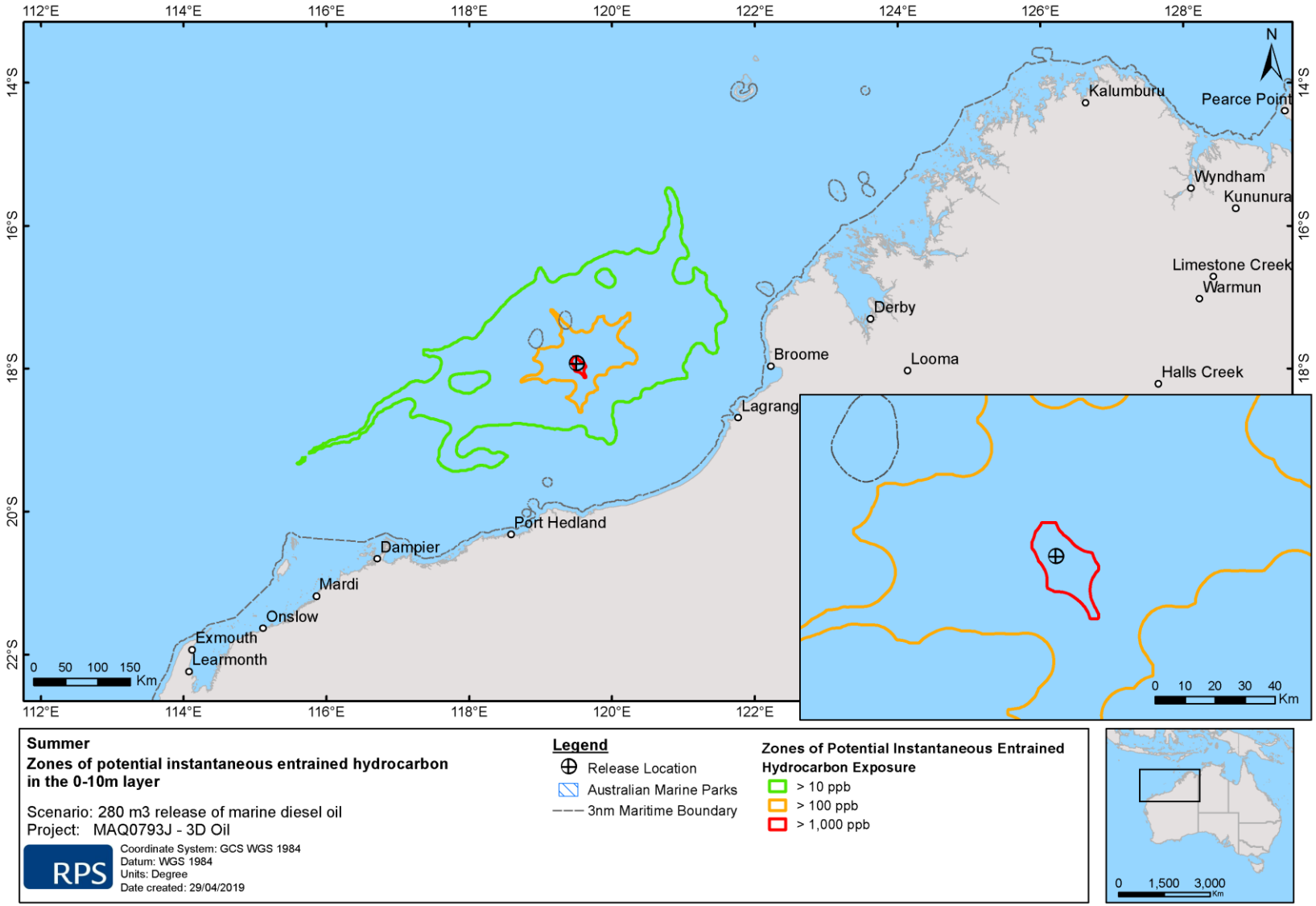


Figure 40 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during summer wind and current conditions.

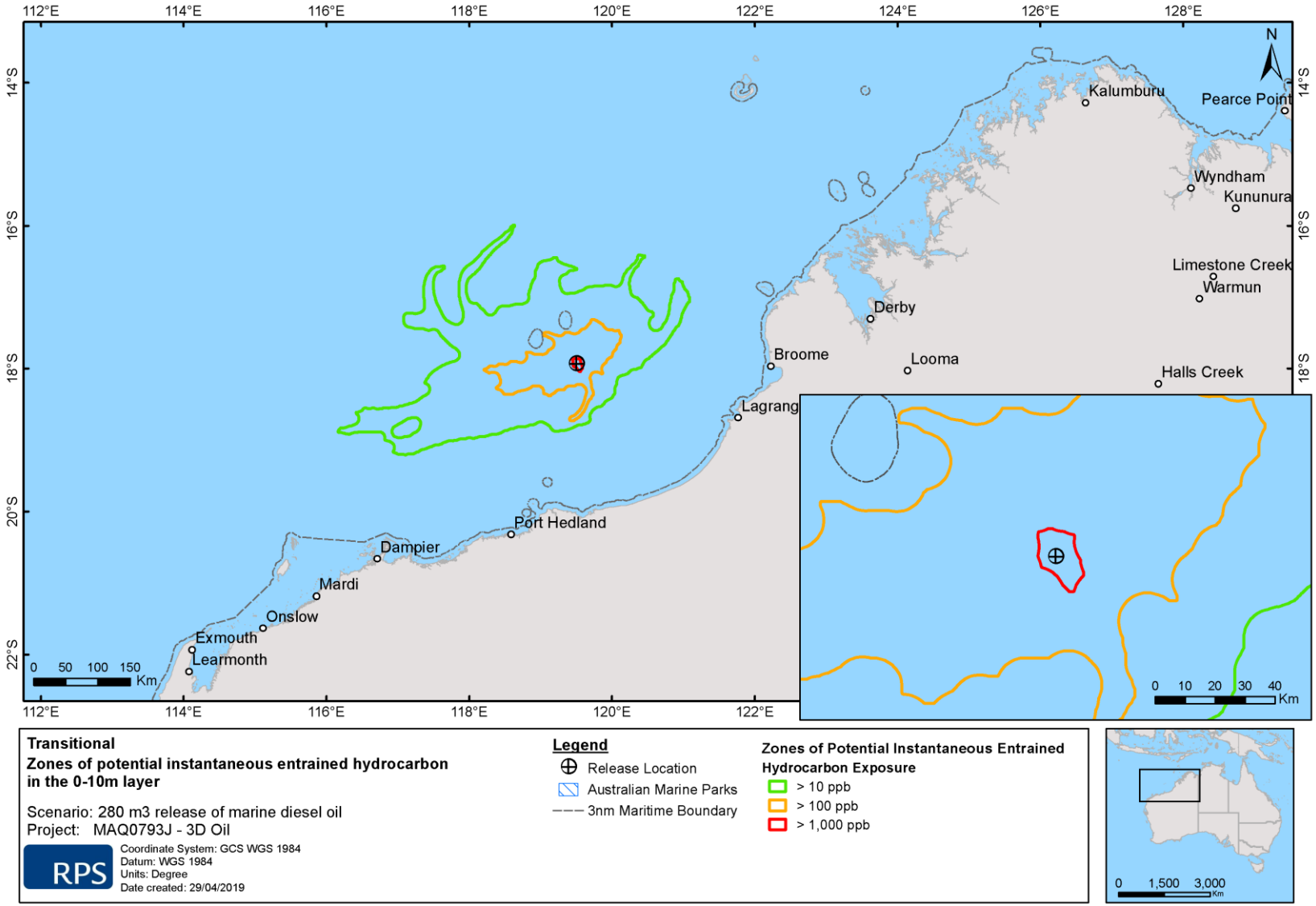


Figure 41 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during transitional period wind and current conditions.

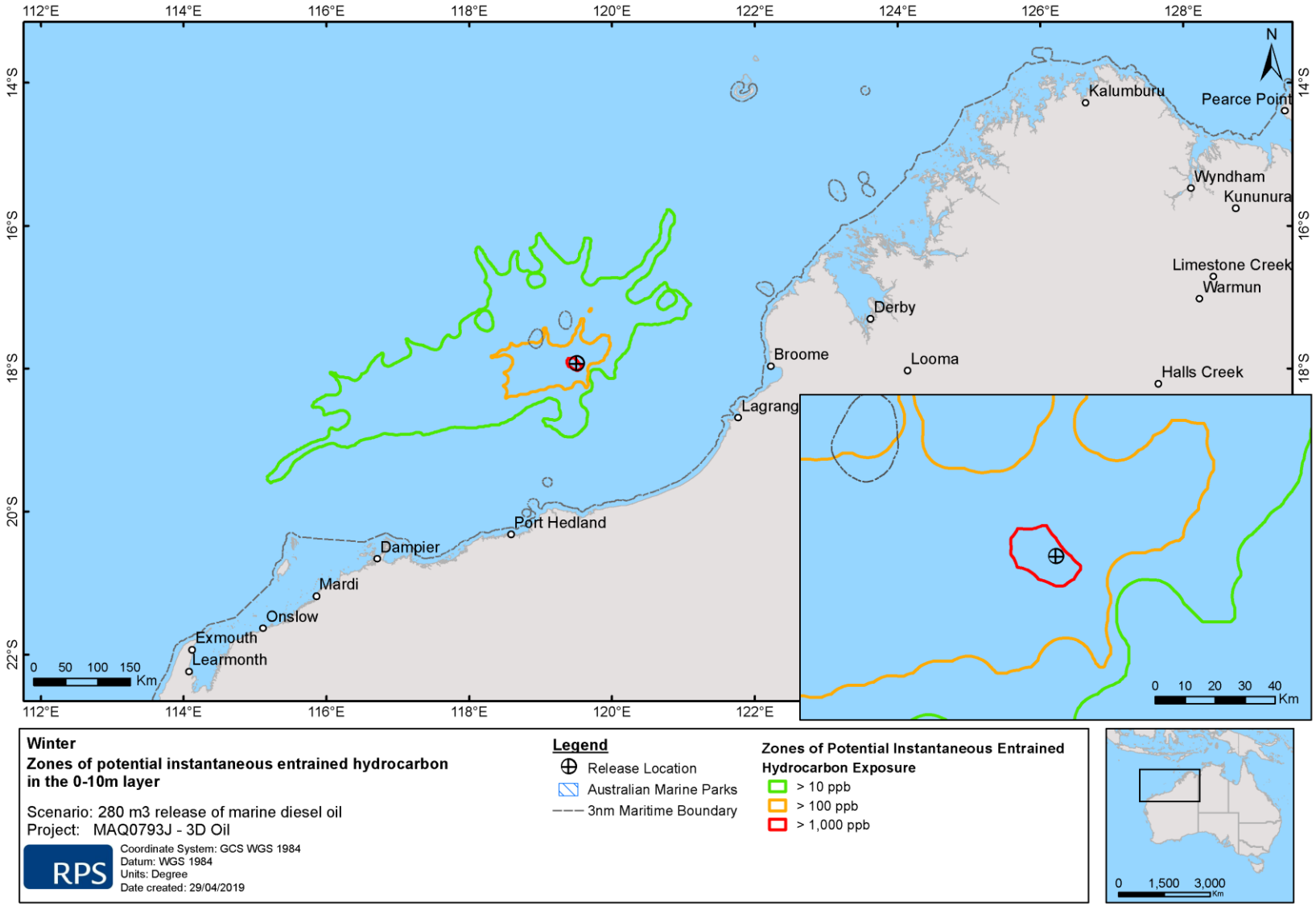


Figure 42 Zone of potential instantaneous entrained hydrocarbon exposure at 0–10 m below the sea surface in the event of a 280 m³ of surface release of MDO over 6 hours, tracked for 30 days. The results were calculated from 100 spill trajectories simulated during winter wind and current conditions.

9 REFERENCES

American Society for Testing and Materials (ASTM) 2013, 'F2067-13 Standard Practice for Development and Use of Oil-Spill Trajectory Models', ASTM International, West Conshohocken (PA).

Andersen, OB 1995, 'Global ocean tides from ERS 1 and TOPEX/POSEIDON altimetry', Journal of Geophysical Research: Oceans, vol. 100, no. C12, pp. 25249–25259.

Australian Maritime Safety Authority (AMSA) 2015a, Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities.

Australian Maritime Safety Authority (AMSA) 2015b, National Plan - Response, Assessment and Termination of Cleaning for Oil Contaminated Foreshores (NP-GUI-025)

Becker, JJ, Sandwell, DT, Smith, WHF, Braud, J, Binder, B, Depner, J, Fabre, D, Factor, J, Ingalls, S, Kim, S-H, Ladner, R, Marks, K, Nelson, S, Pharaoh, A, Trimmer, R, Von Rosenberg, J, Wallace, G & Weatherall, P 2009, 'Global bathymetry and evaluation data at 30 arc seconds resolution: SRTM30_PLUS', Marine Geodesy, vol. 32, no. 4, pp. 355–371.

Bonn Agreement 2009, 'Bonn Agreement aerial operations handbook, 2009 - Publication of the Bonn Agreement', London, viewed 13 January 2015, http://www.bonnagreement.org/site/assets/files/3947/ba-aoh_revision_2_april_2012.pdf

Chassignet, EP, Hurlburt, HE, Smedstad, OM, Halliwell, GR, Hogan, PJ, Wallcraft, AJ, Baraille, R & Bleck, R 2007, 'The HYCOM (hybrid coordinate ocean model) data assimilative system', Journal of Marine Systems, vol. 65, no. 1, pp. 60–83.

Chassignet, E, Hurlburt, H, Metzger, E, Smedstad, O, Cummings, J & Halliwell, G 2009, 'U.S. GODAE: Global Ocean Prediction with the HYbrid Coordinate Ocean Model (HYCOM)', Oceanography, vol. 22, no. 2, pp. 64–75.

Condie, SA., & Andrewartha, JR (2008). Circulation and connectivity on the Australian Northwest Shelf. Continental Shelf Research, 28, 1724-1739.

Davies, AM 1977a, 'The numerical solutions of the three-dimensional hydrodynamic equations using a B-spline representation of the vertical current profile', in JC Nihoul (ed), Bottom Turbulence: Proceedings of the 8th Liège Colloquium on Ocean Hydrodynamics, Elsevier Scientific, Amsterdam, pp. 1–25.

Davies, AM 1977b, 'Three-dimensional model with depth-varying eddy viscosity', in JC Nihoul (ed), Bottom Turbulence: Proceedings of the 8th Liège Colloquium on Ocean Hydrodynamics, Elsevier Scientific, Amsterdam, pp. 27–48.

DEWHA, 2007. Characterisation of the marine environment in the north marine region. Marine Division, Department of the environment, water heritage and the arts.

DEWHA. 2008. The North-West Marine Bioregional Plan - Bioregional Profile. Retrieved February 12, 2013, from Australian Government Department of Environment, Water, Heritage and the Arts: http://www.environment.gov.au/coasts/mbp/publications/north-west/pubs/bioregional-profile.pdf

French, D, Schuttenberg, H & Isaji, T 1999, 'Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida Power and Light', Proceedings of the 22nd Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Alberta, pp. 243–270.

French-McCay, DP 2003, 'Development and application of damage assessment modelling: example assessment for the North Cape oil spill', Marine Pollution Bulletin, vol. 47, no. 9, pp. 9–12.

French-McCay, DP 2004, 'Spill impact modelling: development and validation', Environmental Toxicology and Chemistry, vol. 23, no.10, pp. 2441–2456.

French-McCay, D, Rowe, JJ, Whittier, N, Sankaranarayanan, S, & Etkin, DS 2004, 'Estimate of potential impacts and natural resource damages of oil', Journal of Hazardous Materials, vol. 107, no. 1, pp. 11–25.

Gordon, R 1982, 'Wind driven circulation in Narragansett Bay' PhD thesis, Department of Ocean Engineering, University of Rhode Island.

Isaji, T & Spaulding, M 1984, 'A model of the tidally induced residual circulation in the Gulf of Maine and Georges Bank', Journal of Physical Oceanography, vol. 14, no. 6, pp. 1119–1126.

Isaji, T, Howlett, E, Dalton C, & Anderson, E 2001, 'Stepwise-continuous-variable-rectangular grid hydrodynamics model', Proceedings of the 24th Arctic and Marine Oil spill Program (AMOP) Technical Seminar (including 18th TSOCS and 3rd PHYTO), Environment Canada, Edmonton, pp. 597–610.

International Tankers Owners Pollution Federation (ITOPF) 2014, 'Technical Information Paper 2 - Fate of Marine Oil Spills', International Tankers Owners Pollution Federation td, UK.

Kostianoy, AG, Ginzburg, AI, Lebedev, SA, Frankignoulle, M & Delille, B 2003, 'Fronts and mesoscale variability in the southern Indian Ocean as inferred from the TOPEX/POSEIDON and ERS-2 Altimetry data', Oceanology, vol. 43, no. 5, pp. 632–642.

Levitus, S, Antonov, JI, Baranova, OK, Boyer, TP, Coleman, CL, Garcia, HE, Grodsky, AI, Johnson, DR, Locarnini, RA, Mishonov, AV, Reagan, JR, Sazama, CL, Seidov, D, Smolyar, I, Yarosh, ES & Zweng, MM 2013, 'The World Ocean Database', Data Science Journal, vol.12, no. 0, pp. WDS229–WDS234.

Ludicone, D, Santoleri, R, Marullo, S & Gerosa, P 1998, 'Sea level variability and surface eddy statistics in the Mediterranean Sea from TOPEX/POSEIDON data', Journal of Geophysical Research I, vol. 103, no. C2, pp. 2995–3011.

Matsumoto, K, Takanezawa, T & Ooe, M 2000, 'Ocean tide models developed by assimilating TOPEX/POSEIDON altimeter data into hydrodynamical model: A global model and a regional model around Japan', Journal of Oceanography, vol. 56, no.5, pp. 567–581.

National Oceanic and Atmospheric Administration (NOAA) 2013, 'Screening level risk assessment package Gulf state', Office of National Marine Sanctuaries & Office of Response and Restoration, Washington DC.

Owen, A 1980, 'A three-dimensional model of the Bristol Channel', Journal of Physical Oceanography, vol. 10, no. 8, pp. 1290–1302.

Qiu, B & Chen, S 2010, 'Eddy-mean flow interaction in the decadally modulating Kuroshio Extension system', Deep-Sea Research II, vol. 57, no. 13, pp. 1098–1110.

Saha, S, Moorthi, S, Pan, H-L, Wu, X, Wang, J & Nadiga, S 2010, 'The NCEP Climate Forecast System Reanalysis', Bulletin of the American Meteorological Society, vol. 91, no. 8, pp. 1015–1057.

Spaulding, ML., Kolluru, VS, Anderson, E & Howlett, E 1994, 'Application of three-dimensional oil spill model (WOSM/OILMAP) to hindcast the Braer Spill', Spill Science and Technology Bulletin, vol. 1, no. 1, pp. 23–35.

Spaulding, MS, Mendelsohn, D, Crowley, D, Li, Z, and Bird A, 2015. Technical Reports for Deepwater Horizon Water Column Injury Assessment- WC_TR.13: Application of OILMAP DEEP to the Deepwater Horizon Blowout. RPS APASA, 55 Village Square Drive, South Kingstown, RE 02879.

Willmott, CJ 1981, 'On the validation of models', Physical Geography, vol. 2, no. 2, pp.184–194.

Willmott, CJ 1982, 'Some comments on the evaluation of model performance', Bulletin of the American Meteorological Society, vol. 63, no. 11, pp.1309–1313.

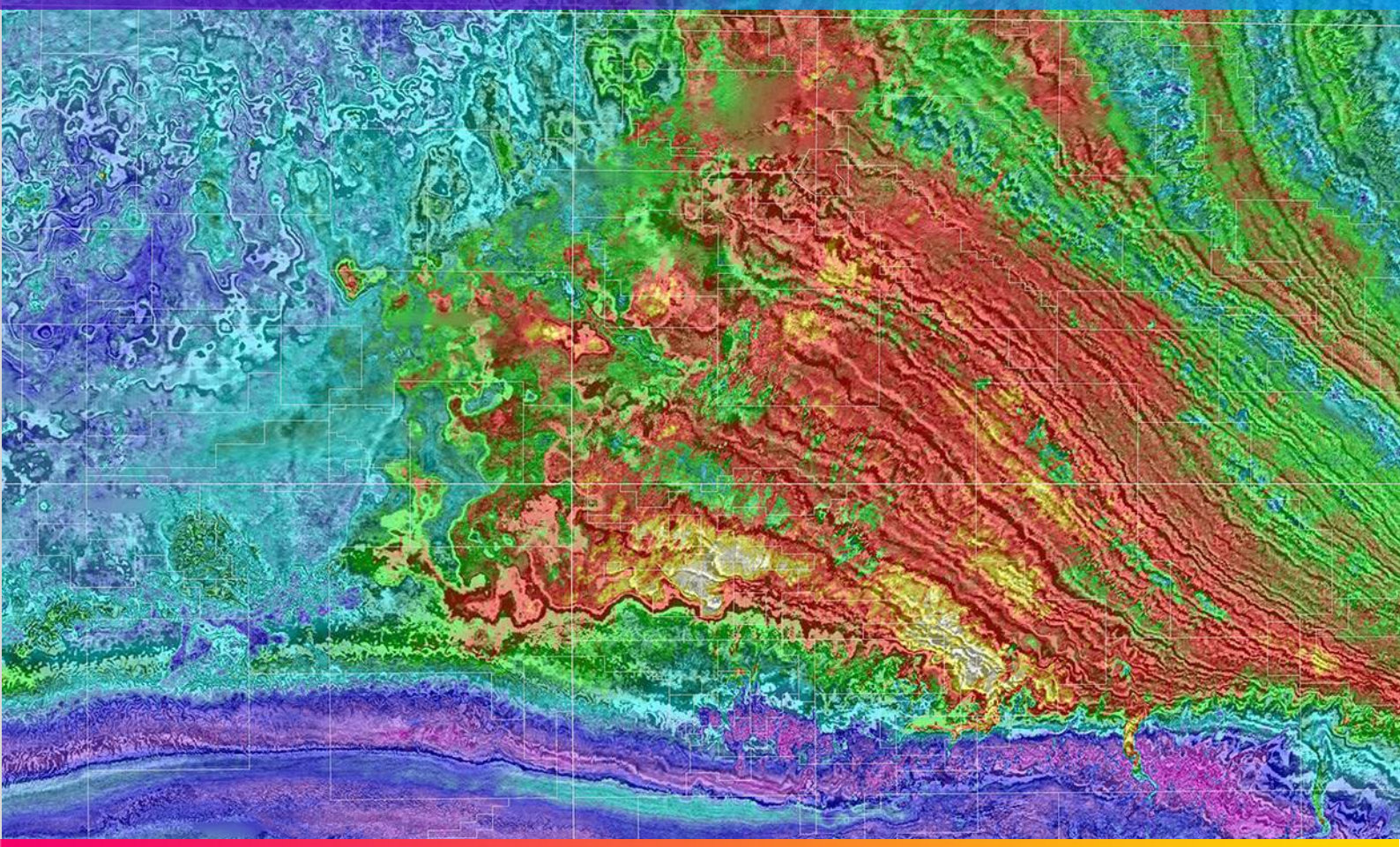
Willmott CJ, Ackleson SG, Davis RE, Feddema JJ, Klink, KM, Legates, DR, O'Donnell, J & Rowe, CM 1985, 'Statistics for the evaluation of model performance', Journal of Geophysical Research, vol. I 90, no. C5, pp. 8995–9005.

Willmott, CJ & Matsuura, K 2005, 'Advantages of the mean absolute error (MAE) over the root mean square error (RMSE) in assessing average model performance', Journal of Climate Research, vol. 30, no. 1, pp. 79–82.

Yaremchuk, M & Tangdong, Q 2004, 'Seasonal variability of the large-scale currents near the coast of the Philippines', Journal of Physical Oceanography, vol. 34, no., 4, pp. 844–855.

Zigic, S, Zapata, M, Isaji, T, King, B, & Lemckert, C 2003, 'Modelling of Moreton Bay using an ocean/coastal circulation model', Proceedings of the 16th Australasian Coastal and Ocean Engineering Conference, the 9th Australasian Port and Harbour Conference and the Annual New Zealand Coastal Society Conference, Institution of Engineers Australia, Auckland, paper 170.

Appendix H: Oil Pollution Emergency Plan



OIL POLLUTION EMERGENCY PLAN

Sauropod 3D Marine Seismic Survey (WA-527-P)

cgg.com

SEE THINGS DIFFERENTLY

CGG

Document Status					
Version	*Purpose of document*	*Authored by*	*Reviewed by*	*Approved by*	*Review Date*
A	Draft for internal review	RPS	RPS	RPS	15/07/2021
B	Draft for client review	RPS	CGG	CGG	6/08/2021
0	Final for issue	RPS	CGG	CGG	16/2/2022
1	Review and update	RPS	RPS	CGG	15/08/2022
1.1	Review and update	RPS	CGG	CGG	1/9/2023
1.2	Review and update	RPS	CGG	CGG	10/09/2025

PREPARED BY:

MAKING COMPLEX EASY
A TETRA TECH COMPANY

Level 3, 500 Hay Street
Subiaco, WA 6008

T +61 8 9211 1111
W rpsgroup.com

Table of contents

Acronyms and Abbreviations 5
First Strike Response 7
1 Introduction 10
1.1 Purpose, Scope and Objectives 10
1.2 Activity Overview and Location 10
1.3 Relationship to Other Plans 11
1.3.1 Vessel SOPEP 12
1.3.2 NatPlan 13
1.3.3 State Hazard Plan 13
1.3.4 WA Oiled Wildlife Response Plan 14
1.4 Review and Update 14
2 Response Arrangements 15
2.1 Jurisdictional Authority and Control Agency 15
2.1.1 Commonwealth Waters 15
2.1.2 State Waters 15
2.2 Emergency Response Organisation 16
2.3 Spill Level Classification 17
2.4 Spill Response Management Team – Level Structures 19
2.4.1 Level 1 Structure 19
2.4.2 Level 2/3 Structure 19
2.5 Notification and Reporting Requirements 19
2.5.1 Internal 19
2.5.2 External 20
2.5.3 Supplementary 21
2.6 Oil Spill Response Resources 22
2.6.1 Seismic and Support Vessels 22
2.6.2 NatPlan Resources 22
2.6.3 State Hazard Plan 23
3 Response Option Assessment 24
3.1 Hydrocarbon Spill Scenarios 24
3.2 Hydrocarbon Characteristics (MDO) 24
3.3 Oil Spill Modelling 25
3.3.1 Geographic Response Area 26
3.4 Response Option Effectiveness 27
3.5 Net Environmental Benefits Assessment 29
3.6 Protection Priorities and Preliminary Response Strategies 31
3.7 Operational NEBA, Incident Action Planning and Effectiveness Monitoring 31
4 Response Strategies 33
4.1 Source Control 33

4.2 Monitor and Evaluate 33
4.2.1 Oil Spill Trajectory Calculation 33
4.2.2 Visual Monitoring Surveillance (Aerial/Vessel) 34
4.2.3 Satellite Tracking Drifter Buoys 35
4.2.4 Oil Spill Trajectory Modelling 35
4.3 Oiled Wildlife Response 35
4.4 Scientific Monitoring 35
4.4.1 Scope of Studies 35
4.4.2 Consultation 36
4.5 Response Termination 36
5 Response Training 37
5.1 Testing of Response Arrangements 37
6 References 38

Figures

Figure 1-1 - Location of Sauropod 3D Marine Seismic Survey 11
Figure 1-2 - Inter-relationship between CGG and Seismic Contractors Emergency Plans 12
Figure 2-1 - Sauropod 3D MSS Emergency Reporting Structure 16
Figure 2-2 - NatPlan Guidance on Spill Level Classification 18
Figure 3-1 - Weathering of MDO Under Three Static Winds Conditions (Five, Ten and 15 Knots). The Results Are Based on a 280 m^3 Surface Release of MDO over Six Hours and Tracked for 30 Days 25
Figure 3-2 - Predicted Geographic EMBA 26
Figure 4-1 - Spill Vectoring Overview 34
Figure 4-2 - Bonn Agreement Oil Appearance Code (Examples) 35

Tables

Table 0-1 - Notification and Call-out Authorities 7
Table 0-2 - Spill Response Action List – MDO Spill 7
Table 1-1 - Contents of a Typical SOPEP 13
Table 2-1 - Jurisdictional Authority and Control Agency (source: AMSA 2018) 15
Table 2-2 - Response Teams and Responsibilities 16
Table 2-3 - Notification Information 20
Table 2-4 - Notification Requirements for a Vessel Spill 20
Table 2-5 - Additional External Notifications 22
Table 3-1 - MDO Fuel Properties (ITOPF, 2011) 24
Table 3-2 - Preliminary Response Option Assessment 27
Table 3-3 - Sensitivity Prioritisation 29
Table 3-4 - Environmental Sensitivities and NEBA 30
Table 3-5 - Protection Priorities and Preliminary Response Strategies 31
Table 4-1 - Source Control Actions 33
Table 4-2 - Guidelines for Estimating Spill Volume 34

Appendices

Appendix 1 – Contact Directory

Acronyms and Abbreviations

Name	Description
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
CA	Control Agency
CEMT	Crisis and Emergency Management Team (CGG)
CGG	CGG Services Australia
DBCA	WA Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DMIRS	WA Department of Mines, Industry Regulation and Safety
DNP	Director of National Parks
DoT	WA Department of Transport
EMBA	Environment that maybe affected
EP	Environment Plan
ERG	Emergency Response Group (shoreside vessel contractor)
ERM	Environmental Resources Management
ERP	Emergency Response Plan (vessel emergency response)
ERT	Emergency Response Team (vessel response group)
HSE	Health Safety & Environment
IAP	Incident Action Plan
IMO	International Maritime Organization
ITOPF	International Tanker Owners Pollution Federation
JA	Jurisdictional authority
JRCC	Joint Rescue Coordination Centre
MDO	Marine diesel oil
MFO	Marine fauna observer
MOP	Marine oil pollution
MSS	Marine seismic survey
NEBA	Net Environmental Benefits Assessment
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
OPEP	Oil Pollution Emergency Plan
OSMP	Operational & Scientific Monitoring Plan
POLREP	Pollution Report
SITREP	Situation Report
SOPEP	Shipboard Oil Pollution Emergency Plan
WA	Western Australia

Reference Documents		
Jurisdiction	**Plan Title**	**Function / Application**
Commonwealth of Australia (Commonwealth waters)	National Plan for Maritime Environmental Emergencies – 2020 edition (NatPlan)	The NatPlan sets out an effective response to marine pollution events in Commonwealth waters through an integrated arrangement between the federal, state and Northern Territory and the petroleum industry. There are national guidelines for the development of marine oil pollution (MOP) contingency plans. Under the NatPlan states / territories are required to develop operational and tactical plans to deal with oiled wildlife in their jurisdiction.
Western Australia (State waters)	State Hazard Plan for Maritime Environmental Emergencies - 2021 edition (State Hazard Plan)	Replaced the WestPlan – Marine Oil Pollution (MOP) and the WestPlan Marine Transport Emergency. Details the management arrangements for the prevention, preparation, response and recovery for MOP minimise the impacts of marine oil pollution from vessels, offshore petroleum activities and other sources. The rehabilitation of oil-affected wildlife is a recognised response activity under WestPlan-MOP.

First Strike Response

Detailed below is the checklist of first strike response actions in the event of a marine diesel spill (Level 1 or Level 2) from vessels undertaking the Sauropod 3D MSS activity in Exploration Permit WA-527-P.

In a spill event, a response will be activated commensurate to the size and level of risk. As the Sauropod 3D MSS activity is vessel-based in Commonwealth waters, the Control Agency (CA) (i.e. organisation in control of oil spill response) is the Australian Maritime Safety Authority (AMSA). CGG and the vessel contractor will support the oil spill response activities.

This OPEP is activated on the release of any hydrocarbon substance from MSS vessels to the marine environment during survey activities in the Sauropod 3D MSS Operational Area. This OPEP does not apply to vessel spills during transit activities to/from the Sauropod 3D MSS Operational Area, which will be managed via the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP).

The CGG project manager is responsible for activating this OPEP. Notification and callout responsibilities are summarised in Table 0-1. Contact details for these groups/organisations are provided in Appendix 1.

Table 0-1 - Notification and Call-out Authorities

Group/Organisation	Notified/Mobilised by:	Method:	Assembly Point
Vessel Response Crew	Vessel master	Internal (phone/ radio/alarm)	As directed
Vessel Management Emergency Support Group	Vessel master	Telephone	-
CGG project manager	CGG offshore representative	Telephone	CGG Board Room
CGG Emergency/ Crisis Management Team (Level 2 spill)	CGG project manager	Telephone	CGG Board Room
AMSA	Vessel master	AMSA JRCC (phone)	-
NOPSEMA (reportable spill)	CGG managing director	Telephone	-
NOPTA, DNP and DMIRS (reportable spill)	CGG managing director	Email	-
DoT (state waters – Level 2 spill)	CGG project manager	Telephone	-
Stakeholders	CGG project manager	Telephone	-

Table 0-2 - Spill Response Action List – MDO Spill

Response Action (Note: CGG in Support Role Only)			
	Action	Responsibility	Timing
	Initial Emergency Actions		
1.	Sound relevant alarm. vessel master is notified of spill in accordance with SOPEP	Crew member discovering leak	ASAP
2.	Manage safety of all vessel personnel. Secure sources of ignition and alert all personnel (appropriate to level of spill). Implement the relevant emergency response procedures to protect human life and equipment and in particular, those procedures focused at reducing the risk of fire or explosion (i.e. Shipboard Oil Pollution Emergency Plan (SOPEP/ERP)) or equivalent)	Vessel master	ASAP refer SOPEP

Response Action (Note: CGG in Support Role Only)			
	Action	**Responsibility**	**Timing**
3.	If safe, stop spill through source control actions. Minimise loss overboard utilising available spill prevention/clean-up equipment on-board.	Vessel master (or delegate)	ASAP refer SOPEP
4.	After safety measures have been implemented, identify the damage, location of incident, proximity to land, other navigational hazards, other traffic in the area, extent of spill (rate/volume) and the weather/current conditions in the area. Estimate the quantity of oil released and provide initial incident information.	Vessel master (or delegate)	ASAP Refer Section 4.2
5.	Notify AMSA immediately and confirm response actions (AMSA JRCC Phone: +61 2 6230 6811 or 1800 641 792). Issue POLREP to AMSA	Vessel master	ASAP Refer Section 2.5.2
6.	As appropriate, issue emergency call-out on marine radio VHF Channel 16 to warn other vessels in the immediate path of the spill. Warning should include the type of accident, such as collision or leak; where the accident has occurred; possible hazards such as risk of fire or explosion; where the slick is moving and recommended actions, for example leaving the area, staying 500 m up-current, up-wind from the spill site and no naked flames.	Vessel master	ASAP
7.	Notify the CGG project manager with spill incident details	CGG Offshore Rep.	ASAP
8.	Notify NOPSEMA verbally WITHIN TWO HOURS of a reportable spill (ph: (08) 6461 7090) and provide written record of notification to NOPSEMA, NOPTA and DMIRS. Notify Director of Marine Parks on ph: 0419 293 465 (24 hr Marine Compliance Officer) if the spill is likely to impact on Australian Marine Parks. Notify: DoT on ph: (08) 9480 992 (24 hr duty officer) if the spill is within or impending on WA state waters.	CGG managing director (or delegate)	Within two hrs Refer Section 2.5.2
	Level 2 Spill:		
9.	On advice from AMSA, initiate response strategy.	vessel master	-
10.	Deploy oil spill tracking buoy to track spill. Provide data to AMSA and DoT (if required).	CGG Offshore Rep.	Within 30 minutes of spill Refer Appendix 2
11.	As directed, monitor leak size, changes to the physical/chemical character of the slick, direction, weather and sea- State conditions providing this information to AMSA and CGG. Formally log and record this data on a time basis. Activate OSMP vessel surveillance and SSM4 (marine fauna monitoring using MFOs) (as directed by AMSA) vessel master / CGG offshore rep.	Refer Section 4.2	
12.	Undertake other stakeholder notifications (as necessary)	CGG MD or CGG project manager	Refer Stakeholder Contacts Directory

Response Action (Note: CGG in Support Role Only)			
	Action	**Responsibility**	**Timing**
13.	Based on an agreed time frame with AMSA forward regular SITREPs details to AMSA (cc. CGG)	Vessel master / CGG Offshore Rep.	-
14.	Forward copies of SITREPs to NOPSEMA and DoT (if required).	CGG project manager	-
15.	Continue to implement OPEP (or equivalent) procedures	CGG project manager	Ongoing
16.	As directed by AMSA, undertake spill surveillance by support vessel (as appropriate). Continue to monitor the spill providing information on spill amount, trajectory, weather, area of coverage and spill appearance. Information to be provided back to AMSA and CGG. Provide DoT with the information (if required).	Vessel masters / CGG Offshore Rep.	Ongoing
17.	Confirm trajectory (weather conditions and vector analysis) and area impacted. If drifting to WA state waters, request RPS modelling if not requested by AMSA. Identify additional scientific monitoring required and mobilise resources.	Vessel masters / CGG Offshore Rep.	Refer Section 4.2 Refer Section 4.3
18.	Consult with DNP, DCCEEW and DoT (as appropriate) on: a. Scope of scientific monitoring b. Definition of impact and reference sites	CGG project manager (or delegate)	Refer OSMP
19.	As directed by AMSA, continue routine surveillance to monitor the effectiveness of natural weathering strategy (i.e. monitoring and surveillance strategy) utilising the following effectiveness criteria: a. Trajectory is in line with manual estimates and predicted weathering b. No new environmental sensitivities are being threatened	Vessel master / Support vessel master	
20.	If natural weathering strategy is determined as not effective, confirm with AMSA the revised response strategy based on environmental resources at risk (as appropriate). Provide support where directed	Vessel master / CGG Offshore Rep.	
21.	Coordinate oil spill response activities (response equipment deployment, aerial surveillance, oil spill trajectory modelling (as necessary).	AMSA	
22.	Continue to advise marine stakeholders on the progress of the spill response	Vessel master / CGG project manager (CEMT) / AMSA	Refer Section 2.5.3
23.	Advise AMSA of any observed changes or increased threats to environmental sensitivities (as relevant).	Vessel master	
	Response termination		
24.	The oil spill response termination criteria will be determined and advised by AMSA. Water monitoring (oil-in-water sheen) will continue until termination criteria are achieved. AMSA will advise vessel master and CGG when the response is terminated	AMSA	
25.	CGG to advise NOPSEMA of spill response termination	CGG MD (or delegate)	
26.	Continue with scientific monitoring until OSMP termination criteria has been met for individual studies	CGG project manager	Refer OSMP

1 Introduction

1.1 Purpose, Scope and Objectives

This OPEP details the oil spill response arrangements to be undertaken by CGG to mitigate impacts and risks to the marine environment arising from an oil spill incident from the Sauropod 3D MSS located in Exploration Permit WA-527-P.

The objectives of this OPEP are to ensure that:

- The oil spill response processes/structures used by CGG are consistent with those used in applicable plans such as the NatPlan and the State Hazard Plan.
- CGG has assessed the potential support required during a Sauropod 3D MSS spill event and has timely access to appropriately trained people and resources in order to assist with an effective response.
- There is effective integration and use of industry/government response efforts and resources in responding to a Sauropod 3D MSS spill.

This OPEP covers hydrocarbon spills from vessels involved in the Sauropod 3D MSS located in WA-527-P. This OPEP is to be read in conjunction with the Sauropod EP when considering the existing environment, environmental impacts, risk management, performance standards, reporting compliance, and the decision processes that will apply in the event that a spill occurs.

Any spill originating from vessels outside the Sauropod 3D MSS Operational Area or when transiting to or from the project are managed via their respective Shipboard Oil Pollution Emergency Plans (SOPEPs) as regulated by The Australian Maritime Safety Authority (AMSA) under the *Commonwealth Protection of the Seas (Prevention of Pollution by Ships) Act 1983*.

1.2 Activity Overview and Location

CGG Services (Australia) Pty Ltd (CGG) is proposing to undertake the Sauropod 3D marine seismic survey (hereafter referred to as the Sauropod 3D MSS) in exploration permit area WA-527-P, which is located on the North West Shelf in the Roebuck Basin. An Environment Plan (EP) was previously accepted by NOPSEMA for this activity on 16 February 2022, however CGG is now planning to conduct the survey in WA-527-P under a revised and updated EP. The purpose of the Sauropod 3D MSS is to collect three-dimensional (3D) geophysical data about the underlying rock types to inform oil and gas exploration.

The survey will be undertaken within an ‘Acquisition Area’, where seismic data acquisition will occur. The Acquisition Area will be located within a broader ‘Operational Area’, which includes additional space for vessel activities such line turns, run-ins, run-outs, soft-start procedures and seismic source testing.

The Acquisition Area will be up to a maximum of approximately 3,500 km^2, with an Operational Area of approximately 6,000 km^2 (Figure 1-1). At its closest point the Operational Area is approximately:

- 63 km and 67 km from Clerke Reef and Imperieuse Reef respectively (the Rowley Shoals)
- 90 km from Bedout Island
- 120 km from the WA coast at Eighty Mile Beach
- 190 km from Port Hedland
- 230 km from Broome.

Water depths in the Acquisition Area range from approximately 95 to 172 m.

The 3D seismic survey will take a maximum of 60 days to acquire and will be undertaken within the period of January to May 2026 or 2027.

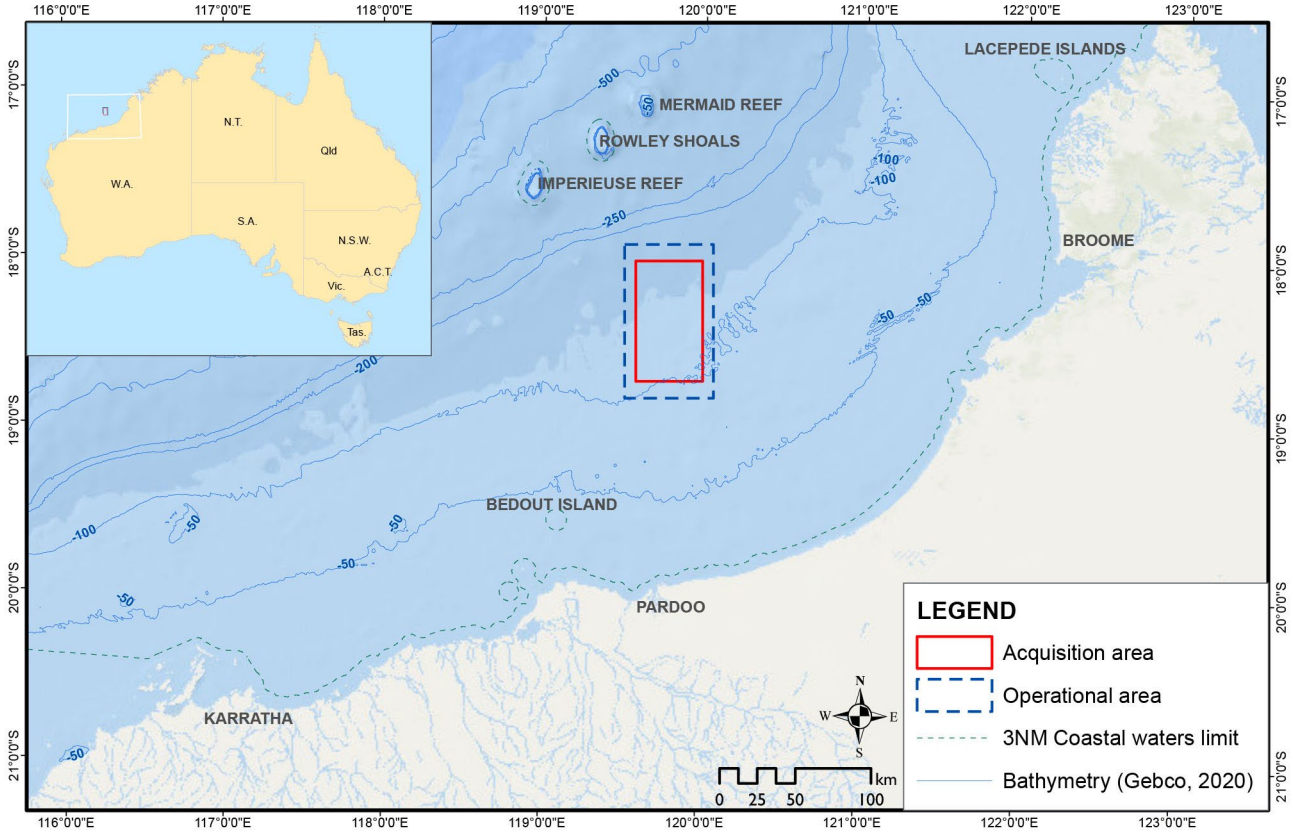


Figure 1-1 - Location of Sauropod 3D Marine Seismic Survey

1.3 Relationship to Other Plans

Oil spill response arrangements detailed in this OPEP integrate with the following CGG and seismic contractor plans, which support the Sauropod 3D MSS activities (refer Figure 1-2):

- Vessel-specific Crew HSE Plan which includes Emergency Response Procedures
- Sauropod 3D MSS Project Specific HSE Plan
- Vessel's SOPEP
- Seismic Contractors' Emergency Response/Crisis Plans.

The support and chase vessels will have SOPEP or SOPEP–equivalent documents according to the size and classification of the vessel. These plans ensure timely response to emergencies and effective management of oil spills.

In addition, this OPEP is consistent with the following government response plans:

- National Plan for Maritime Environmental Emergencies (NatPlan)
- WA State Hazard Plan for Maritime Environmental Emergencies (State Hazard Plan)
- WA Oiled Wildlife Response Plan.

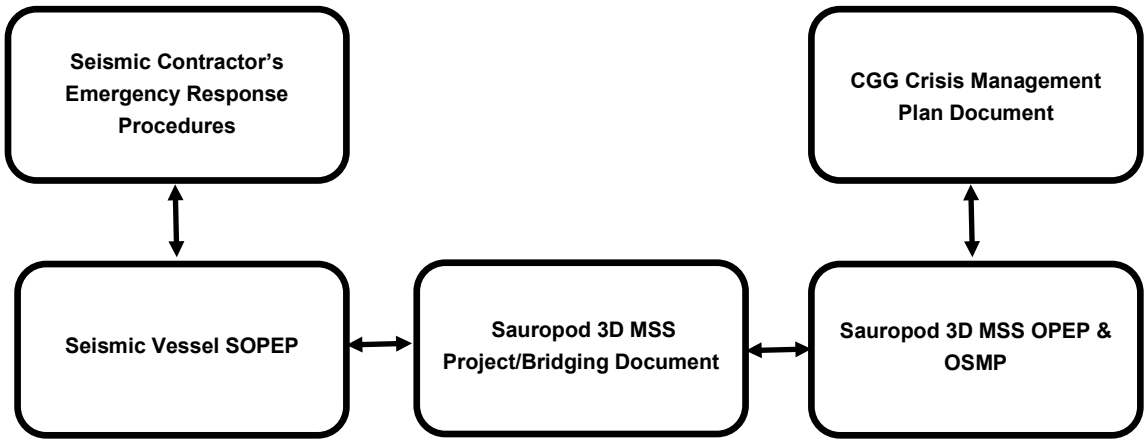


Figure 1-2 - Inter-relationship between CGG and Seismic Contractors Emergency Plans

1.3.1 Vessel SOPEP

As required under MARPOL 73/78 Annex I (Regulation 37), all ships greater than 400 gross tonnes must carry a shipboard oil pollution emergency plan (SOPEP), as required by the International Maritime Organization (IMO). For all ships in Australian waters, the NatPlan also applies. The SOPEP recognises the divisions of responsibility as defined under NatPlan to provide effective response to marine pollution incidents.

SOPEP's, the principal working document for vessel and crew in the event of a marine oil spill, provides for the following specific management response provisions to mitigate and combat oil spills originating from vessels:

- The procedure to be followed by the vessel master to report an oil spill incident, the list of authorities to be contacted (i.e. AMSA JRCC) and the oil spill details to be provided (i.e. forms)
- A detailed description of action to be taken by the personnel on board to reduce or control the discharge (actual or probable) following the incident (i.e. operational spill prevention)
- Roles and responsibilities of all personnel (master, radio officer, chief officer, chief engineer, etc.,) with respect to the particular oil spill incident experienced
- Procedures and point of contact on the ship for coordinating shipboard activities with national and local authorities
- Details of SOPEP equipment held on-board the vessel
- Vessel drawings (drainage and layout)
- SOPEP testing and drill requirements.

The SOPEP also includes specific emergency procedures including steps to control discharges for bunkering spills, hull damage, grounding and stranding, fire and explosions, collisions, tank failure, sinking and vapour release. The typical structure and content of a SOPEP is provided in Table 1-1.

CGG, as part of seismic contractor selection, will confirm the vessel has an IMO certified SOPEP (or equivalent document according to vessel class); equipment and resources as described in the SOPEP are available; and that all scheduled drills and exercises have been undertaken against the documented testing program in the SOPEP.

Table 1-1 - Contents of a Typical SOPEP

Section	Section Title	Content
1	General purpose and introduction	Details the custodian of the manual and its purpose
2	Reporting requirements	Reporting procedures, when and what to report
		Information requirements, actual/probable discharges
		Lists of people to contact including coastal ports; coastal
		State and vessel interested contacts
3	Steps to control/prevent discharges	Types of operational spills (pipes, tank leakage, spills from equipment) and types of spills from accidents and groundings (prevention of fire/explosion, extent of damage containment, reduction of spill volumes, securing the vessel).
		Priority actions followed by mitigation actions, transfer of bunker/lightering, hull stress assessment
		Responsibilities of the master and designated Officers
		General Responsibilities of crew
4	National and local coordination	master to coordinate all activities with the coastal state
		Communication procedures for assistance/liaison with the coastal state
5	Other relevant information	Local requirements
		Insurance policy details
		Owner/operator policies
		Reference material
Appendices	Appendix 1: Initial Notification	
	Appendix 2: Coastal State Contacts (Focal Points)	
	Appendix 3: Port Contacts	
	Appendix 4: Ship Interest Contacts	
	Appendix 5: Ship Plans and Drawings	
	Appendix 6: On-board Spill Equipment	
	Appendix 7: Records on Oil Pollution Drills	

1.3.2 NatPlan

The National Plan for Maritime Environmental Emergencies (NatPlan) sets out national arrangements, policies and principles for the management of maritime environmental emergencies.

The NatPlan integrates Commonwealth and state government response oil spill response frameworks to facilitate effective response to marine pollution incidents. AMSA manages NatPlan, working with state governments (who have equivalent state plans which integrate into NatPlan); the shipping, petroleum, chemical industries; and emergency services to maximise Australia's marine pollution response capability to incidents.

NatPlan applies to all hydrocarbon spills in Commonwealth waters seaward of the state waters limit and the State Hazard Plan applies in state waters within 3 nm of the territorial sea baseline.

1.3.3 State Hazard Plan

The WA state Hazard Plan for Maritime Environmental Emergencies (State Hazard Plan) provides an overview of arrangements for the management of marine oil pollution and marine transport emergencies in Western Australia and contains information on prevention, preparedness, response and recovery.

The State Hazard Plan prescribes the management arrangements for the prevention of, preparation for, response to and recovery from a MOP incident in order to minimise the impacts of MOP from vessels, offshore petroleum activities and other sources in state waters.

In accordance with the plan, where state waters are impacted by a Level 2/3 MOP incident resulting from an offshore petroleum activity in Commonwealth waters, the Western Australia Department of Transport (DoT) will assume the role of CA for the portion of the response activity that occurs within state waters.

Note that oil spill modelling results indicate a low likelihood of oil spill residue intersection with Western Australian state waters.

1.3.4 WA Oiled Wildlife Response Plan

Oiled wildlife response is an integral part of a Maritime Environmental Emergency response. The Western Australian Oiled Wildlife Response Plan for a Maritime Environmental Emergency is administered by the Department of Biodiversity, Conservation and Attractions (DBCA).

During a Maritime Environmental Emergency, DBCA will lead the oiled wildlife response under the control of the appointed CA.

1.4 Review and Update

This OPEP is required to be reviewed, and if applicable updated, to ensure that all relevant information is accurate and that new information or improved technology is evaluated and used to adapt and improve the management of spills.

Any revisions to this OPEP will be undertaken utilising CGG's Management of Change process observing the EP revision triggers in the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023.

Trigger thresholds for an EP revision include:

- Inclusion of a new activity
- If there is a significant modification or new stage to an activity
- If a significant new environmental impact or risk, or significant increase in existing environmental impact or risk identified for the Sauropod 3D MSS activity
- If there is a series of new environmental impacts or risks or a series of increases in existing environmental impacts or risks, which when taken together, results in a significant new environmental impact or risk; or a significant increase in existing environmental impact or risk no provided for in the EP; or
- If there is a change in titleholder that results in a change in the manner in which environmental impacts and risks are managed.

This OPEP will be distributed to all relevant CGG Sauropod 3D MSS participants, the seismic contractor and relevant government authorities after acceptance of the Sauropod 3D MSS EP.

2 Response Arrangements

2.1 Jurisdictional Authority and Control Agency

The NatPlan defines two levels of responsibility:

- Jurisdictional Authority (JA), having the jurisdictional or legislative responsibility to ensure there is adequate prevention of, preparedness for, response to and recovery from an oil spill incident
- Control Agency (CA) having the responsibility to take operational control and respond to an oil spill in the marine environment.

Table 2-1 provides details of the JA and CA with respect to a marine oil spill from vessels and petroleum activities in Commonwealth waters. A spill from Sauropod 3D MSS activities would be classed as an offshore petroleum vessel-based incident, as shaded in the table.

Table 2-1 - Jurisdictional Authority and Control Agency (source: AMSA 2018)

Spill Location	Spill Source	Jurisdictional Authority	Control Agency
Commonwealth waters	Vessel-based Incident	AMSA	AMSA
	Offshore petroleum vessel-based incident (including seismic and support vessels)	NOPSEMA and AMSA*	AMSA
	Petroleum activity – facility or infrastructure	NOPSEMA	Petroleum titleholder

* NOPSEMA has legislative responsibilities for oversight of offshore petroleum activities. AMSA has legislated responsibility for all vessels in Commonwealth waters.

CGG recognises the legislated responsibility of AMSA as CA for vessel-based marine oil spills in Commonwealth waters, and AMSA will assume control of the incident as CA for vessel-based spills associated with the Sauropod 3D MSS. However, CGG will monitor and liaise with AMSA, the vessel master and seismic contractor and provide assistance as required.

AMSA will implement NatPlan in the event of a vessel-based spill in Commonwealth waters in accordance with the spill level descriptions contained in Figure 2-2.

AMSA will maintain control of the response until relevant termination criteria are achieved, or in the event that the spill enters state waters, CA responsibility may transfer to DoT.

2.1.1 Commonwealth Waters

AMSA is both the JA for ensuring suitable vessel-sourced spill response arrangements and the CA responsible to respond to vessel-based spills in Commonwealth waters in accordance with the NatPlan. For the purposes of oil spill contingency planning, vessels are considered part of the 'petroleum activity' while they are in the Sauropod 3D MSS Operational Area. If a vessel-sourced spill occurs when undertaking MSS activities, this OPEP will be activated to support the spill, however AMSA, as CA, will remain in control of the response activities with CGG providing available support to AMSA.

Any spill originating from vessels outside the Sauropod 3D MSS Operational Area or when transiting to or from the area are not 'petroleum activities;' and are managed via their respective Shipboard Oil Pollution Emergency Plans (SOPEPs) as regulated by AMSA under the *Commonwealth Protection of the Seas (Prevention of Pollution by Ships) Act 1983*.

2.1.2 State Waters

DoT is the JA and CA responsible for managing MOP emergencies in state waters, in accordance with the State Hazard Plan. The CA has overall responsibility for ensuring there is an adequate response to a MOP incident in state waters, including those from a petroleum activity originality in Commonwealth waters. If a vessel-based spill occurs during the Sauropod 3D MSS (and enters state waters), this OPEP will be activated to support the spill, however DoT, as CA, will remain in control of the response activities within the portion of the response in state waters. CGG will provide support to DoT (as necessary).

2.2 Emergency Response Organisation

Figure 2-1 provides the Sauropod 3D MSS emergency reporting structure for marine emergencies/oil spills. Table 2-2 details the responsibilities of response teams with regard to oil spill response. Notification responsibilities are contained in Section 2.5.

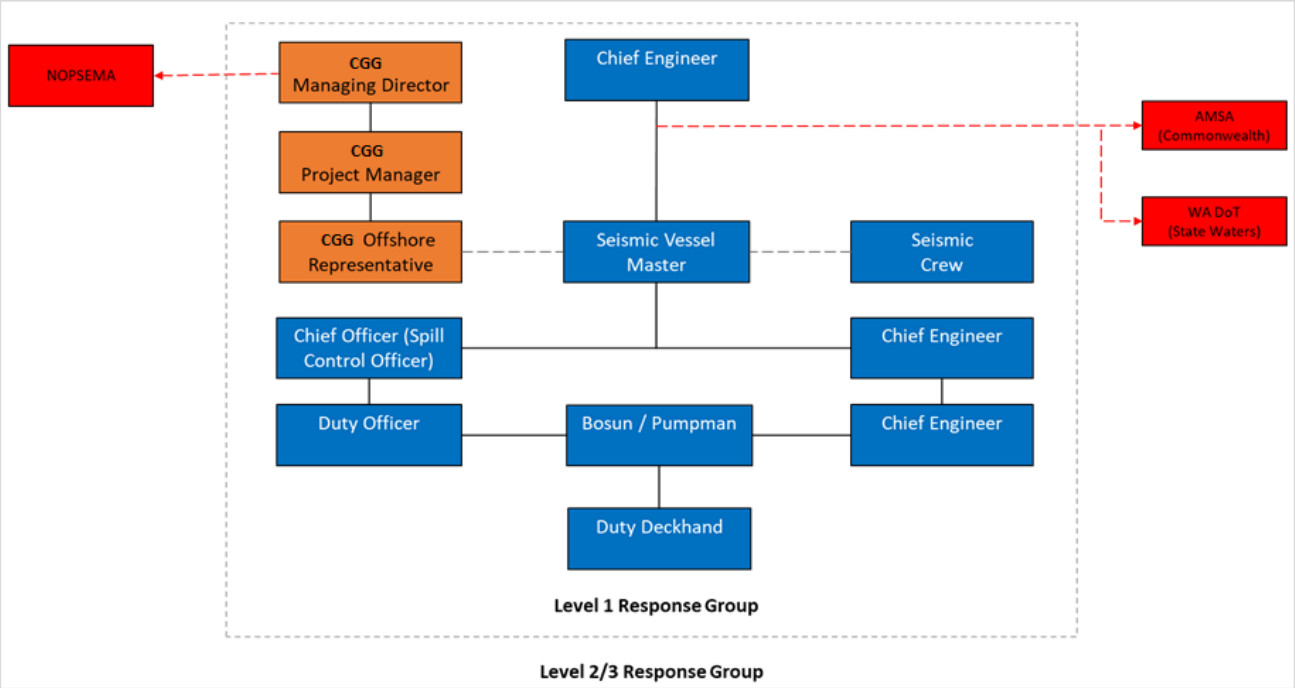


Figure 2-1 - Sauropod 3D MSS Emergency Reporting Structure

Table 2-2 - Response Teams and Responsibilities

Team	Responsibility
MSS Vessel Emergency Response Team (ERT)	The ERT is responsible for initiating the Incident Action Plan (refer Immediate Actions – First Strike Response) and emergency procedures as detailed in the vessel's SOPEP. The major roles within the ERT are as follows: The vessel master has overall control of the on-board operations and has the responsibility of reporting the incident, without delay, to AMSA. The master oversees any stability computations/evaluations, direct damage controls; initiates incident investigations and coordinates response activities with AMSA (as appropriate). The chief engineer, in charge of the engine room and bunkering activities, coordinates spill response activities within the engine room and ensures that all available engine room staff are mobilised for containment and clean-up activities. The duty engineer ensures engine room services are available to deck personnel engaged in clean-up operations (e.g. air, water, power). The chief officer is responsible for containment and clean-up activities, checking stability criteria and keeping the master informed and updated. The duty officer assists the chief officer as required, and alerts and mobilises all off-duty personnel. The duty deckhand alerts all personnel as soon as possible and will attempt to contain any oil spill on deck, and prevent oil from going over the side by using available sorbents or sawdust, rags, scuppers, etc.

Team	Responsibility
	Duty rating(s) alerts officer(s) on duty immediately of an oil leakage. Positions sorbent materials/clean-up material to prevent any oil from escaping overboard and commences clean-up by using the available equipment on-board the vessel. Other crew responsibilities follow the instructions of the chief officer and carry out containment and clean-up operations as directed
Seismic contractor company Emergency Response Group (ERG)	Primary duty is to ensure that the master is fully supported and to engage with regulatory authorities and relevant resources as detailed in the SOPEP. This may include logistics support and telecommunications; safety; planning; finance; insurance and legal support. The seismic vessel manager normally represents the ERG.
CGG Crisis and Emergency Management Team (CEMT)	The CGG managing director normally represents the CGG CEMT and maintains contact with NOPSEMA after initial incident notification (and provides regular interval updates). The CEMT monitors the incident and provides support (as required). The CEMT also provides updates to affected stakeholders (as necessary). Note, in the event of a Level 2 oil spill from Sauropod 3D MSS vessels, CGG will monitor for oil impacts to environmental sensitivities and if oil is detected at levels which may cause environmental impact to the particular sensitivity and will undertake any additional scientific monitoring considered necessary (e.g. wildlife monitoring).

2.3 Spill Level Classification

The level of spill response depends on the nature and scale of the spill, whether on-site resources can manage the response or additional support resources are required, and the environmental sensitivities at risk. Figure 2-2 provides NatPlan guidance for spill level classification. The CGG project manager shall make an initial assessment of the spill level based upon the initial guidance information provided and NatPlan criteria.

Characteristic	Level 1	Level 2	Level 3
		MANAGEMENT	
Jurisdiction	Single jurisdiction	Multiple jurisdictions	Multiple jurisdictions, including international
Delegation	Incident Controller responsible for all functions	Some functions delegated or Sections created	All functions delegated and/or divisions created
Number of agencies	First-response agency	Routine multi-agency response	Agencies from across government and industry
Incident Action Plan	Simple/Outline	Outline	Detailed
Resources	Resourced from within one area	Requires intra-state resources	Requires national or international resources
		TYPE OF INCIDENT	
Type of response	First-strike	Escalated	Campaign
Duration	Single shift	Multiple shifts Days to weeks	Extended response Weeks to months
Hazards	Single hazard	Single hazard	Multiple hazards
		RESOURCES AT RISK	
Human	Potential for serious injuries	Potential for loss of life	Potential for multiple loss of life
Environment	Isolated impacts or with natural recovery expected within weeks	Significant impacts and recovery may take months. Remediation required	Significant area and recovery may take months. Remediation required
Wildlife	Individual fauna	Groups of fauna or threatened fauna	Large numbers of fauna
Economy	Business level disruption	Business failure	Disruption to a sector
Social	Reduced services	Ongoing reduced services	Reduced quality of life
Infrastructure	Short term failure	Medium term failure	Severe impairment
Public Affairs	Local and regional media coverage	National media coverage	International media coverage

Figure 2-2 - NatPlan Guidance on Spill Level Classification

For a Level 1 response:

- The spill can be managed by the vessel master with on-board equipment and trained vessel crew members. These are small spills which will not impact shorelines or other sensitive resources.
- The vessel master is responsible for notifying the JA (AMSA). The vessel master (or delegate) shall monitor the spill and notify AMSA of the situation status. AMSA, as CA for Level 1 spills in Commonwealth waters will monitor and continue to assess this level of spill.

For a Level 2/3 Response:

- A Level 2/3 spill cannot be managed by the vessel master or may have serious impacts on the environment.
- The vessel master will notify AMSA as soon as possible. AMSA will assume control of the spill incident and respond. The responsibilities of the CA under a Tier 2/3 spill scenario include:
  - Monitoring the spill, its weathering and proximity to environmentally sensitive locations and developing an oil spill response strategy to mitigate impacts to protection priorities in the spill-affected area
  - Undertaking oil spill trajectory modelling (as necessary) to predict slick movement
  - As required, and after a NEBA assessment, deploy appropriate resources or equipment to protect identified sensitive environmental resources (i.e. primarily marine fauna).

On-site resources will continue to provide status updates (SITREPs), regardless of the spill level, at the direction of AMSA, throughout the response activity.

2.4 Spill Response Management Team – Level Structures

2.4.1 Level 1 Structure

The vessel master will mount the first response to the spill incident in accordance with the vessel's SOPEP using the resources immediately available to the vessel. The master will also immediately notify any spill to the Rescue Coordination Centre (AMSA). Refer to Section 2.5 for regulatory notification responsibilities.

The CGG offshore representative is responsible for notifying the CGG project manager of the spill. For this spill level, while the CGG managing director will be internally notified, full mobilisation of the CGG CEMT is not anticipated.

The vessel master (or delegate) shall monitor the spill and provide updated reports to AMSA of the spill situation to inform AMSA on the adequacy of the spill response strategy. Updates will occur at frequencies determined by AMSA, until the spill is effectively dispersed or evaporated, with oversight by, and in close cooperation with, AMSA.

AMSA, as CA for Level 1 spills in Commonwealth waters will monitor and continue to assess this level of spill. Note that AMSA can reassess the response at any time and escalate the level as required.

2.4.2 Level 2/3 Structure

A Level 2 spill cannot be managed by on site resources and/or could have serious impacts on the environment.

The vessel master, after ensuring safety of crew, fire prevention and notification to AMSA JRCC, will implement the SOPEP and consider actions to reduce the oil volume released to the environment (refer Section 5.1 for typical SOPEP responses to vessel spill scenarios). AMSA will assume control of a Level 2/3 spill incident and response in Commonwealth waters. If the spill enters state waters, DoT will assume the role of CA for the portion of the response activity that occurs within the state waters. A high-level coordination between DoT, AMSA and CGG would be required in the event of cross-jurisdictional incidents.

The CGG offshore representative will notify the CGG project manager of the spill. Full mobilisation of the CGG CEMT may occur as a result of a Level 2 spill. CGG will notify NOPSEMA, NOPTA, DMIRS, DNP and DoT (for state waters) of the incident.

AMSA (CA) will determine the appropriate response strategies depending upon the protection priorities at risk within the affected spill area. AMSA will determine the need for oil spill trajectory modelling (OSTM) to confirm areas at risk from the spill; and initiate possible sea/aerial surveillance to confirm/inform trajectory predictions. All selected response strategies will be in accordance with NatPlan and a Net Environmental Benefits Assessment (NEBA) for the specific spill scenario. This will include an assessment of all available response strategies, the effectiveness of the response for the oil type, and their associated risk to protection priorities in the affected area. CGG will consult with AMSA during this assessment.

The vessel master is responsible for providing SITREPs to AMSA to inform the spill response strategy.

AMSA will maintain CA responsibility for the response until relevant termination criteria are achieved.

A Level 3 spill response is not considered credible for the Sauropod 3D MSS activities, due to the limited spill size, fuel type and location of activity.

2.5 Notification and Reporting Requirements

This section provides a summary of the internal and external notifications for any hydrocarbon release from vessel activities in the Sauropod 3D MSS Operational Area.

The vessel master shall ensure that all port and emergency agency contact lists are complete, listed and posted in key locations on the vessel and that all relevant notifications have been provided to these agencies prior to the survey commencement.

2.5.1 Internal

Spill Notification: All spill events to the marine environment will be notified to the CGG project manager regardless of the volume. Information to be supplied with the notification to allow the CGG project manager to assess the response level is contained in Table 2-3.

Table 2-3 - Notification Information

Details
What is the source of the spill and the location of the spill?
What type of hydrocarbon has been released?
How much material has been released (e.g. estimated size based on a 'known' hydrocarbon inventory or an estimate based upon the appearance and area of oil on the sea surface (refer Section 5.2)?
Has the SOPEP been implemented and has the source been contained or is it continuing?
What is the worst-case scenario?
What are the weather conditions – wind speed and direction, swell and current speed and direction?

2.5.2 External

Regulatory Authorities: All Level 2 spills must be notified to the relevant JA as soon as practicable but within two hours of the event (or becoming aware of the event). Regulatory notification and reporting requirements for vessel spills are provided in Table 2-4.

It is important that information generated during an initial response is accurately recorded, transmitted, acted upon and ultimately stored for future use. The information most important to capture is:

- Incident details – where, what, when, how, why (where possible)
- Extent of spill (volume, hydrocarbon type, continuing release)
- Immediate actions taken.

Table 2-4 - Notification Requirements for a Vessel Spill

From	To	Method	Timing	Additional Information
CGG offshore representative	CGG project manager	Verbal	Immediately	Details in Table 2-1
Vessel master	Vessel manager	Verbal	Immediately	-
	AMSA	Verbal	Immediately	Report verbally to AMSA: Ph: +61 2 6230 6811
		Written notification (POLREP)	ASAP	Online: https://amsa-forms.nogginoca.com/public/
		Written updates (SITREP)	As requested, or every 24 hours	Online: https://amsa-forms.nogginoca.com/public/
CGG project manager	CGG Crisis/ Emergency Management Team (CEMT)	Verbal	ASAP	CEMT callout list (refer Appendix 1)
CGG managing director (or delegate)	For Level 2 (Reportable) Spill: NOPSEMA	Verbal	ASAP but not later than two hrs of the incident occurring	Notify verbally: Ph: 1300 674 472
		Written notification	ASAP after verbal notification	NOPSEMA Form N-3000-FM0831 available at https://www.nopsema.gov.au/document-hub/forms-and-templates Email: submissions@nopsema.gov.au

From	To	Method	Timing	Additional Information
		Written incident report	Within three days of incident	Written incident report: submissions@nopsema.gov.au
	For Level 2 (Reportable) Spill: NOPTA	Written notification	As soon as practicable after NOPSEMA notification	Copy of NOPSEMA Form N-3000-FM0831 Email: reporting@nopta.gov.au
		Written incident report	Within seven days of written report submission to NOPSEMA	Written incident report: reporting@nopta.gov.au
	For Level 2 (Reportable) Spill: DMIRS	Written notification	As soon as practicable after NOPSEMA notification	Copy of NOPSEMA Form N-3000-FM0831 Email: petroleum.environment@dmirs.wa.gov.au
		Written incident report	Within seven days of written report submission to NOPSEMA	Written incident report: petroleum.environment@dmirs.wa.gov.au
	Director of National Parks	Verbal	ASAP - For any spill release within a marine park or likely to impact on a marine park:	Notify verbally: Ph: 0419 293 465 (24 hr marine compliance duty officer Information to include: Title holder details Time and location of incident (including marine park likely to be affected) Proposed response Contact details of the response coordinator Email: marineparks@environment.gov.au
	For Level 2 Spill: DoT	Verbal	Within two hours – for all actual or impending spill incidents that are in, or may impact, state waters	Verbal notification to maritime environmental emergency response (MEER) duty officer via the 24-hour reporting number (08) 9480 9924.
		Written notification (POLREP)	Following verbal notification	Initial notification to be followed by detailed MOP Incident Report Form (POLREP) accessed at: https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf Report submitted to: marine.pollution@transport.wa.gov.au

2.5.3 Supplementary

Table 2-5 provides additional external notifications (excluding response resources) which may be required depending upon the nature and scale of the spill incident (specified scenarios).

Table 2-5 - Additional External Notifications

Stakeholder	Issue	Spill Level	Time Frame	References
Commercial Fishing Licence holders	Protection from spill impacts	Level 2/3	Within four hours	Refer stakeholder contacts directory
Adjacent petroleum titleholders	Spill notification	Level 2/3	Within four hours	Refer Appendix 1
Department of Energy and Environment	Damage to wildlife of national environmental significance	Any	Within 72 hours	Refer Appendix 1

2.6 Oil Spill Response Resources

2.6.1 Seismic and Support Vessels

General Equipment: The response equipment for the prevention / minimisation of loss of oil to sea during the proposed Sauropod 3D MSS will include the vessel's on-board spill response kit equipment. Typical contents include:

- Absorbent materials and kits
- Scupper and drain plugs
- Hand shovels and scoops
- Protective clothing
- Portable pumps
- Portable containers
- Portable radios.

This equipment is stored in dedicated lockers located on the vessel and identified as spill equipment (as outlined in the Vessel's SOPEP).

All relevant crew are trained in the use of the vessel equipment listed above and the PPE required to appropriately respond to the spill (as contained in Safety Data Sheets).

Sauropod Resources: For the Sauropod 3D MSS, the following additional resources are also available to assist in oil spill response activities:

- A support and scout vessel (slick monitoring)
- Marine fauna observers (MFOs) on the MSS vessel to monitor for oil spill impacts on fauna
- An oil spill trajectory monitoring buoy to be released from the MSS vessel in the event of a Level 2 spill to assist with slick monitoring
- Access to OSTM services (not 24 hour/emergency)
- Scientific monitoring resources.

2.6.2 NatPlan Resources

AMSA as CA in Commonwealth waters has the capability of mobilising resources for the following activities:

- Trained personnel to support oil spill response activities
- NatPlan equipment (Dampier is the closest national equipment stockpile)
- Oil-industry based Australian Marine Oil Spill Centre (AMOSC) equipment and 'core-group' personnel
- Oil spill trajectory modelling services
- Aerial surveillance via Dornier aircraft (if no conflict with search and rescue activities)
- OSRA resources.

2.6.3 State Hazard Plan

The DoT maintains a database of Maritime Environmental Emergency response equipment managed by DoT, the port authorities, port facility operators and boat harbour operators.

Each port, port operator, port facility operator and boat harbour operator is required at a minimum to hold and maintain a stockpile of Level 1 response equipment commensurate with their identified risk.

3 Response Option Assessment

3.1 Hydrocarbon Spill Scenarios

Credible spill scenarios identified for the Sauropod 3D MSS activity are broadly divided into two categories:

- Small spill quantities from uncontained deck spills/leaks or refuelling to the marine environment
- Larger spills resulting from vessel failure (e.g. vessel collision).

In accordance with NatPlan/State Hazard Plan, the following strategy should be adopted by the CA, depending on the circumstances of the spill and the conditions prevailing:

- If possible, control or stop the outflow of oil from the source
- If coastal or marine resources are not threatened or likely to be threatened, monitor the movement and behaviour of the spill
- If coastal and marine resources are threatened, where practicable, activate response operations to protect sensitive resources
- If possible, contain the spread of oil
- If, due to weather and se conditions, response at sea is not feasible or protection of sensitive areas is not feasible, or these have already been affected, determine appropriate clean-up priorities and other response measures.

3.2 Hydrocarbon Characteristics (MDO)

Vessels engaged in the Sauropod 3D MSS will use marine diesel oil (MDO) which is classified as Group II oil. The properties of MDO are described in Table 3-1.

MDO has the following behaviour at sea:

- The hydrocarbon spreads very rapidly to thin thicknesses elongated in the direction of the wind and current.
- Evaporation is the dominant process contributing to the removal of spilled MDO from the sea surface and can account for 60–70% loss (depending upon wind conditions and sea temperature).
- MDO residues usually consist of heavy components which may persist for longer and tend to disperse as oil droplets in the upper layers of the water column in the presence of waves but can refloat to the surface if wave energies abate.

Table 3-1 - MDO Fuel Properties (ITOPF, 2011)

Oil type	SG (at 25 °C)	Viscosity (cP at 25 °C)	Pour Point (°C)	Flash Point (°C)	API Gravity	Oil Persistence Category/ Classification
MDO	0.83	4.0	-14.0	61.5	37.6	Group II (Light Persistent Oil)

The prevailing weather conditions will influence the weathering and fate of the MDO. Under lower wind speeds (five knots), the MDO will remain on the surface longer, spread quicker, and in turn increase the evaporative process. Conversely, sustained stronger winds (>15 knots) will generate breaking waves at the surface, causing a higher amount of MDO to be entrained into the water column and reducing the amount available to evaporate. Figure 3-1 provides the predicted weathering and fate graphs as a percentage of a single instantaneous surface spill of 280 m^3 MDO under three static wind conditions (five, ten and 15 knots).

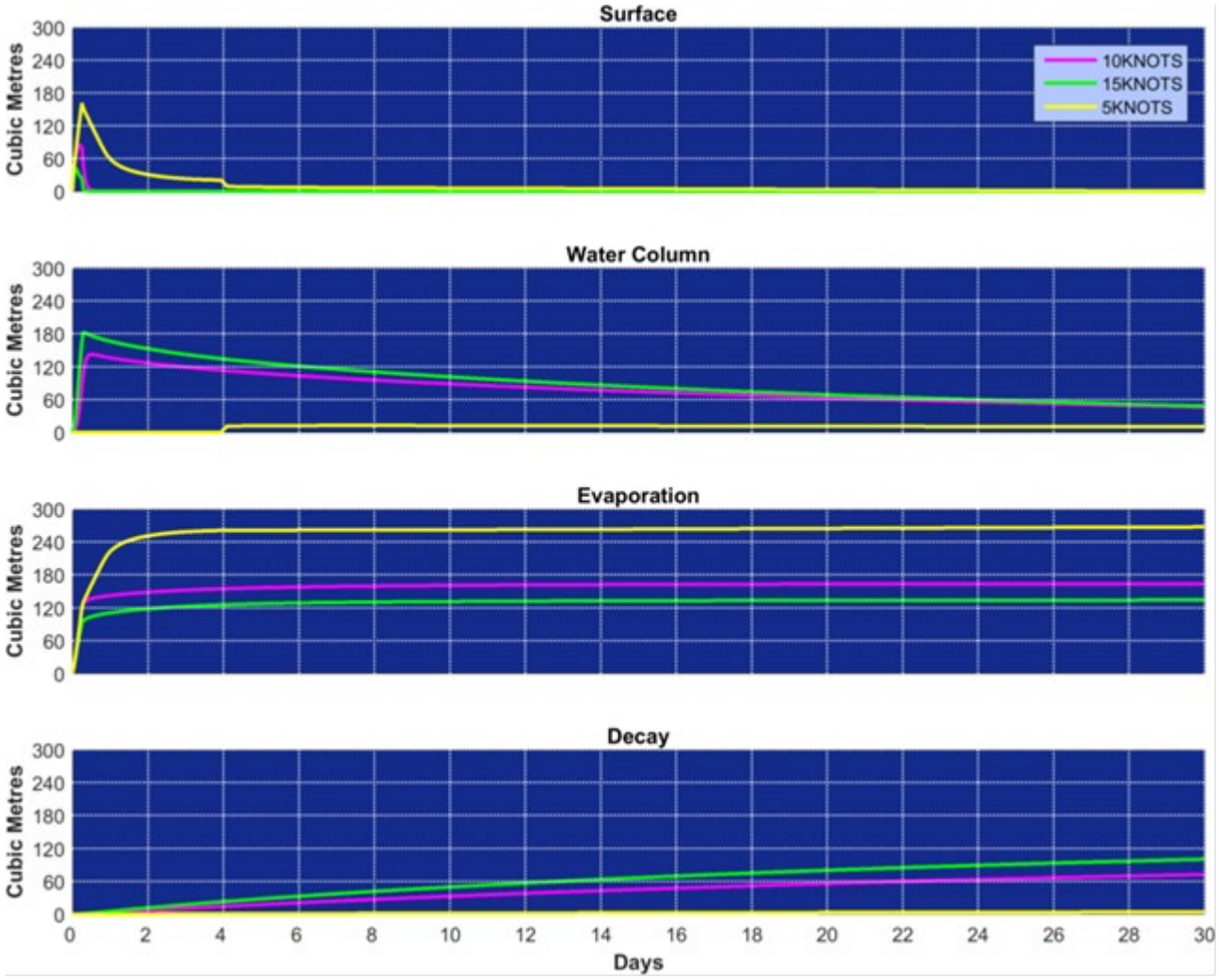


Figure 3-1 - Weathering of MDO Under Three Static Winds Conditions (Five, Ten and 15 Knots). The Results Are Based on a 280 m^3 Surface Release of MDO over Six Hours and Tracked for 30 Days

3.3 Oil Spill Modelling

3D Oil commissioned RPS to model the worst case (credible) oil spill scenario for the Sauropod 3D MSS, using the oil spill dispersion model SIMAP. 3D Oil conducted hydrocarbon spill modelling for the largest fuel tank size in their planned vessel type (of 280 m^3). Although the specific vessel for the survey has yet to be determined, this scenario is used for the basis of this risk assessment as it is greater than the largest single fuel tank size for the vessels proposed for this survey (257 m^3) and therefore is considered to be a conservative assessment. SIMAP's stochastic model was used to quantify the probability of exposure to the sea surface and water column and probability of shoreline contact from hypothetical spill scenarios.

The model considered the following hypothetical, yet plausible scenario:

- A 280 m^3 release of marine diesel oil resulting from a vessel collision incident at the closest point of the operational area to the Rowley Shoals.

The key findings of the modelling, included:

- No shoreline contact above the low (10 g/m^2) threshold was predicted for the scenario.
- Modelling results demonstrated that surface oil at low (1 g/m^2), moderate (10 g/m^2) and high (25 g/m^2) exposure levels could potentially travel greater distances during the transitional period, compared to the summer and winter periods. The maximum distance travelled by surface oil for the low, moderate and high threshold was 66 km, 14 km and 7 km, respectively.

- While the low exposure surface oil was predicted to travel in any directions from the release site, surface oil above the moderate and high exposure levels remained along the north-west to south-east axis across all seasons.
- The modelling results demonstrated a low likelihood (1–2%) of low surface oil exposure to the Argo-Rowley Terrace Australian Marine Park.
- The maximum time-averaged exposure to dissolved hydrocarbon at the depths of 0–10 m remained less than 1 ppb for the winter and transitional seasons while reaching 4 ppb for the summer and winter seasons for various receptors. The maximum instantaneous exposure to dissolved hydrocarbons ranged from 6 ppb to 73 ppb for the transitional and summer seasons, respectively.
- There were no zones of potential time-averaged exposure to dissolved hydrocarbon above the low exposure threshold (6 ppb).
- The maximum time-averaged exposure to entrained hydrocarbons ranged from 4 ppb to 499 ppb for the transitional and winter seasons respectively.
- The maximum instantaneous exposure to entrained hydrocarbon was 6,287 ppb for the North West Shelf.

3.3.1 Geographic Response Area

The environment that may be affected (EMBA) and geographic response area is based on spill modelling for the worst-case credible spill scenario during the Sauropod 3D MSS. Modelling was conducted for a spill scenario at the north-west corner of the Operational Area. The EMBA is defined by the furthest extent that may be reached by entrained hydrocarbons (>10 ppb) in the event of a surface release of 280 m^3. It is important to note that the EMBA covers a much larger area than the area that is likely to be affected during any one single spill event. The modelling was run for a variety of weather and metocean conditions (300 simulations in total), and the resulting EMBA for the north-west corner of the Operational Area was extrapolated to the three other corners.

Figure 3-2 provides the predicted geographic area covered by this OPEP based upon the environment which may be affected (EMBA) from spills during Sauropod 3D MSS activities.

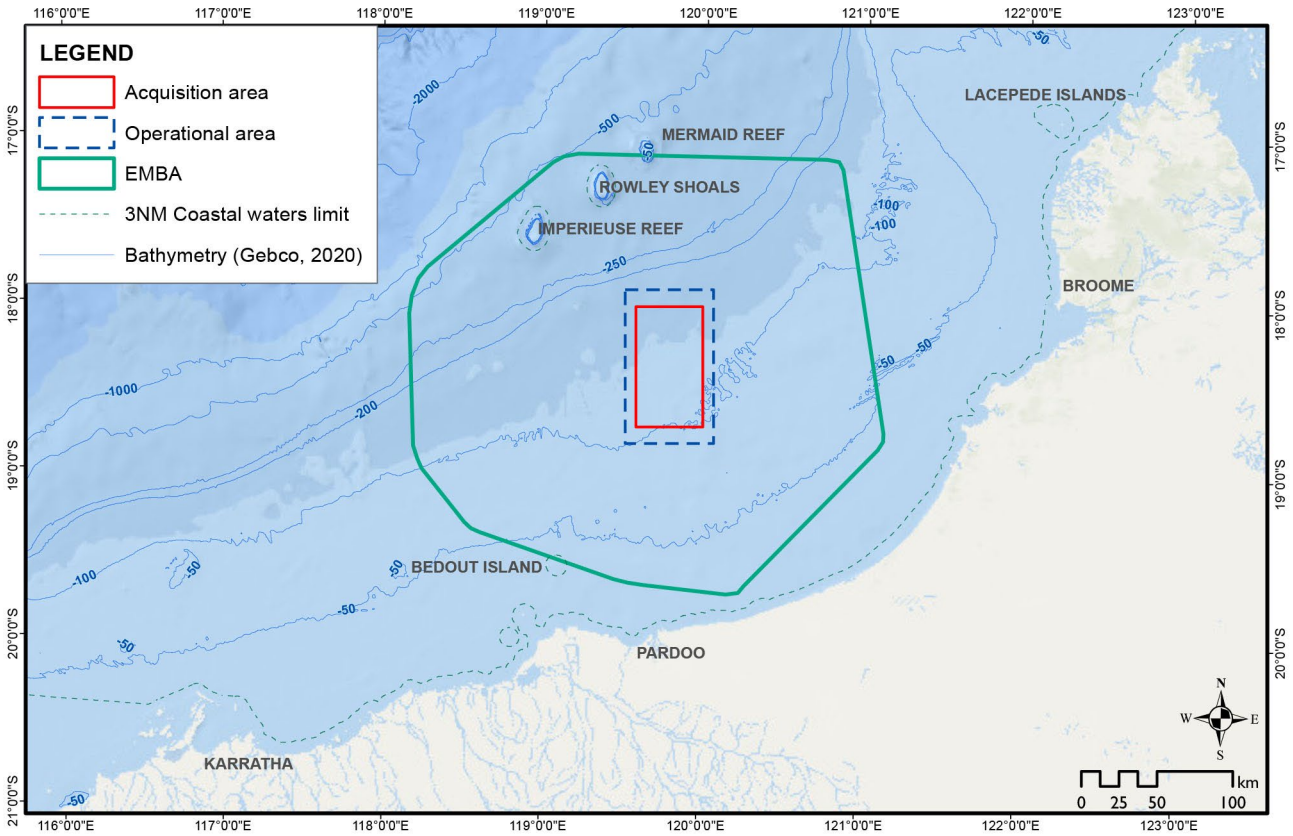


Figure 3-2 - Predicted Geographic EMBA

3.4 Response Option Effectiveness

A preliminary assessment of the suitability and operational effectiveness of response options to MDO has been undertaken in Table 3-2.

Given the rapid evaporation/volatilisation of MDO when released, the rapid spreading rate of MDO, and the small amounts of residual hydrocarbon reaching shorelines, the primary response strategy is to initiate source control and then monitor and evaluate the spill (natural weathering). Additional measures may be adopted to protect specific environmental sensitivities within the spill response EMBA.

The response strategy selected during a real-life spill event will be determined by the CA (AMSA in Commonwealth waters and DoT in state waters).

Table 3-2 - Preliminary Response Option Assessment

Response Option	Description	Sauropod 3D MSS MDO Assessment	Suitability
Source control	Stop or limit flow of oil to the environment.	Achievable in accordance with vessel-specific SOPEP.	✓
Monitor and evaluate	Direct observation (aerial or marine) Spill trajectory / vector calculations Oil spill trajectory modelling Satellite tracking buoys.	To maintain situational awareness all monitor and evaluate options are suitable. Aerial is more effective than vessel surveillance to inform spill response. MSS vessels may provide support with observations.	✓
Natural weathering	This response option is adopted with a monitor and evaluate surveillance strategy when sensitive environmental resources are not considered 'at risk' from a marine oil spill, or where other response options are not practicable or will not achieve a net benefit.	MDO evaporates rapidly leaving only small levels of persistent residues after 24-48 hrs of weathering. No toxic components are predicted to be present in concentrations which would affect marine fauna after approximately 24 hours. Response option is preferred for MDO spills as it avoids other additional hazards associated with intervention.	✓
Dispersant application	Application (i.e. spraying) of oil dispersant agents onto oil from an aircraft or vessel may breakdown surface oil slicks and draw droplets into upper layers of water column. Increases biodegradation and weathering.	MDO is not amenable to dispersant application. MDO, while having a small persistent fraction, spreads rapidly to thin layers. Dispersant application can result in punch-through where dispersant passes into the water column without breaking oil layer down. This response option is unsuitable for MDO.	X
In-situ burning	Controlled in-situ burning involves the controlled burning of hydrocarbons in order to rapidly reduce the volume of oil on the water's surface, thereby reducing its potential to spread to sensitive receptors.	In-situ burning is only suitable for use on hydrocarbons >1–2 mm think with calm sea and light winds. It also requires fire-resistant booming. MDO spreads rapidly to less than 10 g/m^2 (0.01 mm), which makes this response option unsuitable for MDO.	X
Contain and recover	Booms and skimmers to contain surface oil for mechanical or manual recovery and disposal. Relies on calm conditions and thicknesses >10 g/m^2 in order to be effective.	MDO spreads rapidly to less than 10 g/m^2 thicknesses within 24–48 hours. Given the time to mobilise resources to the spill site (>24 hrs), this response option is unsuitable for an MDO spill.	X

Response Option	Description	Sauropod 3D MSS MDO Assessment	Suitability
Protect and deflect	Booms deployed to protect environmental sensitivities. Environmental conditions (e.g. currents and waves will limit application)	MDO spreads rapidly to less than 10 g/m^2 thicknesses within 24–48 hours. Given the time to mobilise resources to the spill site (>24 hrs), booms will have limited, if any, effect. Surface / shoreline receptors within the EMBA are limited. Shorelines or emergent reefs are not predicted to be exposed to MDO from a spill during the Sauropod 3D MSS. Booms have the potential to damage coral reef during deployment.	X
Shoreline assessment and clean-up	Where shoreline impacts are predicted or have occurred, a shoreline assessment may be initiated. Subject to the outcome of a shoreline assessment and a NEBA, shoreline clean-up may be initiated. This may include manual or mechanical removal of oiled substrate, physical washing or jetting of shorelines, or chemical cleaning.	Note shoreline assessment will depend on the mobilisation and safety of trained personnel in remote locations. No shorelines are predicted to be contacted by MDO from a spill during the Sauropod 3D MSS. In the highly unlikely event that a real-life spill event results in oil contacting shorelines / emergent reef at the Rowley Shoals or Bedout Island, quantities will be small and the state of weathering of the MDO will be advanced. Leaving remaining traces of MDO to weather and disperse is likely to have a greater net environmental benefit than clean-up, which may remove or disturb shoreline habitats. The remote locations also limit the ability for this option to be initiated safely and effectively.	X
Oiled wildlife response	Consists of capture, cleaning and rehabilitation of oiled wildlife. May include hazing or pre-spill captive management. In WA this is coordinated by DoT and DBCA. Mobilisation and safety of trained personnel in remote locations, as well as the limited potential to recover wildlife from the water, significantly limit the potential effectiveness of this option.	Given limited spill volume and rapid spreading and weathering of MDO, a large-scale wildlife response is not predicted. There is potential for a small number of individual birds or other fauna to be affected in the immediate vicinity of the spill. Limited	

3.5 Net Environmental Benefits Assessment

This section provides details on the environmental sensitivities at specific locations within the Sauropod 3D MSS EMBA where spill response may offer a net environmental benefit. Based upon this assessment, protection priorities and preliminary location-specific response strategies have been identified.

Table 3-3 provides the sensitivity criteria adopted in the prioritisation of environmental sensitivities.

An assessment of effective spill mitigation techniques and the net benefit they offer to specific environmental sensitivities within the Sauropod 3D MSS EMBA is provided in Table 3-4. This planning NEBA is used to compare the environmental and socio-economic benefits of implementing a response option against a 'do-nothing' (monitor and evaluate and natural weathering) strategy to arrive at a response strategy for the location which results in the lowest overall environmental and socioeconomic impacts.

Table 3-3 - Sensitivity Prioritisation

Sensitivity	Code	Criteria
High	S1	Identified marine sanctuary or reserve. Presence of known threatened species feeding, breeding, nesting or aggregation areas. Areas of national significance or biological processes for species of national significance (e.g. breeding sites and national and state parks, Commonwealth heritage listed areas). Region of known sensitive habitat (coral reef, mangrove, salt marshes, and sheltered tidal flats) which if impacted may have significant impacts and long recovery periods.
Medium	S2	Region of known moderately sensitive habitats (sheltered rocky rubble coasts, exposed tidal flats, gravel beaches, mixed sand and gravel beaches) that have a medium recovery period (~2–5 years). Presence of known threatened species or cultural heritage impacted. Presence of non-threatened species feeding, breeding, nesting or aggregation. Region of significant commercial activity (e.g. fishing, tourism). Places of public interest such as beaches.
Low	S3	Region of known low sensitivity habitat (fine grained beaches, exposed wave-cut platform and exposed rocky shores) which have a rapid recovery period (~ year). Minimal impact to marine life, business, public areas or cultural heritage items.

Receptor	Sensitivity	Environmental Sensitivities That May be Exposed to a Surface MDO Spill										Oil Type	Response Option			
		Marine	Mermaid Reef	Clerke Reef	Imperieuse Reef	Bedout Island	Argo-Rowley Terrace AMP	Mermaid Reef AMP	Eighty Mile Beach AMP	Rowley Shoals MP (State)	Mermaid Reef and Cwlth Waters KEF	MDO	✓ Source Control	✓ Monitor and Evaluate	✓ Natural Weathering	OWR Limited potential
Marine Ecology																
Marine mammals (protected)	S1	✓										↑	-	-		
Marine birds (protected)	S1	✓										↑	-	-	↑	
Marine reptiles (protected)	S1	✓										↑	-	-	↑	
Sharks and rays (protected)	S2	✓										↑	-	-		
Fish assemblages	S3	✓										↑	-	-		
Commercially targeted fish stocks	S3	✓										↑	-	-		
Benthic communities	S3	✓										↑	-	-		
Plankton communities	S3	✓										↑	-	-		
Coastal Habitats																
Sandy islands	S2		✓	✓	✓	✓						↑	-	-		
Coral reefs	S1		✓	✓	✓	✓						↑	-	-		
Socio-economic																
Tourism / recreation	S2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	↑	-	-		
Commercial fishing	S2	✓	✓	✓	✓	✓	✓	✓	✓		✓	↑	-	-		
Commercial shipping	S3	✓										↑	-	-		
Petroleum activities	S3	✓										↑	-	-		
Marine archaeology (shipwrecks)	S3	✓	✓			✓				✓		↑	-	-		
Australian Marine Parks	S1	✓					✓	✓	✓			↑	-	-		
State protected areas	S1	✓								✓		↑	-	-		
Commonwealth heritage site	S1	✓										↑	-	-		
Key Ecological Features	S1	✓									✓	↑	-	-		

Legend:
↑ Net benefit
- No net benefit or detriment ('do-nothing' – monitor and evaluate and natural weathering strategy)
↓ Net detriment

Table 3-4 - Environmental Sensitivities and NEBA

3.6 Protection Priorities and Preliminary Response Strategies

Based on the sensitivity prioritisation and NEBA provided in Table 3 4, protection priorities have been identified as follows:

- Protected marine fauna (e.g. birds, reptiles, mammals)
- Rowley Shoals (comprising emergent coral reef Imperieuse Reef, Clerke Reef, Mermaid Reef) and surrounding Rowley Shoals Marine Park (state), Mermaid Reef AMP, Argo-Rowley Terrace AMP, and the Mermaid Reef and Commonwealth waters KEF
- Bedout Island (state) and surrounding Eighty Mile Beach AMP.

Note that the stochastic spill modelling did not predict any shoreline contact at the Rowley Shoals or at Bedout Island. Worst-case predicted hydrocarbon exposures in state waters at these locations include low surface (>1 g/m^2), dissolved (>6 ppb) or entrained (>10 ppb) hydrocarbons.

Table 3-5 provides an assessment of the response strategies which might be adopted at sensitive locations and within designated/protected areas affected by MDO residues from a Sauropod 3D MSS MDO spill.

Table 3-5 - Protection Priorities and Preliminary Response Strategies

Location	Protection Priority	Source Control	Monitor and Evaluate (Natural Weathering)	OWR
Marine	Protected fauna (birds, turtles, mammals)	✓	✓	✓
Rowley Shoals and surrounding state and Commonwealth waters	Mermaid Reef	✓	✓	✓
	Clerke Reef	✓	✓	✓
	Imperieuse Reef	✓	✓	✓
	Rowley Shoals Marine Park (state)	✓	✓	✓
	Mermaid Reef AMP	✓	✓	✓
	Argo-Rowley Terrace AMP	✓	✓	✓
	Mermaid Reef and Commonwealth waters KEF	✓	✓	✓
	Mermaid Reef – Rowley Shoals Heritage	✓	✓	✓
Bedout Island and surrounding state and Commonwealth waters	Bedout Island	✓	✓	✓
	Eighty Mile Beach AMP	✓	✓	✓

The following response strategies are considered viable and may have a net environmental benefit in a Sauropod 3D MSS MDO spill:

- Source control
- Monitor and evaluate (via vessel/aerial surveillance, oil spill trajectory modelling, oil spill tracking buoys)
- Oiled wildlife response (if oiled wildlife is observed and a response is practicable).

The Sauropod 3D MSS Operational and Scientific Monitoring Plan (OSMP) will also be activated in the event of a Level 2 spill incident.

3.7 Operational NEBA, Incident Action Planning and Effectiveness Monitoring

AMSA (for Commonwealth waters) and DoT (for WA state waters) as CAs for these geographical areas are responsible for undertaking a NEBA to determine the appropriate response strategy for a Sauropod 3D MSS Level 2 spill. At the time of the spill, an operational NEBA will be completed to confirm net benefits based upon the spill volume, spill type, spill location, weather conditions, weathering and trajectory predictions (including any surveillance output), and the sensitivities requiring protection. For all response activities the safety and protection of field personnel shall be a primary consideration in implementing response activities for identified protection priorities. When finalised the Incident Controller shall endorse the NEBA. This document shall be used to develop the Incident Action Plan (IAP) for the incident.

The IAP details short-term (i.e. hours to days) operational objectives, response options and priority areas for protection based on the actual circumstances of the event, considering weather conditions and safety considerations. The IAP is relevant over a specified, short-term period. Initially this may be for a few hours only, but once the operation is underway it is likely to address the activities required over each of the following 24-hour periods or longer.

During the incident response, the response effectiveness will be assessed by the CA using the NEBA process.

4 Response Strategies

4.1 Source Control

The vessel SOPEP contains vessel-specific actions to contain and mitigate oil spills for identified credible oil spill threats. Table 4-1 provides a summary of the typical source control actions to be taken by a vessel master in the event of an oil spill incident. The vessel SOPEP will be implemented to limit spill volumes and mitigate spill impacts.

Table 4-1 - Source Control Actions

Release Type	Action
Bunkering overflow/ transfer system leak	Immediately stop the transfer; report the discharge; contain the spill; evaluate the cause and corrective actions to be undertaken; undertake on-board clean-up; and obtain permission to resume operations
Hull failure/leak	Where possible stop/reduce outflow; take appropriate safety action; contain the spill (as practical); report the spill/threat; evaluate the cause and corrective actions to be undertaken; initiate on-board clean-up; identify leaking tank (consider internal transfer if leak can be identified, else consider reducing level in all tanks in the vicinity giving careful consideration to hull stress and stability)
Collision:	Immediate notification; determine tanks penetrated (above and below water line) and any other oil spilled by vessel; assess consequences of separating two interlocked vessels causing ignition; reducing buoyancy/sinking; awareness that action may have a larger spill; assess the potential danger to other vessel traffic and manoeuvrability after separation; consider bringing vessel upwind of the oil slick; isolating penetrated tanks; and making ready for towing or lightering
Fire and explosion	Fight fire; notify incident; bring vessel upwind of oil slick; isolate damaged tanks; undertake damage assessment and repair; initiate on-board clean-up; carryout hull leak prevention; make ready to tow or bunker transfer
Equipment failure (propulsion, steering	Notify incident; determine cause of failure; determine possibility, methods and duration of repairs; determine proximity of navigational hazards (i.e. shoreline, reefs); determine likely drift due to wind, tide and currents; determine availability of tugs, salvage equipment; assess future weather conditions; consider the potential for pollution; consider the timeframe for assistance to arrive or the possibility of assistance from other nearby vessels

4.2 Monitor and Evaluate

The following section provides details of the techniques which may be utilised to gain situational awareness of a spill, predict the movement of the spill and observe the weathering of the spill material. Monitoring and evaluation will be coordinated by the CA (AMSA or DoT). CGG will participate in monitoring and evaluation, as directed by the CA.

Note: All surveillance monitoring results will be provided to both AMSA and DoT (as necessary).

4.2.1 Oil Spill Trajectory Calculation

Spill Movement: The movement and behaviour of an oil slick may be manually estimated by undertaking vector calculations. Manual calculations can commence as soon as the preliminary information on the spill is known. For spills in close proximity to shore and where oil spill tracking buoys are utilised, this method may provide the best option for predicting the likely spill trajectory and timeframes before protection priorities are impacted.

Prior to commencing the calculation, the wind and current data is required. This can be accessed via:

- Currents: Oil spill tracking buoy or from the vessels in the field
- Winds: Bureau of Meteorology Met-eye (http://www.bom.gov.au/australia/meteye).

The calculation is based on the spill moving 100% of the current vector and 3% of the wind vector, as shown in Figure 4-1.

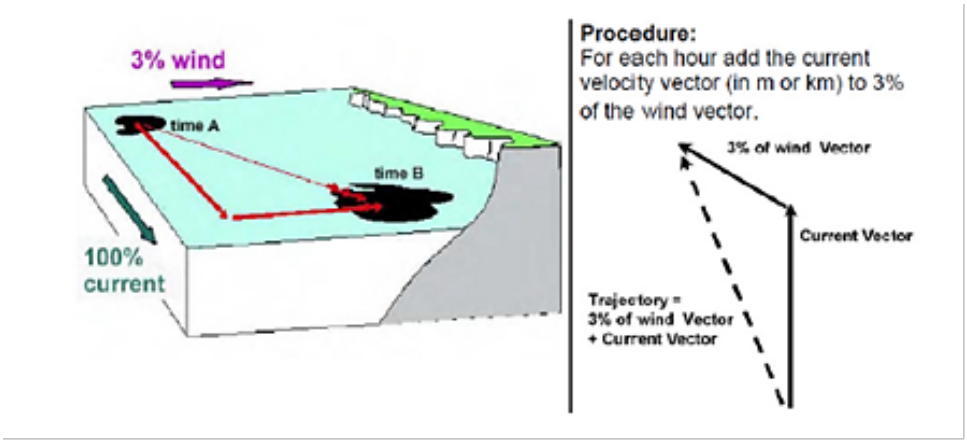


Figure 4-1 - Spill Vectoring Overview

Spill Size Estimation: The spill size may be determined based upon the estimated amount of hydrocarbon released from a 'known' hydrocarbon inventory; an estimate of release rates from time of the commencement of the incident; or an estimate of the appearance of oil on the sea surface based upon the likely thickness and type of oil (refer Table 4-2 and Figure 4-2 below).

Hydrocarbon Weathering: The Automated Data Inquiry for Oil Spills (ADIOS) can be used to provide weathering predictions of hydrocarbon types for spill volumes at different wind speeds and water temperatures. This computer-based oil spill response tool is available to download from http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/response-tools/downloading-installing-and-running-adios.html.

4.2.2 Visual Monitoring Surveillance (Aerial/Vessel)

To gain situational awareness and inform the spill response, observation should be carried out via aerial surveillance. Aerial surveillance will be commissioned by the incident controller. Trained aerial observers may be sourced through AMOSC (staff/core group members) and AMSA (NRT members) and it is expected that observations will be undertaken over the spill location and any predicted areas of shoreline contact.

CGG shall participate in vessel-based surveillance as directed by AMSA or DoT. Monitoring and evaluation will be undertaken to assess the natural weathering process and identify the location of the slick. In all cases this will involve visual monitoring from vessels immediately following a spill incident. Spill observers may include CGG project team members and vessel crews.

Coarse estimates of spill volume can be made on the basis of its appearance at sea, using the area covered and colour of spill (refer Table 4-2). Examples of appearance are provided in

. AMSA provides guidance called 'Identification of Oil on Water – Aerial Observation and Identification Guide (Jan 2014)' which can be found at: https://www.amsa.gov.au/marine-environment/pollution-response/identification-oil-water.

Table 4-2 - Guidelines for Estimating Spill Volume

Code	Description of Appearance	Approximate Thickness (µm)	Approximate litres per km^2
1	Sheen	0.04 to 0.30	40-300
2	Rainbow	0.3 to 5.0	300-5,000
3	Metallic	5.0 to 50	5,000-50,000
4	Discontinuous true oil colour (heavy oil)	50 to 200	50,000 – 200,000
5	Continuous true colour (heavy oil)	>200	>200,000
Other	Mousse or emulsion		

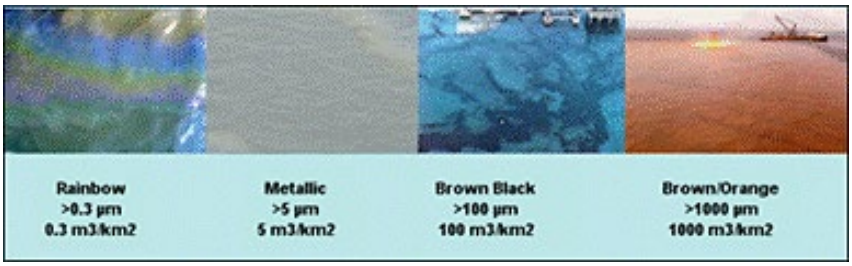


Figure 4-2 - Bonn Agreement Oil Appearance Code (Examples)

4.2.3 Satellite Tracking Drifter Buoys

The Sauropod 3D MSS vessel will carry a satellite tracking drifter buoy for deployment in the event of a significant spill. Instructions will be provided for the deployment of the buoy to the vessel master (refer Appendix 2). At the time of a spill, the drifter buoy will be activated and deployed overboard to allow for real-time satellite tracking of the spill direction and speed (Level 2 only). The buoys' location will be monitored real-time and through regular data downloads.

4.2.4 Oil Spill Trajectory Modelling

The movement of a hydrocarbon slick can be estimated in real time using computerised oil spill trajectory modelling (OSTM). Under the NatPlan, AMSA and DoT have 24/7 access to oil spill trajectory modelling (OSTM. The vessel master / CGG offshore representative may assist AMSA / DoT to complete the OSTM request proforma; the by providing observational data on the oil slick behaviour and wind conditions.

CGG also has access to OSTM capability, provided by RPS. CGG has utilised RPS to undertake the predictive modelling for the Sauropod 3D MSS. CGG has the capacity to extend the existing contract with RPS to provide deterministic modelling in the event of an oil spill, if required. This capability is not on an emergency callout basis (as per the current AMSA agreement). Preliminary modelling results are generally available within four hours after simulation commencement.

During the spill, RPS will utilise all available information from operational surveillance monitoring and from satellite imagery (as available) to refine forecasts.

Contact details for RPS:

Nathan Benfer

Email: nathan.benfer@rpsconsulting.com

Phone: (07) 3124 9459 / 0411 627 740

4.3 Oiled Wildlife Response

All oiled wildlife response activities will be coordinated and implemented by the CA.

No CGG or MSS crew personnel shall interfere with any oiled wildlife. Oiled wildlife observations will be reported to the CA.

4.4 Scientific Monitoring

4.4.1 Scope of Studies

The Sauropod 3D MSS Operational and Scientific Monitoring Plan (OSMP, supports this OPEP. The OSMP provides a framework for the monitoring programs that may be implemented in the event of a Level 2 spill from the Sauropod 3D MSS activity.

The objectives of the OSMP are to:

- Identify high priority protection areas within the EMBA in real time
- Specify monitoring methodologies
- Detail the process CGG will follow to determine the monitoring studies that will be implemented in order to:
  - Provide situational awareness and assist in planning and execution of spill response to minimise environmental harm

- Provide for short-term and long-term environmental damage and recovery assessments.

4.4.2 Consultation

CGG will consult with Commonwealth and state authorities affected by spill residues to ensure that scientific monitoring is undertaken to the satisfaction of the Commonwealth and state.

CGG will notify relevant authorities on a Level 2 spill event and provide operational data to the authorities relevant to the spill level. CGG will consult with these authorities at the commencement of a Level 2 spill on any proposed baseline/ scientific studies and control sites to allow for feedback and OSMP study modification to fulfil all state requirements (e.g. on-the-day sampling design, modified scope).

Available operational monitoring results collated by CGG resources will be provided throughout the response to allow for continued feedback and modification of baseline/scientific requirements. Other critical liaison points will be established between relevant authorities through the spill consultation process.

In the event of an oil spill, CGG will engage with First Nations groups, including relevant IPA managers, to seek input into spill response planning.

4.5 Response Termination

The decision to terminate spill response actions is made by the CA Incident Controller when the response is not returning any tangible benefit. This may include a gradual downsizing of response teams and resources or complete termination of the response. Decision factors to terminate will include:

- The efficacy and benefit of the response options implemented against natural weathering
- The significance of the environmental receptor impacted
- Potential for environmental damage due to further clean-up efforts weighed up against other risk factors; or
- Termination criteria, as adopted by the CA, have been met.

The CA incident controller will ensure that all relevant organisations, stakeholders and personnel are notified to stand down once the decision to terminate or the termination criteria have been satisfied.

5 Response Training

5.1 Testing of Response Arrangements

A desktop OPEP drill of the Sauropod MSS OPEP, including the vessel SOPEP, will be conducted to assess the effectiveness of the arrangements, considering the nature and scale of the risk of a hydrocarbon prior to the survey commencing.

Specifically, the OPEP drill will test the following:

- Roles and responsibilities of those involved in oil spill response are clear and understood
- Communication sequence from the vessel master to vessel-contractor onshore management and the CA, including notification of the AMSA JRCC is adequate, current and includes all relevant details
- Communication between the CGG offshore representative and CGG project manager and subsequent notification authorities is adequate and timely
- Ensures Type 1 operational monitoring such as spill surveillance and tracking is appropriate, understood and practiced
- Equipment and procedures intended for source control on-board the vessel are available for use as outlined in the vessel SOPEP.

The outcomes of the Sauropod 3D MSS OPEP drill will be documented, reviewed and improvements identified (as needed). Should any inadequacies, altered contractual arrangements or improvements to arrangements be identified via testing, these corrective actions will be registered as a non-conformance and the EP/OPEP will be amended for these items via a Management of Change process.

The OPEP will be tested on the following triggers:

- Prior to the survey commencing
- Following any significant amendment of the arrangements.

These arrangements for testing the OPEP are commensurate with the nature and scale of the worst-case oil spill scenario and the short duration of the MSS activity.

The vessel master must ensure that all relevant vessel personnel are inducted and familiar with the contents of this OPEP and accompanying SOPEP; and trained to carry out their individual responsibilities.

6 References

Australian Maritime Safety Authority (AMSA). 2017. National Plan for Maritime Environmental Emergencies. Available at https://www.amsa.gov.au/marine-environment/nationalplan-maritime-environmental-emergencies/national-plan-maritime.

Australian Maritime Safety Authority (AMSA). 2018. Australian Government coordination arrangements for maritime environmental emergencies, NP-GUI-020. Australian Government, Canberra. Available at: https://www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies/np-gui-020-national-plan.

International Tanker Owners Pollution Federation (ITOPF) Limited. 2011. Fate of Oil Spills, Technical Information Paper No. 2. Available at: http://www.itopf.com/information-services/publications/documents/TIP2FateofMarineOilSpills.pdf.

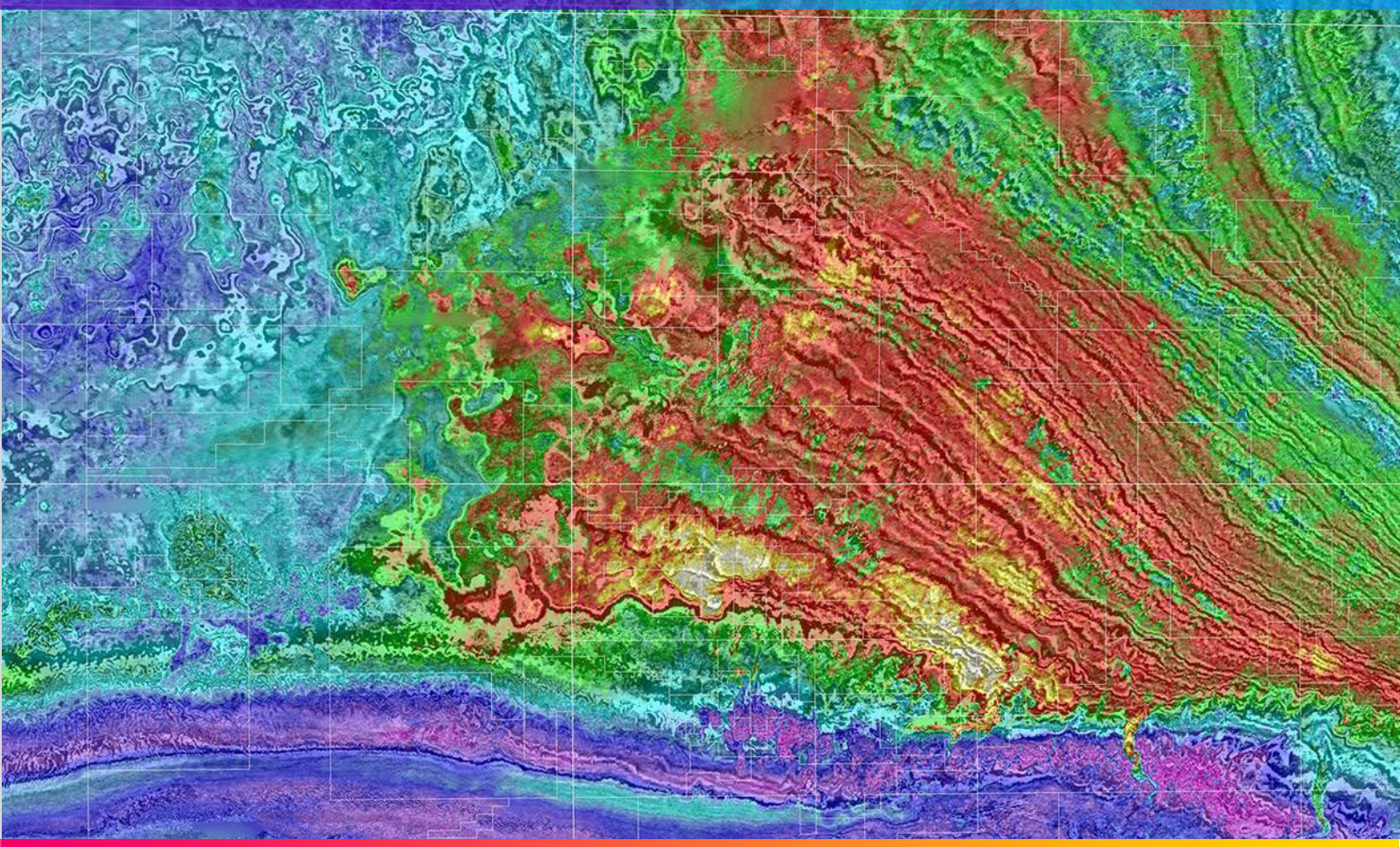
Western Australian Department of Transport (WA DoT). 2018. State Hazard Plan Maritime Environmental Emergencies. Accessed 15 March 2018 at https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_stateHazardPlanMaritimeEnviroEmergMEE.pdf.

Western Australian Parks and Wildlife (WA DPaW). 2014. Western Australian Oiled Wildlife Response Plan. Available at: https://www.dpaw.wa.gov.au/images/documents/conservation-management/marine/wildlife/West_Australian_Oiled_Wildlife_Response_Plan_V1.1.pdf.

Appendix 1 – Contact Directory

Organisation	Position	Contact Details	
		Telephone	Email
CGG	Offshore representative	TBC	TBC
	Project manager	TBC	TBC
Seismic vessel	Vessel master	TBC	TBC
Support vessel	Vessel master	TBC	TBC
Chase vessel	Vessel master	TBC	TBC
Seismic vessel management	Vessel manager	TBC	TBC
Regulators			
NOPSEMA		+61 8 6461 7090	submissions@nopsema.gov.au
DMIRS		+61 419 960 621	petroleum.environment@dmirs.wa.gov.au
NOPTA		NA	reporting@nopta.gov.au
DNP		+61 419 293 465	marine.compliance@environment.gov.au
DCCEEW		+61 2 6274 1372	environment.compliance@awe.gov.au
AMSA		+61 2 6230 6811	https://amsa-forms.nogginoca.com/public/polrep.html
DoT		+61 8 9480 9924	marine.pollution@transport.wa.gov.au
Scientific Resources			
RPS Spill Modelling	Nathan Benfer	+61 7 3124 9459 0411 627 740	nathan.benfer@rpsconsulting.com
For other stakeholders – refer to the stakeholder consultation log			

Appendix I: Operational and Scientific Monitoring Plan



OPERATIONAL & SCIENTIFIC MONITORING PLAN

Sauropod 3D Marine Seismic Survey (WA-527-P)

cgg.com

SEE THINGS DIFFERENTLY

CGG

Document Status					
Version	*Purpose of document*	*Authored by*	*Reviewed by*	*Approved by*	*Review Date*
A	Draft for client review	RPS	CGG	CGG	7/12/2021
0	Final for use	RPS	CGG	CGG	16/02/2022
0.1	Review and update	RPS	CGG	CGG	1/9/2023
0.2	Review and update	RPS	CGG	CGG	10/09/2025

PREPARED BY:

MAKING COMPLEX EASY
A TETRA TECH COMPANY

Level 3, 500 Hay Street
Subiaco, WA 6008

T **+61 8 9211 1111**
W **rpsgroup.com**

Table of contents

Acronyms and Abbreviations 5
1 Introduction 6
1.1 Purpose, Scope and Objectives 6
1.2 Activity Overview and Location 6
1.3 Guidance 7
1.4 Monitoring types 7
1.5 Structure 8
1.6 Review and update 8
2 Implementation framework and strategy 9
2.1 Framework 9
2.1.1 Monitoring management and information pathways 9
2.1.2 List of monitoring studies 10
2.1.3 Monitoring strategy template 12
2.1.4 Monitoring Implementation plan template 12
2.2 OSMP Implementation 13
2.2.1 Roles and responsibilities 13
2.2.2 OSMP phased approach 13
2.2.3 Reporting 14
2.2.4 Internal review and external auditing 14
2.3 Scientific monitroing 15
2.3.1 Establishing a baseline database 15
2.3.2 Impact and reference sites 15
2.3.3 Impact assessment approach 16
3 Monitoring strategies 17
3.1 Preliminary activities 17
3.1.1 Impacts from response activities 17
3.1.2 Monitoring strategies – Protected matters constraints 17
3.2 Operational monitoring 18
3.2.1 OPM1: Operational forecast modelling 19
3.2.2 OPM2: Hydrocarbon spill surveillance & tracking 20
3.2.3 OPM3: Marine megafauna surveys 21
3.2.4 OPM4: Shorebird and seabird population monitoring 23
3.3 Scientific monitoring 26
3.3.1 SSM1: Marine water quality monitoring 26
3.3.2 SSM2: Marine and inter-tidal sediment monitoring 29
3.3.3 SSM3: Sub-tidal and inter-tidal benthos monitoring 32
3.3.4 SSM4: Marine megafauna surveys 34
3.3.5 SSM5: Shorebird and seabird population monitoring 36
3.3.6 SSM6: Hydrocarbon monitoring of representative Commercial fish species 39

3.3.7 SSM7: Hindcast modelling 42
4 References 44

Figures

Figure 1-1 - Location of Sauropod 3D Marine Seismic Survey 7
Figure 2-1 -Monitoring and information flow management framework 9

Tables

Table 2-1 – OSMP studies 10
Table 2-2 – Level 2 spill sensitivities 11
Table 2-3 – Structure of studies 12
Table 2-4 – Roles and responsibilities 13
Table 2-5 – OSMP implementation phases 13
Table 3-1 – Secondary monitoring activities 17

Acronyms and Abbreviations

Name	Description
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
CA	Control Agency
CEMT	Crisis and Emergency Management Team (CGG)
CGG	CGG Services Australia
DBCA	Department of Biodiversity Conservation and Attractions
DMIRS	WA Department of Mines, Industry Regulation and Safety
DNP	Director of National Parks
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoT	WA Department of Transport
EMBA	Environment that maybe affected
EP	Environment Plan
ERG	Emergency Response Group (shoreside vessel contractor)
ERM	Environmental Resources Management
ERP	Emergency Response Plan (vessel emergency response)
ERT	Emergency Response Team (vessel response group)
HSE	Health Safety & Environment
IAP	Incident Action Plan
IMO	International Maritime Organization
ITOPF	International Tanker Owners Pollution Federation
JA	Jurisdictional authority
JRCC	Joint Rescue Coordination Centre
MDO	Marine diesel oil
MFO	Marine fauna observer
MOP	Marine oil pollution
MSS	Marine seismic survey
NEBA	Net Environmental Benefits Assessment
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
OPEP	Oil Pollution Emergency Plan
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSMP	Operational & Scientific Monitoring Plan
POLREP	Pollution Report
SITREP	Situation Report
SOPEP	Shipboard Oil Pollution Emergency Plan
WA	Western Australia

1 Introduction

1.1 Purpose, Scope and Objectives

This Operational & Scientific Monitoring Plan (OSMP) has been prepared to support an assessment of oil spill impacts from the Sauropod 3D Marine Seismic Survey (MSS) activity located in Exploration Permit WA-527-P.

The objectives of the OSMP are to:

- Outline the monitoring required to assess any short-term and long-term impacts to the marine and coastal environments from a significant (Level 2) oil spill during the Sauropod 3D MSS and inform any remediation activities (Scientific Type 2 monitoring);
- Provide the strategy for each of the monitoring studies including the monitoring outcomes, study standards adopted, study initiation and termination points; and
- Reference specific study implementation plans (IPs) for each of the monitoring areas.

1.2 Activity Overview and Location

CGG Services (Australia) Pty Ltd (CGG) is proposing to undertake the Sauropod 3D marine seismic survey (hereafter referred to as the Sauropod 3D MSS) in exploration permit area WA-527-P, which is located on the North West Shelf in the Roebuck Basin. An Environment Plan (EP) was previously accepted by NOPSEMA for this activity on the 16 February 2022, however CGG is now planning to conduct the survey in WA-527-P under a revised and updated EP. The purpose of the Sauropod 3D MSS is to collect three-dimensional (3D) geophysical data about the underlying rock types to inform oil and gas exploration.

The Sauropod 3D Marine Seismic Survey (MSS) will take place within Commonwealth waters off the north-west Western Australian (WA) coast within the Roebuck Basin in exploration permit area WA-527-P.

The survey will be undertaken within an ‘Acquisition Area’, where seismic data acquisition will occur. The Acquisition Area will be located within a broader ‘Operational Area’, which includes additional space for vessel activities such line turns, run-ins, run-outs, soft-start procedures and seismic source testing.

The Acquisition Area will be up to a maximum of approximately 3,500 km^2, with an Operational Area of approximately 6,000 km^2 (Figure 1-1). At its closest point the Operational Area is approximately:

- 63 km and 67 km from Clerke Reef and Imperieuse Reef respectively (the Rowley Shoals)
- 90 km from Bedout Island
- 120 km from the WA coast at Eighty Mile Beach
- 190 km from Port Hedland
- 230 km from Broome.

Water depths in the Acquisition Area range from approximately 95 to 172 m.

The 3D seismic survey will take a maximum of 60 days to acquire and will be undertaken within the period of January to May 2026 or 2027.

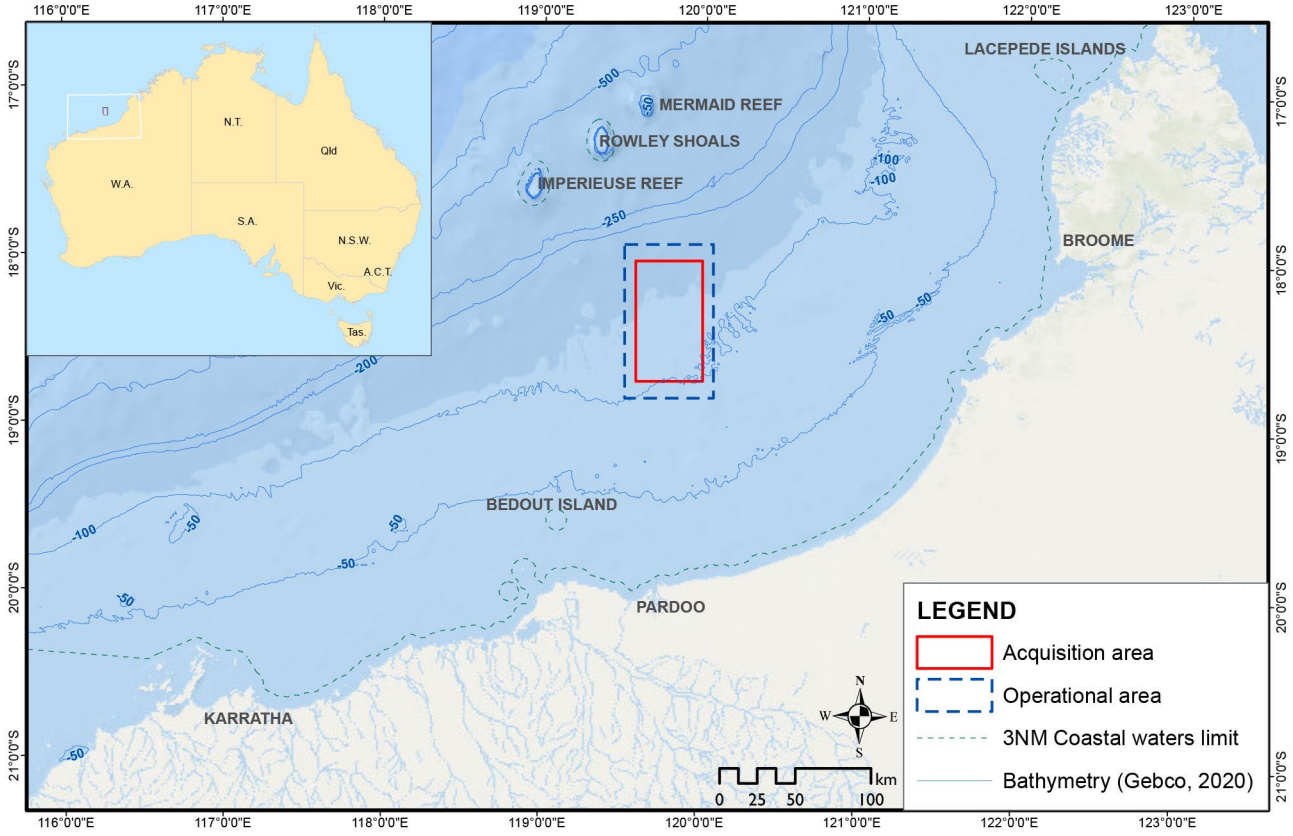


Figure 1-1 - Location of Sauropod 3D Marine Seismic Survey

1.3 Guidance

This OSMP has been prepared to satisfy the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) requirements for OSMP readiness prior to an accidental hydrocarbon release and incorporates guidance on the following NOPSEMA documents:

- Oil Pollution Risk Management (GN1488, October 2024); and
- Operational & Scientific Monitoring Programs (IP1349, January 2024).

This OSMP has been developed to satisfy the requirements of Regulation 22(8) and 22(9D) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R).

1.4 Monitoring types

A two-class nomenclature has been developed in Australia to define the primary objectives of a hydrocarbon monitoring program which can be defined as:

- **Type 1** monitoring (also referred to as operational monitoring) - undertaken during a spill response to inform response planning and operations. The focus of Type 1 monitoring is to obtain and process information regarding the nature and scale of the spill and the resources at risk so it can be acted upon as quickly as possible. Type 1 monitoring may also provide information on the effectiveness of spill response activities; and
- **Type 2** monitoring (also referred to as scientific monitoring) - aims to quantify the extent, severity and persistence of environmental impacts from a significant spill and inform on appropriate remediation activities.

For the Sauropod 3D MSS, the Australian Maritime Safety Authority (AMSA) is the Control Agency for vessel-based spills in Commonwealth waters and is responsible for Type 1 operational monitoring. CGG is responsible for Type 2 scientific monitoring.

1.5 Structure

The OSMP has been designed to provide:

- Monitoring coordination by the Principal Investigator (PI) and the OSMP Program Manager (or delegate);
- Details of thoroughness of required information to carry out each study; and
- A clear and auditable monitoring strategy for CGG and relevant regulatory agencies.

This OSMP is clearly structured in the following manner:

- Section 1: Introduction;
- Section 2: OSMP Implementation;
- Section 3: Monitoring Strategies; and
- Section 4: References.

1.6 Review and update

This OSMP is required to be reviewed, and if applicable updated, to ensure that all relevant information is accurate and that new information is evaluated and used to adapt and improve the monitoring strategies.

Any revisions to this OSMP will be undertaken utilising CGG's Management of Change process observing the EP revision triggers in the OPGGS(E)R.

Trigger thresholds for an EP revision include:

- Inclusion of a new activity
- If there is a significant modification or new stage to an activity
- If a significant new environmental impact or risk, or significant increase in existing environmental impact or risk identified for the Sauropod 3D MSS activity
- If there is a series of new environmental impacts or risks or a series of increases in existing environmental impacts or risks, which when taken together, results in a significant new environmental impact or risk; or a significant increase in existing environmental impact or risk no provided for in the EP; or
- If there is a change in titleholder that results in a change in the manner in which environmental impacts and risks are managed.

This OSMP will be distributed to all relevant CGG Sauropod 3D MSS participants, the seismic contractor and relevant government authorities after acceptance of the Sauropod 3D MSS EP.

2 Implementation framework and strategy

2.1 Framework

In the event of a significant Level 2 hydrocarbon release incident from the Sauropod 3D MSS, environmental monitoring studies will be implemented to evaluate the potential environmental impacts to the marine environment.

The potential impacts of MDO spills have been assessed in the Sauropod 3D MSS Environment Plan (EP) with management and response details provided in the associated Sauropod 3D MSS OPEP. The content of this OSMP is aligned with the environmental sensitivities outlined in Section 4 of the Sauropod 3D MSS EP.

2.1.1 Monitoring management and information pathways

In the unlikely event of a Level 2 spill incident, CGG will immediately initiate the relevant Type 2 monitoring according to the sensitivities affected. The sensitivities identified within the “environment that may be affected” (EMBA) from the largest significant hydrocarbon is identified in Table 2 2. Environmental sensitivity assessment to a MDO spill is provided in the Sauropod 3D MSS EP (Section 8).

2.1.1.1 Information pathways

Type 1 monitoring information will be used by CGG to inform scientific monitoring activities. AMSA, the Control Agency for vessel-based spills, is responsible for operational monitoring in Commonwealth waters to inform response activities, however, CGG will assist with monitoring (where possible). All Type I monitoring information will be directed to AMSA to assist in operational response planning and effectiveness.

Information resulting from Type 2 monitoring will be directed to the relevant Commonwealth and State authorities as it becomes available.

These monitoring and information flow management pathways are illustrated conceptually in Figure 2-1.

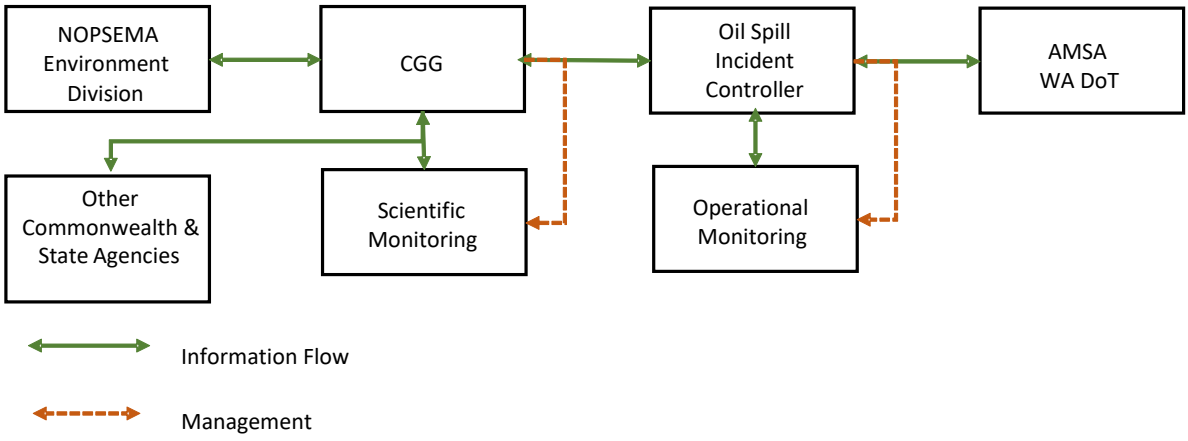


Figure 2-1 -Monitoring and information flow management framework

2.1.1.2 Type 2 monitoring consultation

CGG will consult with relevant Commonwealth and State authorities and other relevant stakeholders prior to the implementation of Type 2 monitoring studies to ensure that scientific monitoring is undertaken to the satisfaction of the authorities. These stakeholders will include:

For Commonwealth waters:

- The Department of Climate Change, Energy, the Environment and Water (DCCEEW), for matters of National Environmental Significance (MNES);
- The Director of National Parks (DNP);
- AMSA;

- Marine research organisations (e.g. AIMS, CSIRO);
- Australian Fisheries Management Authority (AFMA); and
- Other relevant parties identified which have an interest in the affected area.

For State waters:

- The WA Department of Transport (DoT);
- Relevant marine research organisations (e.g. WAMSI);
- The WA Department of Biodiversity, Conservation and Attractions (DBCA); and
- The WA Department of Primary Industries and Regional Development (DPIRD Fisheries).

CGG will notify these stakeholders in the event of a Level 2 spill and provide available operational data. CGG will consult with these stakeholders on the content of the Type 2 studies (e.g. baseline, location of reference and control sites, study method) and obtain feedback which will be incorporated into the Type 2 study design to ensure Type 2 monitoring is to the satisfaction of the Commonwealth and State stakeholders. From this, the Type 2 implementation plans within this OSMP may be modified based upon this feedback.

2.1.2 List of monitoring studies

A list of possible OSMP studies that would be developed in the event of a Level 2 MDO spill (as required depending on the location and extent of the spill) is provided in Table 2-1. It is noted that shoreline contact above impact thresholds is not predicted as presented in the EP. References to the proposed strategy for each study are also provided in Table 2-1.

The linkage between the environmental sensitivities, sensitive locations, the study strategies of this OSMP and the SOPEP/OPEP response options are summarised in Table 2-2. Generally, the monitoring performance outcomes will focus on:

- The relevant environmental performance outcomes (EPOs) of the Sauropod 3D MSS EP;
- Informing response planning and management activities; and
- Assessing impacts, recovery and possible remedial measures for identified environmental sensitivities

Table 2-1 – OSMP studies

Study ID	Study Name	Section Ref.
OPM1	Operational Forecast Monitoring (Contingency Provision)	3.2.1
OPM2	Hydrocarbon Surveillance & Tracking (Vessel Only)	3.2.2
OPM3	Marine megafauna surveys	3.2.3
OPM4	Shorebird and seabird population surveys	3.2.4
SSM1	Marine Water Quality	3.3.1
SSM2	Marine and Inter-tidal Sediment	3.3.2
SSM3	Sub-tidal and Intertidal Benthos	3.3.3
SSM4	Marine Fauna Monitoring	3.3.4
SSM5	Marine Bird Population Monitoring	3.3.5
SSM6	Fish Species Monitoring	3.3.6
SSM7	Hindcast Modelling	3.3.7

Table 2-2 – Level 2 spill sensitivities

Receptor	OSMP Study	Marine Environment	Mermaid Reef	Clerke Reef	Imperieuse Reef	Bedout Island	Argo-Rowley Terrace AMP	Mermaid Reef AMP	Eighty Mile Beach AMP	Rowley Shoals State MP	Mermaid Reef KEF
Habitats											
Marine Water Quality	SSM1	X					X	X	X	X	X
Marine and Inter-tidal Sediment	SSM2		X	X	X	X					
Sub-tidal and Intertidal Benthos	SSM3		X	X	X	X					
Species											
Marine Fauna	SSM4	X									
Shoreline & Seabird Populations	SSM5	X	X	X	X	X					
Commercial Fish Species	SSM6	X									

Note: Operational & Hindcast Studies apply to all receptors and will determine contact.

X Indicates receptors that will be monitored if contacted by hydrocarbons.

2.1.3 Monitoring strategy template

This section describes the generic format and content of a monitoring (field) study strategy. Each monitoring strategy outlines the process for a study's implementation and specifically addresses the following key questions:

- Why? – Monitoring performance outcome;
- What? – Monitoring performance standard;
- Who? When? How? Where? – Measurement criteria and other components of the strategy. The technical details of the when (e.g., monitoring frequency), the how (e.g., sampling and analysis methodology and logistics) and the where (e.g., locations of sites) are provided in the implementation plans for each monitoring study.

Each monitoring study's strategy has been structured in a consistent manner to facilitate familiarity and ease of reference via a tabular format as described in Table 2-3.

Table 2-3 – Structure of studies

Strategy Component	Description
Monitoring Performance Outcome	Monitoring' goal(s) from the implementation of the monitoring program
Monitoring Performance Standard	Performance(s) required of the monitoring study elements (systems, equipment, personnel and/or procedures) that are used as the basis to manage achievement of the monitoring performance outcome
Initiation Trigger	Criteria to initiate the monitoring study
Termination Trigger	Criteria to terminate the monitoring study
Study Implementation Plan	Reference to OSMP Implementation Plan (IP) for a particular Study
Baseline	Available Baseline References
Competencies	Competency criteria for roles on the monitoring study team
Reporting	Outputs (e.g. reports) of the findings of study for dissemination to relevant and approved parties
Review and Audit	Internal (reviews/audits) overview
Responsibilities	Responsibilities for different elements of each monitoring study
Relevant References and Guidelines	Guidelines and high-level references to implement the strategy

2.1.4 Monitoring Implementation plan template

In the event of a Level 2 spill of MDO, implementation plans will be developed for each study (as required depending on the location and extent of the spill), in accordance with the measurement criteria of the strategy. The implementation plans for each study will include, at a minimum, the following elements:

- Introduction;
- Project Management;
- Baseline data establishment;
- Field logistics – mobilisation, monitoring logistics and demobilisation;
- Sampling and analysis methodology;
- Reporting and communications;
- Quality assurance/control procedures; and
- Internal reviews: Compliance schedule and reporting.

2.2 OSMP Implementation

2.2.1 Roles and responsibilities

In the event of a Level 2 spill, CGG is responsible for the implementation and adherence to this OSMP. Table 2-4 identifies primary responsibilities associated with OSMP key roles. Each strategy in Section 3 provides more specificity of responsibilities for a particular monitoring program.

Table 2-4 – Roles and responsibilities

Position	Responsibility
CGG Technical Operations Manager (primary onshore contact)	• Overall responsibility for implementation of the OSMP • Reports all environmental incidents
OSMP Program Manager (PM)	• Approval of reports and plans • Day-to-day coordination and review of the monitoring plans • Oversees review/audits • Compliance interface with regulator(s)
Principal Investigator (PI)	• Responsible for the implementation of a particular study • Review and/or carry out study's monitoring reporting requirements • Provides advice with respect to environmental issues as required.
Monitoring Personnel (MP)	• Implements study • Complies with requirements of this OSMP

2.2.2 OSMP phased approach

Development and implementation of the OSMP is as detailed in Table 2-5.

Table 2-5 – OSMP implementation phases

Phase	Activity	Purpose	Output
Approval			
Regulatory acceptance of the Environment Plan	Scientific Monitoring Studies defined. Ensure availability of human resources, logistics and scientific equipment to implement OSMP if required	Studies and monitoring strategies identified that may require implementation in the event of a Level 2 spill. 'Readiness' for initiation of OSMP field activities if required	OSMP. Resources available (people, equipment, plant) and confirmation that competent persons (PIs) are aware of OSMP responsibilities (as practicable).
Readiness			
Capacity available and enhanced if and where required	Pool of resources for monitoring team identified	'Readiness' for a timely response upon notification from the CGG technical operations manager for monitoring mobilisation	Timely mobilisation of environmental monitoring teams in event of a Level 2 spill.

Phase	Activity	Purpose	Output
Monitoring			
Post-spill, pre-exposure	Mobilisation of monitoring team and implementation of OSMP.	Operational monitoring to inform response planning and management of spill. Collection of reactive baseline data in scientific monitoring studies (as triggered).	Data, notifications, and reports to inform response team for response planning and management (AMSA/DoT). Condition of environmental values established at start of hydrocarbon spill prior to exposure (as triggered).
Post Exposure	Continued implementation of the OSMP. Collate and assess existing baseline data for environmental sensitivities. Cease operational monitoring when termination criteria met	Operational monitoring to inform response planning and management and scientific monitoring studies to monitor impact to environmental sensitivities. Acquisition of existing data to establish baseline condition of environmental sensitivities and identify gaps in baseline data to be acquired for scientific monitoring (as triggered). Cessation of response planning and management because environmental sensitivities no longer at risk from additional hydrocarbon impacts.	Data, notifications, and reports to inform response planning and management (AMSA/DoT) and to monitor impact to environmental sensitivities (as triggered). Database of available baseline data established, plan for acquisition of baseline data gaps formulated (as triggered). Data/information collated to date for both Type 1 and Type 2 to inform Type 2 hind-cast modelling.
Long-Term Monitoring	Continued implementation of OSMP. Cease scientific monitoring when termination criteria are met.	Scientific monitoring studies to monitor impact/recovery to environmental sensitivities. Cessation of monitoring because environmental sensitivities completely / sufficiently recovered from hydrocarbon impacts.	Data and reports to monitor impact / recovery to environmental sensitivities. Final Reports.

2.2.3 Reporting

The reporting requirements for the OSMP are detailed in the monitoring strategy of each study (Section 3). For the scientific (Type 2) monitoring studies, the appropriate regulator will be provided with:

- Annual reports (as appropriate) that summarise all of the on-going (or recently terminated) monitoring studies; and
- Final reports for each monitoring study.

Where required and agreed, the appropriate regulator can request other reports from the OSMP Program Manager (or delegate) and may also confirm adherence to the reporting schedule and contents (defined in the strategies and implementation plans) through the auditing mechanism which is described in Section 2.2.4.

2.2.4 Internal review and external auditing

Across the suite of OSMP studies, the adopted internal review and auditing approach comprises the following framework:

- The Implementation Plan for each study will define a monitoring compliance audit schedule on the basis of the commitments in the study's strategy (refer Section 3) and more detailed commitments defined in the Implementation Plan;
- Internal review by the OSMP Program Manager regarding conformance to the OSMP's audit schedule elements will be carried out routinely (every three months for Type 2). Any non-conformances will need to be rectified by the PI within two weeks of the internal review. All internal reviews will be recorded and archived on compliance pro-forma reports in each study's Implementation Plan;
- External audits by the relevant regulator(s) of completed compliance reports and other OSMP commitments may be carried out at any time.

2.3 Scientific monitroing

2.3.1 Establishing a baseline database

The data accrued for the Sauropod 3D MSS EP only provides an overview of the environmental baseline and is insufficient to serve as a robust baseline dataset for a scientifically based impact and recovery assessment in the event of a hydrocarbon spill.

The primary data gaps of concern for the scientific monitoring studies are likely to be:

- Methodology differences between past monitoring studies (e.g., field methods and data analysis techniques);
- Spatial and temporal coverage of data (e.g., sensitive locations not monitored, temporal gaps at sensitive locations).

Establishment of a robust baseline dataset is primarily required for assessment of impacts and recovery to environmental sensitivities at sensitive locations. Establishment of baseline datasets as far as practicable during the planning/readiness phase is important. Hence, the procedure for the establishment of baseline data in each relevant scientific monitoring Implementation Plan will, where possible, be as follows:

- Relevant scientific monitoring studies at the sensitive locations are catalogued along with the custodian's contact details;
- Existing monitoring methodology, monitoring sites, and sampling duration and frequency of these relevant monitoring studies will (where known) be assessed to identify methodology and spatial/temporal types of baseline data gaps;
- In the event of a Level 2 spill, data custodians will be contacted and datasets requested;
- Any identified data gaps will be used by the PI of a particular study in the development of the sampling and analysis component of the IP to optimise the design of each scientific monitoring study; given the methodological, spatial and temporal properties of the existing monitoring data sets.

Undertaking baseline studies in addition to obtaining the existing baseline information will only be triggered by a Level 2 spill and are nominated in the study strategies within Section 3.

2.3.2 Impact and reference sites

In the event of a Level 2 spill, the sensitive locations identified in Table 2 2, if contacted by hydrocarbons will have monitoring sites established to monitor the identified environmental sensitivities at that location.

Stochastic modelling predicts that there is a very low likelihood of very limited areas being impacted by a MDO spill, so alternate sensitive locations will be available as a suitable reference location (i.e., control or 'non-impact' location) in the event of a significant spill. Monitoring sites at reference locations will be selected that are:

- As similar as possible to impacted sites;
- Representative of the wider area;
- Free from obvious anthropogenic impacts.

They should also be similar in key physical parameters (e.g., tidal currents, habitat type, substrata, temperature, salinity, shore profile, shore exposure) and not differ significantly between sites. Selection of multiple reference sites will assist in accounting for natural variability between impact and reference sites.

2.3.3 Impact assessment approach

Collection of post-impact data for comparison with baseline data (where it exists) is required to determine whether any differences between the impact and reference locations is attributable to the hydrocarbon release. To enable detection of environmental impact from a hydrocarbon release requires careful consideration of the sampling/survey strategy since spatial and temporal variability will also account for differences between locations despite whether there has been a disturbance or not. Multiple reference locations will be necessary to prevent falsely attributing any differences in the spatial data to the impact and to allow robust statistical analyses of the resultant data.

Where limited or no baseline data is available as identified in the Implementation Plan, post-impact monitoring will be designed by PIs with before-after-control-impact (BACI) or 'beyond- BACI' principles, or with a sufficient number of reference sites to result in data that are amenable to statistical techniques such as asymmetrical analyses of variance following procedures described by Underwood (1994).

3 Monitoring strategies

3.1 Preliminary activities

3.1.1 Impacts from response activities

Implementation of oil spill response actions may have impacts upon environmental sensitivities located at impacted locations. Additional 'secondary' impacts caused by spill response activities in addition to the primary objective of this OSMP (spill impacts) will also monitored and reported during OSMP activities.

CGG has assessed possible secondary impacts to sensitivities associated with response and monitoring activities. These possible impacts shown in Table 3-1, are incorporated into monitoring strategies.

This listing will be reviewed, modified or supplemented during the spill response to reflect site-specific conditions.

Table 3-1 – Secondary monitoring activities

Response Activity	Secondary Impacts	Monitoring Strategy	Monitoring Parameters
Source Control	Vessel impacts to megafauna	OPM3: Marine Fauna SSM4: Marine Fauna	Megafauna 'injury' incidents
Monitor & Evaluate (OPM2: Vessel Surveillance)	Vessel impacts to megafauna	OPM3: Marine Fauna SSM4: Marine Fauna	Megafauna 'injury' incidents
SSM1: Marine Water Quality SSM2: Marine Sediment (vessel-based) SSM3: Sub-tidal & Intertidal Benthos (vessel-based) SSM4: Marine Fauna	Vessel impacts to megafauna	OPM3: Marine Fauna SSM4: Marine Fauna	Megafauna 'injury' incidents
SSM2: Inter-tidal Sediment SSM3: Inter-tidal Benthos SSM5: Shoreline & Seabird Population	Cultural Heritage Impacts Coastal Habitat Disruption Shorebird Habitat Disturbance	SSM2: Inter-tidal Sediment SSM3: Inter-tidal Benthos SSM5: Shoreline & Seabird Population	Native Vegetation Damage Altered access routes to shore Disturbance to supratidal areas Disturbance to, or abandonment of nesting areas Dead/injured birds (non-oiled)

3.1.2 Monitoring strategies – Protected matters constraints

3.1.2.1 Species protection

Prior to the deployment of monitoring teams to a spill location, a Job Hazard Assessment (JHA) will be undertaken to ensure all activities are performed safety, with minimal impacts to the environment and verify equipment. This assessment will consider the following with respect to the protected matters which may be present at monitoring locations:

- Likelihood of encounter with protected species at monitoring locations and the seasonal activity of the protected species (i.e. nesting, calving, etc.);

- Review of latest threatened species recovery plans or conservation advices with respect to species 'threats' and management controls and restrictions to prevent impacts during monitoring activities;
- Confirmation of regulatory restrictions (e.g. marine mammal buffer distances) which must be observed when undertaking activities.

These requirements will be documented within the JHA and monitoring personnel will participate in the JHA to confirm their awareness of these constraints.

3.1.2.2 Monitoring parameter selection

Monitoring parameters and methodologies selected observe the necessary requirements of conservation management plans with respect to monitoring methodology and parameters to be monitored. Where available, management plans provide details of relevant 'umbrella species' which are monitored over time (e.g., long-term indicators for RAMSAR sites) to monitor the long-term health of the area and meet objectives of the Management Plan (e.g. water quality indicators, inter-tidal reef indicators). Relevant management plans have been consulted in the preparation of IPs to identify these indicators (e.g., for bird species such as the Hooded Plover parameters such as population size and breeding success).

Protected matters requirements have been considered in the selection of methodologies and monitoring parameters in the respective monitoring strategies.

3.1.2.3 Monitoring strategies prioritization

In the event of a Level 2 spill, modelling (OPM1) will establish the predicted location of oil spill residues. The scale of the spill and likelihood/consequence of oil impact on sensitive habitats, protected species or areas of conservation value (i.e., Australian Marine Parks, Key Ecological Features, etc.) at threat will define the level of effort required and the particular parameters (e.g., species/habitat) monitored in each scientific monitoring strategy. If necessary, factors affecting the selection and prioritisation of species and/or habitats to be monitored during a spill incident include, but not limited to:

- The species/habitat sensitivity to oiling and the likelihood of oiling;
- Ability to access the monitoring location;
- Identified species which are monitored within conservation management plans;
- Social factors which may affect selection due to their iconic nature or may have commercial impacts;
- Available baseline data for individual species or habitat;
- Time for oil to impact the habitat/species and the ability to access the monitoring locations; and
- Feedback from relevant Commonwealth and State authorities.

The OSMP Program Manager (or delegate) will observe these parameters when determining, selecting and prioritising species/populations/habitats to the monitored in conjunction with scientific monitoring teams.

Species currently targeted for monitoring on the basis of available information (baseline and conservation management plans) are contained within the respective monitoring strategies in this OSMP.

3.2 Operational monitoring

Operational monitoring during a spill event is the responsibility of the Commonwealth or State Control Agency (CA), however CGG will provide support (where possible). CGG can provide support through the following operational monitoring strategies:

- OPM1: Operational Forecast Monitoring; and
- OPM2: Hydrocarbon Surveillance & Tracking (Vessel-based only).
- OPM3: Marine megafauna surveys
- OPM4: Shorebird and seabird population monitoring

The strategy for each operational monitoring study is provided in this section.

3.2.1 OPM1: Operational forecast modelling

Strategy Component	Description
Monitoring Performance Outcomes	Carry out daily real-time predictions (forecasts) of the temporal / spatial distribution and concentrations of hydrocarbons on the surface and within the water column via numerical modelling to meet the following requirements: • Provide data / information to support and inform response planning and operations and monitor the spill response. • Identify sensitivities at risk of hydrocarbon exposure, inform the Net Environmental Benefits Assessment (NEBA) and identify which sensitivities require scientific monitoring.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement OPM1 forecast modelling	Sauropod 3D MSS operational forecast model developed by RPS is in place. CGG contracts RPS to undertake forecast modelling. Note: Arrangements with RPS will not include an emergency call-out contract as this arrangement resides currently with AMSA.
2. Provision of daily quasi-real-time predictions (forecasts) to inform operational responses (and scientific monitoring of sensitive locations)	If not undertaken by AMSA, the location, volume, start time and duration of spill provided to RPS by OSMP Program Manager (or delegate) to initiate modelling as soon as reasonably practicable after AMSA decision and (as required) initial deterministic spill modelling results. Daily information from OPM2 (Hydrocarbon spill surveillance and tracking) to refine and improve short-term model forecasts of spill distribution. Up to 3-day hydrodynamic forecasts performed at least on a daily basis to provide inputs to hydrocarbon fate modelling. Performed daily to incorporate updates to regional current hydrodynamic and wind forecasts. Model adjusted where applicable based on validation information provided by the PI of Study OPM2.
Initiation Trigger	Any Level 2 spill incident (if study is not initiated by AMSA)
Termination Trigger	As applicable, the OSMP Program Manager (or delegate) will terminate the module when the following criteria has been met: • The spill has ceased; and • When the spill is no longer visible to human observers and 24hrs has elapsed since the last confirmed observation of surface hydrocarbons. Specifically, a 'silvery / grey' sheen, as defined by Bonn Agreement Oil Appearance Code (BAOAC) is not observable.
Competencies	RPS is a recognised industry leader in predictive modelling of hydrocarbon incidents and holds the current contract with AMSA to undertake response modelling. No competency test and training is warranted.
Reporting	Provision of location, start time, volume and duration of spill memorandum to RPS. Forecast modelling daily report including forecast modelling inputs, outputs, validation and uncertainties and modelling results uploaded daily to a secure website by RPS for CGG and other relevant parties
Review & Audit	None Required.

Strategy Component	Description
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and Implementation Plan. OSMP Program Manager (or delegate): • Communicates with RPS & AMSA as required regarding forecast modelling. • Provides spill input data to RPS. • Communicates with authorities on modelling results (as required). • Ensures information from study OPM2 is provided to RPS. • Communicates with NOPSEMA. PI (RPS): • Provision of quasi-real-time modelling and daily updates to a secure website • Advice to CGG with respect to forecast modelling.
Relevant References and Guidelines	American Society for Testing and Materials (ASTM) 2013. F2067-13 Standard Practice for Development and Use of Oil-Spill Trajectory Models, ASTM International, West Conshohocken (PA). ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

3.2.2 OPM2: Hydrocarbon spill surveillance & tracking

Strategy Component	Description
Monitoring Performance Outcomes	Conduct surveillance and tracking of surface hydrocarbon spill distribution to meet the following requirements: • Provide operational data / information to support and inform response planning and operations and monitor the spill response. • Identify sensitivities at risk of hydrocarbon exposure, inform the Net Environmental Benefits Assessment (NEBA) and identify which sensitivities require scientific monitoring.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement OPM2 Surveillance Tracking	CGG has arrangements in place with support vessels to undertake surveillance activities. Study OPM2 is in place with vessel crews trained in oil slick observation and quantification. Note: These arrangements supplement AMSA arrangements.
2. Acquisition of daily vessel-based surveys of hydrocarbon distribution.	OSMP Program Manager liaises with AMSA to determine vessel-based surveillance scope on a daily basis. The day's vessel-based surveillance objectives are recorded in the daily report. Vessel MP prepare a summary of the daily vessel-based surveillance activities for inclusion in the daily report.
3. Daily Report Provision	PI prepares daily report on hydrocarbon spill surveillance and tracking observations. Provided to the OSMP Program Manager (or delegate) and Study OPM1 PI.
4. Final surveillance report	PI provides final report to summarise surveillance and tracking data sufficiently to serve as the validation data set to inform planning for post-incident scientific monitoring of SSM2-SSM8 within 4 weeks after cessation of monitoring activities. Provided to OSMP Program Manager (or delegate) and SSM1-SSM8 PIs.

Strategy Component	Description
Initiation Trigger	Any Level 2 spill incident
Termination Trigger	As applicable, the OSMP Program Manager (or delegate) will terminate the module when the following criteria has been met: • The spill has ceased; and • When the spill is no longer visible to human observers and 24hrs has elapsed since the last confirmed observation of surface hydrocarbons. Specifically, a 'silvery / grey' sheen, as defined by BAOAC is not observable.
Competencies	• Vessel-based observers trained in vessel-based hydrocarbon spill monitoring. • Available vessels for surveillance
Reporting	• Daily OPM2 reports on spill surveillance and tracking observations. • Final study report within 4 weeks of cessation of monitoring activities.
Review & Audit	• Validation of crew training and competence in slick estimation and use of tracking buoys; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and Implementation Plan. OSMP Program Manager (or delegate): • Communicates with AMSA as required regarding surveillance activities. • Day-to-day coordination of study results • Provides surveillance data to RPS (OPM1). • Communicates with authorities on surveillance results (as required). • Communicates with NOPSEMA. PI: • Daily implementation of IP. • Plan, coordinate and implement daily surveillance and tracking field activities; • Review, approve and disseminate daily surveillance information and final report; • Daily communication with the MP. MP: • Undertake and record field observations; • Contribute to daily and final reports.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al. 2016) (Section 6)

3.2.3 OPM3: Marine megafauna surveys

Strategy Component	Description
Rationale	Oil spills have the potential for long-term impacts to marine fauna (including whales, dolphins, turtles). Hydrocarbon contact with marine and shoreline fauna due to surface oil may have the potential to impart lethal and sub-lethal impacts to individual and populations of species. This may include behavioural (e.g., migratory deviation, foraging displacement); physiological (digestion disruption) and/or physical effects.

Strategy Component	Description
Monitoring Performance Outcomes	Monitor marine fauna to: • Determine the impact of the oil spill on marine fauna throughout the response at locations contacted by hydrocarbons to inform spill response activities (including documentation of dead individuals).
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement OPM3	PI and MP to be sourced from resources.
2. Acquisition and dissemination of existing marine fauna baseline data.	PI has arrangement in place with vessel providers
3. Acquisition of marine megafauna survey data during the spill	PI responsible for the acquisition of existing marine mega-fauna data from various sources (refer baseline data references) as per the procedure in the OPM3 IP to establish the baseline dataset. Monitoring data will observe all KPIs, objectives and values within species recovery plans or conservation advices have been met.
4. Regulatory Compliance Reporting	MP collect and analyse marine fauna data from within the spill EMBA at predicted impact sites and reference sites (sufficient distance from EMBA which will not be impacted) at frequencies prescribed in the OPM3 IP (i.e. every 1-2 days) during the spill. MP to store / archive field records. Monitoring will observe all KPIs, objectives and values within species recovery plans or conservation advices are met. Note initial data collection will be via vessel MFOs.
Initiation Trigger	Module will be initiated in any Level 2 spill incident.
Termination Trigger	The OSMP Program Manager (or delegate) will terminate field activities, in consultation with DCCEEW, DoT, DNP, AMSA and NOPSEMA, when the following criteria has been met: • Hydrocarbon release has ceased; • No visible sheens are present; and • Modelling predicts no further surface sheens. OR • SSM4 is triggered.
Baseline	Existing baseline data reports which can be drawn upon for marine fauna presence and abundance.
Competencies	• PI with post-graduate research in marine fauna management. Field experience in managing marine fauna surveys (aerial, boat-based, telemetry, acoustic). Experience in leading marine mega-fauna technical studies and reporting. • MP (vessel and aerial-based) will include experienced and qualified marine zoologists with at least five years' experience in surveys of marine mega-fauna. • MP (office) to be experienced marine mega-fauna analysts for SSM4 office-based analyses. • MFOs appropriately qualified to undertake initial sighting data from vessel; • Commercial certified / surveyed vessels
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following • OPM3 Baseline Data Report. • OPM3 Survey Reports.

Strategy Component	Description
Review & Audit	• Random internal review of OPM3 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates non-avian marine fauna monitoring. • Day-to-day coordination and review of monitoring results • Communicates with DoT, DNP, AMSA and other authorities on results (as required). • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final) for external issue. • Report any injuries or fatalities of marine megafauna to the relevant regulator ASAP from survey activities (not spill-related). PI: • Daily implementation of IP. • Plan, coordinate and implement surveys; • Review, approve and disseminate monitoring information; • Review baseline, survey and final reports; • Daily communication between MP and CGG Project Manager. MP: • Undertake monitoring activities; • Report any injuries or fatalities of marine megafauna to the OSMP Program Manager (or delegate) within 2 hours of sighting • Undertakes data analysis; • Report preparation; • Store and archive data.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) Australian Marine Mammal Centre (AMMC, 2019)

3.2.4 OPM4: Shorebird and seabird population monitoring

Strategy Component	Description
Rationale	Oil spills have the potential for long-term impacts to seabird/shorebird populations. Hydrocarbon contact with avifauna may impart lethal or sub-lethal impacts to individual birds and populations of species through direct contact with oiled surfaces; transfer of oil to eggs from contaminated plumage or ingestion during foraging or ingesting contaminated prey.
Monitoring Performance Outcomes	• Provide oiled bird data during spill incident to inform response (remedial) activities; • Assess any impacts to shorebirds/seabirds as a result of response operations.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement OPM4	PI and MP to be sourced from resources. PI has arrangement in place with vessel providers.

Strategy Component	Description
2. Acquisition and dissemination of existing shorebird and seabird baseline data.	PI responsible for the acquisition of existing shorebird and seabird population baseline data from various sources (refer baseline data references) as per the procedure in the OPM4 IP to establish the baseline dataset. Monitoring data will observe all KPIs, objectives and values within species recovery plans or conservation advices have been met. PI to provide OPM4 Marine Fauna Monitoring Baseline Data Report (within 8 weeks of spill) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 2 weeks of submission and distribute to other PIs (as appropriate).
3. Acquisition of shorebird and seabird population monitoring data during the spill and for 3 months after the spill cessation	MP collect and analyse shorebird and seabird population data from priority sensitive locations, predicted impact and reference sites at frequencies prescribed in the OPM4 IP (e.g. daily during spill; after spill termination (if shoreline contacted by hydrocarbons) - fortnightly for 3 months). MP to store / archive field records. Monitoring will observe all KPIs, objectives and values within species recovery plans or conservation advices are met. Note initial data collection within the marine spill zone will be via vessel MFOs. During spill: PI to provide a short data report summarising each field survey, ASAP but within 1 day of survey completion to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve ASAP but within 1 day of submission and distribute to DoT, DCCEEW, AMSA, NOPSEMA, DNP and other relevant authority as identified by CGG. Post spill (if shorelines contacted): PI to provide short data reports summarising each field survey within 2 weeks of the survey completion to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to DoT, DCCEEW, AMSA, NOPSEMA and other relevant authority as identified by CGG
4. Regulatory Compliance Reporting	Final Impact Report: OSMP Program Manager (or delegate) to provide regulators (NOPSEMA, DoT, DNP, and DCCEEW) with the Shorebird and Seabird Population Assessment Report. Seabird & Shorebird Injury during Survey: MP to inform OSMP Program Manager (or delegate) of any injuries or mortality of shorebirds and seabirds within 12 hours of observation. OSMP Program Manager (or delegate) to report any injuries or mortality of avifauna to relevant regulators ASAP but within 72 hours of incident.
Initiation Trigger	Operational Monitoring: Module will be initiated in a Level 2 spill incident.
Termination Trigger	The OSMP Program Manager (or delegate) will terminate the study when, in consultation with DCCEEW, DoT, AMSA and NOPSEMA: • Impacts to seabird and shorebird populations from hydrocarbon exposure have been quantified; • Recovery of impacted seabird and shorebird populations has been evaluated and is reasonably satisfied; and • Agreement with relevant stakeholders and regulators, based upon the nature and scale of the spill impacts are no longer attributable to the spill
Baseline	Existing baseline data which will be drawn upon for avifauna includes the following: • Birdlife Australia (Birdata, Atlas Program, Shorebirds 2020) • Australian Wader Study Group (awsg.org.au) • Atlas of Living Australia (ala.org.au)

Strategy Component	Description
Competencies	• PI will be an experienced marine zoologist with at least 5 years' coastal seabird experience. • MP (vessel-based) will be qualified marine zoologists with experience in vessel-based monitoring activities. • MP (office) to be experienced shorebird and seabird analysts for SSM5 office-based analyses. • MFOs appropriately qualified to undertake initial sighting data from vessel. Commercial certified / surveyed vessels.
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following • OPM4 Baseline Data Report. • OPM4 Survey Reports. • OPM4 Shorebird and Seabird Population Monitoring Assessment Report.
Review & Audit	• Internal review of OPM4 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates shorebird and seabird monitoring in areas of active response during and post spill. • Day-to-day coordination and review of monitoring results • Communicates with authorities on results (as required). • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final) for external issue. • Report any injuries or fatalities of avifauna to the relevant regulator ASAP from survey activities (not spill-related). PI: • Daily implementation of IP. • Plan, coordinate and implement surveys; • Review, approve and disseminate monitoring information; • Review baseline, survey and final reports; • Daily communication between MP and CGG Project Manager; MP: • Undertake monitoring activities; • Report any injuries or fatalities of marine megafauna to the OSMP Program Manager (or delegate) within 2 hours of sighting • Undertakes data analysis; • Report preparation; • Store and archive data.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) Watson, J.E.M., Joseph, L.N. and Watson, A.W.T. 2009. A rapid assessment of the impacts of the Montara field oil leak on birds, cetaceans and marine reptiles. Prepared on behalf of the DEWHA by the Spatial Ecology Laboratory, University of Queensland, Brisbane.

3.3 Scientific monitoring

The aim of the Scientific (Type 2) monitoring is to quantify the nature, extent, severity and persistence of environmental impacts from a significant spill event and inform on appropriate remediation activities. Upon notification of a Level 2 spill, the OSMP Program Manager (or delegate) will initiate the scientific monitoring program. The strategy for each Type 2 monitoring study is provided in this section together with a reference to their respective Implementation Plans.

The studies outlined in this section are:

- SSM1: Marine Water Quality;
- SSM2: Marine and inter-tidal sediment monitoring;
- SSM3: Sub-tidal and inter-tidal benthos monitoring;
- SSM4: Marine megafauna surveys;
- SSM5: Shorebird and seabird population monitoring;
- SSM6: Hydrocarbon monitoring of representative Commercial fish species; and
- SSM7: Hindcast modelling.

3.3.1 SSM1: Marine water quality monitoring

Strategy Component	Description
Rationale	Monitor hydrocarbons in marine waters at sub-tidal and inter-tidal sensitive locations and reference sites to support assessment of environmental impact and recovery.
Monitoring Performance Outcomes	Monitor hydrocarbons in marine waters at sub-tidal and intertidal sensitive locations, commercial fishery areas and reference sites to support the assessment of environmental impacts and recovery. This will be used for: • Detect and monitor for the presence, quantity and behaviour of surface and in-water hydrocarbons; and verify predictions made in modelling about the extent and presence of hydrocarbon contamination; • Identify sensitivities at risk of hydrocarbon exposure, inform the NEBA and identify which sensitivities require scientific monitoring; and • Provide data to validate hind-cast modelling confidence in the fate and transport of hydrocarbons.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM1	PI and MP to be sourced from resources. PI has arrangements in place with vessel service provider.
2. Appropriate collection, transport and analysis of water samples.	MP to collect and store water samples, and keep field records (e.g., field book, checklists) as per the SSM1 IP. Chain-of-Custody (CoC) to confirm sample collection, transport to appropriate laboratories, and sample receipt notification from the NATA-accredited laboratory (e.g., ALS) to confirm arrival of water samples within holding times. Documents stored / archived by MP. Water sample locations are within the EMBA informed through trajectory modelling (OPM1) and/or surveillance (OPM2) information. The monitoring program will initially sample at a greater intensity than may be needed. At least ten sampling locations will be taken as recommended by the US EPA (2011) in order to obtain a statistically significant data set. Samples at each location will be taken depths of 1 m, 5 m, water surface, 2 m over seabed at sensitive features. Once the results of the initial monitoring are analysed a better understanding of the monitoring intensity will be identified, but in the initial stages a greater intensity of sampling than may be required will be employed. Laboratory Analysis Report issued by NATA-accredited laboratory with analyte list defined in the Implementation Plan (TRH, TPH, PAHs, BTEX) within 3 weeks of sample collection and stored by MP.

Strategy Component	Description
3. Acquisition and dissemination of water quality data for hydrocarbons in water	MP collects water quality data as soon as possible for sensitive priority areas, commercial fishery areas and reference sites as per the Implementation Plan. MP store / archive field records. PI to provide hydrocarbon in marine waters survey report (within 1 week of receipt of Laboratory Analysis Report) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission, and distribute to other PIs.
4. Acquisition of hydrocarbon data from marine waters during the hydrocarbon release and after the cessation of the release.	Collection and analysis of hydrocarbon concentrations in marine waters as prescribed in the SSM1 IP by MP during the hydrocarbon release and for 3 months (or period determined by CGG in consultation with environmental regulators) after the cessation of the hydrocarbon release. Impact surveys are targeted at areas predicted or known to be impacted. PI to provide a short report for each survey (within 1 week of receipt of Laboratory Analysis) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to other PIs.
5. Provision of hydrocarbon monitoring of marine waters dataset to SSM9 for Hind-cast Modelling	PI responsible for provision of SSM1 dataset to PI of SSM9 (Hind-cast Modelling Impact Assessment) to serve as a validation data of hydrocarbon concentrations in marine waters at monitored sites within 4 weeks of cessation of spill.
6. If necessary, revise IP for long-term monitoring phase of hydrocarbons in water after the cessation of the hydrocarbon release and carry out long-term monitoring phase (as required and agreed with regulators)	PI to consider final information / results from SSM9 (Hind-cast Modelling for Impact Assessment) in any revision of the IP for the long-term monitoring phase of hydrocarbons in marine waters after the cessation of the spill. Recommendation provided as a brief memorandum to participants for the SSM9 Hind-cast Modelling workshop within 3 months after cessation of hydrocarbon release. Workshop assesses/documents the extent and severity of contamination with reference to the surveillance observations made during OPM2 and in-water measurements obtained as part of SSM1; and confirms potential cause and effect drivers for environmental receptors monitored under other Type 2 studies. PI revises (if necessary) SSM1 IP for long-term monitoring phase of hydrocarbons in water within 3 months after cessation of hydrocarbon releases (or period determined by CGG in consultation with environmental regulators) and provides to the OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve revision to SSM1 IP for long-term monitoring phase of hydrocarbons in marine waters within 8 weeks of submission after consultation with DCCEEW, NOPSEMA, DNP and DoT (as appropriate); and disseminates to MP.
7. Assess impact of hydrocarbons in marine waters	PI responsible to assess the impact of hydrocarbons in marine waters within survey (single survey), annual (as required) and final (all data) reports relative to the established baseline condition and the reference sites as prescribed in the SSM1 IP.
8. Regulatory Compliance Reporting	OSMP Program Manager (or delegate) to provide regulators (NOPSEMA, DoT, DNP and DCCEEW) with the Final Study SSM1 Scientific Monitoring Report within 4 weeks of approval by the OSMP Program Manager (or delegate) and any reports arising from the implementation of a long-term monitoring program (i.e. revised SSM1 IP).
Initiation Trigger	Operational monitoring indicates oil contact within 2 km of a shallow, subtidal (–30 m LAT or above) or intertidal location or BIAs associated with MNES OR Other scientific monitroing programs are triggered that require input from this study (SSM2 or SSM7) .

Strategy Component	Description
Termination Trigger	Field Study Termination: The OSMP Program Manager (or delegate) will terminate the module when, in consultation with DCCEEW, DoT, DNP and NOPSEMA, the following criteria has been met: • The spill has ceased; and • No visible sheens are present and no further sheens are predicted from modelling. Study Termination: Study will be terminated when: • Water monitoring data relating to observations, measurements of hydrocarbons in-water have been complied, analysed and reported.
Baseline	Assumption is that marine water quality contains no detectable hydrocarbons (i.e. below the limits of reporting). No baseline report or studies will be undertaken for marine water quality.
Competencies	• PI to be an experienced and qualified water quality scientist with field experience in vessel-based water quality monitoring. • MP (field) to be experienced marine scientists or technicians with appropriate training and experienced in water quality sampling. • Laboratory services with NATA accreditation.
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following: • SSM1 Survey Reports. • Long-term revision to SSM1 (if required). • SSM1 Final Report.
Review & Audit	• CoC documentation for samples; • Laboratory QA/QC sample analysis; • Internal review of SSM1 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates water quality sampling in areas contacted by hydrocarbon. • Day-to-day coordination and review of monitoring results • Provides surveillance data to RPS (OPM1). • Communicates with authorities on surveillance results (as required). • Communicates with NOPSEMA. • Approve Hydrocarbon Monitoring of Marine Waters Final Report PI: • Daily implementation of IP. • Plan, coordinate and implement water quality surveys; • Review, approve and disseminate water quality monitoring information; • Review water survey reports and final report; • Review of data provided for inputs into SSM8 Hind-cast Modelling; • Daily communication between MP and CGG Project Manager. MP: • Undertake water quality monitoring activities; • Coordinates laboratories; • Undertakes data analysis; • Report preparation; • Store and archive data

Strategy Component	Description
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) Australian and New Zealand Standard 5667.9, Water quality—Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS/NZS 5667.1:1998) ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines USEPA, 2011- Guidance for choosing a Sampling Design for Environmental Data Collection, US EPA, ProQuest, UMI Dissertation Publishing

3.3.2 SSM2: Marine and inter-tidal sediment monitoring

Strategy Component	Description
Rationale	Monitor hydrocarbons in marine sediments at sub-tidal and inter-tidal sensitive locations and reference sites to support assessment of environmental impact and recovery.
Monitoring Performance Outcomes	Monitor hydrocarbons in marine waters at sub-tidal and intertidal sensitive locations, commercial fishery areas and reference sites to support the assessment of environmental impacts and recovery. This will be used for: • Detect and determine the extent, severity and persistence of hydrocarbons in marine sediments across selected sites where hydrocarbons have been observed, recorded or predicted; • Provide information which can be used to interpret possible cause and effect drivers for environmental impacts of sensitive receptors monitored under SMPs; • Provide data to validate hind-cast modelling confidence in the fate and transport of hydrocarbons
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM2	PI and MP to be sourced from resources. PI has arrangements in place with vessel service provider.
2. Appropriate collection, transport and analysis of sediment samples.	MP collects sediment quality data as soon as possible at sub-tidal and inter-tidal locations, commercial fishery areas and reference sites within 1 week of the release. MP to collect and store sediment samples, and keep field records (e.g., field book, checklists). CoC to confirm sample collection, transport to appropriate laboratories, and sample receipt notification from the NATA-accredited laboratory (e.g., ALS) to confirm arrival of water samples within holding times. Documents stored / archived by MP. Sediment sample locations are within the EMBA informed through trajectory modelling (OPM1) and/or surveillance (OPM2) information. The monitoring program will initially sample at a greater intensity than may be needed. At least ten sampling locations will be taken as recommended by the US EPA (US EPA 2012) in order to obtain a statistically significant data set. Once the results of the initial monitoring are analysed a better understanding of the monitoring intensity will be achieved, but in the initial stages a greater intensity of sampling than may be required will be employed. Laboratory Analysis Report issued by NATA-accredited laboratory with analyte list defined in the IP (TOC, TRH, TPH, PAHs, BTEX, PSD) within 3 weeks of sample collection and stored by MP.

Strategy Component	Description
3. Acquisition and dissemination of sediment quality data for hydrocarbons in sediments	MP collects data as soon as possible after analysis. MP store / archive field records. PI to provide hydrocarbon in marine sediments survey report (within 1 week of receipt of Laboratory Analysis Report) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission, and distribute to other PIs
4. Acquisition of hydrocarbon data from marine sediments during the hydrocarbon release and after the cessation of the release.	Collection and analysis of hydrocarbon concentrations in sediments as prescribed in the SSM2 IP by MP for 9 months (or period determined by CGG in consultation with environmental regulators) after the cessation of the hydrocarbon release (recovery surveys). Recovery surveys are targeted at areas known to be impacted. PI to provide a short report for each survey (within 1 week of receipt of Laboratory Analysis) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to other PIs.
5. Provision of hydrocarbon monitoring of marine sediments dataset to SSM9 for Hind-cast Modelling	PI responsible for provision of SSM2 dataset to PI of SSM9 (Hind-cast Modelling Impact Assessment) to serve as a validation data of hydrocarbon concentrations in marine sediments at monitored sites within 4 weeks of cessation of spill.
6. If necessary, revise IP for long-term monitoring phase of hydrocarbons in sediments after the cessation of the spill and carry out long-term monitoring phase (as required and agreed with regulators)	PI to consider final information / results from SSM9 (Hind-cast Modelling for Impact Assessment) in any revision of the IP for long-term monitoring of hydrocarbons in marine waters after the cessation of the spill. Recommendation provided as a brief memorandum to participants for the SSM9 Hind-cast Modelling workshop within 3 months after cessation of hydrocarbon release. PI revises (if necessary) SSM2 IP for long-term monitoring phase of hydrocarbons in sediments within 3 months after cessation of hydrocarbon releases (or period determined by CGG in consultation with environmental regulators) and provides to the OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve revision to SSM2 IP for long-term monitoring phase of hydrocarbons in marine waters within 8 weeks of submission after consultation with DCCEEW, NOPSEMA, DNP and DoT (as appropriate); and disseminates to MP.
7. Assess impact of hydrocarbons in marine sediments	PI responsible to assess the impact of hydrocarbons in marine sediments within survey (single survey), annual (as required) and final (all data) reports relative to the established baseline condition and the reference sites as prescribed in the SSM2 IP.
8. Regulatory Compliance Reporting	OSMP Program Manager (or delegate) to provide regulators (NOPSEMA, DoT, DNP and DCCEEW) with the Final Study SSM2 Scientific Monitoring Report within 4 weeks of approval by the OSMP Program Manager (or delegate) and any reports arising from the implementation of a long-term monitoring program (i.e. revised SSM2 IP).
Initiation Trigger	Module will be initiated immediately following a Level 2 spill incident for coastal areas (water depth < 20 m) where operational monitoring results (OPM1 or OPM2) indicate that inter-tidal or sub-tidal areas have been exposed to surface oil levels of 1 g/m2 (visible sheen); 6 ppb (entrained phase) or 100 g/m2 (shoreline residue).
Termination Trigger	The OSMP Program Manager (or delegate) will terminate the module when, in consultation with DCCEEW, DoT and NOPSEMA, the following criteria has been met: • Concentrations of hydrocarbons in sediment samples are below ANZG 2018 ISQG low-trigger values for biological disturbance or hydrocarbon levels in sediments are within natural variability of baseline condition no longer posing a risk to environmental receptors; and • The extent, severity and persistence of hydrocarbons from concentrations recorded in sediments have been documented.

Strategy Component	Description
Baseline	Pre-exposure (reactive) baseline sampling may be undertaken where practicable and if timeframes permit. In the absence of baseline samples, the assumption is that marine sediment quality contains hydrocarbon concentrations below ANZG (2018) ISQG low-trigger values for biological disturbance.
Competencies	• PI with an experienced marine scientist with at least 5 years' experience in collecting marine sediment samples. • MP (field) will include experienced and qualified marine scientists with field experience in vessel-based sediment and water quality monitoring. • Laboratory services with NATA accreditation.
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following: • SSM2 Survey Reports within one month of completion. • Long-term revision to SSM2 (if required). • SSM1 Final Report within one month after study termination.
Review & Audit	• Chain of Custody documentation for samples; • Laboratory QA/QC sample analysis; • Internal review of SSM2 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates sediment quality sampling in areas contacted by hydrocarbon. • Day-to-day coordination and review of monitoring results • Communicates authorities on surveillance results (as required). • Communicates with NOPSEMA. • Approve Hydrocarbon Monitoring of Marine Sediment Final Report PI: • Daily implementation of IP. • Plan, coordinate and implement sediment surveys; • Review, approve and disseminate sediment quality monitoring information; • Review sediment survey reports and final report; • Daily communication between MP and CGG Project Manager; • Review of data provided for inputs into SSM9 Hind-cast Modelling; • Develop the long-term monitoring phase revision of the IP. MP: • Undertake sediment quality monitoring activities; • Coordinates laboratories; • Undertakes data analysis; • Report preparation; • Store and archive data

Strategy Component	Description
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) National Assessment Guidelines for Dredging (NAGD)(2009) (DEWHA, 2009) AS4482 1-2005: Guide to Sampling and Investigation of Potentially Contaminated Soil. AS1289.3.6.1 (2009). Soil classification tests- Determination of the particle size distribution of a soil – Standard method of analysis by sieving ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

3.3.3 SSM3: Sub-tidal and inter-tidal benthos monitoring

Strategy Component	Description
Rationale	Hydrocarbon contact with shorelines may lead to contamination of inter-tidal and sub-tidal (coastal) habitats. On sandy beaches this can lead to impacts on inter-tidal invertebrates with subsequent impacts to shoreline bird populations and may affect productivity in sub-tidal areas leading to effects on other trophic levels. Categories of inter-tidal and sub-tidal habitat that may be monitored includes rocky reefs, gastropods, site-attached fish, macroalgal communities and invertebrate (sandy beaches) communities.
Monitoring Performance Outcomes	Monitor sub-tidal habitats (e.g., reef habitats) and inter-tidal habitats (e.g. sandy shorelines) at priority sensitive locations and one reference site to support the assessment of environmental impacts and recovery. This will be used to: • Quantify the distribution, abundance and community composition of marine organisms in soft sediment and hard substrate environments; • Quantify the level of exposure to affected communities; and • Determine the impact and recovery of the hydrocarbon release on those habitats.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM3	PI and MP to be sourced from resources. PI has arrangements in place with vessel service provider. PI has arrangement in place for specialised monitoring equipment (e.g., video / drop cameras, side-scan sonar).
2. Reactive baseline monitoring and establishment of sub-tidal benthic habitat monitoring sites.	PI to consider output from OPM1 and OPM2 to prioritise sensitive priority areas for the establishment of monitoring sites and gathering reactive baseline monitoring data where existing baseline data does not exist (*refer Baseline Data section*). MP to establish sites and carry out reactive baseline (where required) within 1 week of the Level 2 spill. PI to provide reactive baseline survey report wining 4 weeks of reactive baseline survey completion, to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to other PIs (as appropriate).
3. Acquisition and dissemination of existing intertidal and sub-tidal habitat baseline data	PI responsible for the acquisition of existing baseline reef, gastropod, macro-algae habitat and invertebrate community data from various sources (*refer existing baseline information*) as per the procedure in the SSM3 IP to establish the baseline dataset. PI to provide SSM4 Intertidal and Sub-tidal Benthic Habitat Baseline Data Report (within 8 weeks of hydrocarbon release) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 2 weeks of submission and distribute to other PIs (as appropriate).

Strategy Component	Description
4. Acquisition of routine inter-tidal and sub-tidal benthic habitat surveys during the hydrocarbon release and for 3 months after the cessation of the spill.	MP to routinely carry out scientific surveys of inter-tidal and sub-tidal benthic habitat sites at the identified sensitive locations and reference sites for 3 months after the cessation of the spill (impact surveys). Field records, photos, video and other data to be stored/archived. PI to provide a short report for each survey (within 4 weeks of completion of survey) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to other PIs.
5. Revise IP for long-term monitoring phase of inter-tidal and sub-tidal benthic habitats after the hydrocarbon release and carry out long-term monitoring phase (as required)	PI to consider final information / results from SSM9 (Hind-cast Modelling for Impact Assessment) in the revision of the IP for the long-term monitoring phase of inter-tidal and sub-tidal benthic habitats after cessation of the spill. PI revises SSM3 IP for long-term monitoring phase of inter-tidal and sub-tidal benthic habitats (within 4 weeks after SSM9 Final Report is approved) and provides to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve revision to SSM3 IP for long-term monitoring phase of inter-tidal and sub-tidal benthic habitats within 4 weeks of submission after consultation with DCCEEW, NOPSEMA, DoT and disseminates to MP. PI responsible for implementation of Long-Term Monitoring Phase SSM3 IP.
6. Assess impact of hydrocarbon release on inter-tidal and sub-tidal benthic habitats	PI assesses impacts to inter-tidal and sub-tidal habitats based on methodology in the SSM3 IP and utilises SSM3 data. PI responsible to report data and to assess the impact of hydrocarbons on inter-tidal and sub-tidal benthic habitats in the survey (single survey), annual (data to date, EP reporting commitment) and final (all data) reports relative to the established baseline condition and the reference sites. PI to prepare and to provide OSMP Program Manager (or delegate) with a SSM3 section for EP Performance Report and the Intertidal and Sub-tidal Benthic Habitat Final Report within 8 weeks of field activity termination. After consultation with DCCEEW, NOPSEMA and DoT, the OSMP Program Manager (or delegate) to approve Final Intertidal and Sub-tidal Benthic Habitat Report within 2 months of field termination for dissemination.
7. Regulatory Compliance Reporting	OSMP Program Manager (or delegate) to provide regulators (NOPSEMA, DoT, and DCCEEW) with the Final Study SSM3 Scientific Monitoring Report within 4 weeks of approval by the OSMP Program Manager (or delegate) and any reports arising from the implementation of a long-term monitoring program (i.e. revised SSM3 IP).
Initiation Trigger	Module will be initiated in a Level 2 spill incident and implemented for coastal areas (water depth < 20 m) where operational monitoring results (OPM1 or OPM2) indicate that inter-tidal or sub-tidal areas have been exposed to surface oil levels of 1 g/m^2 (visible sheen); 6 ppb (entrained phase) or 100 g/m^2 (shoreline residue).
Termination Trigger	The OSMP Program Manager (or delegate) will terminate the module when, in consultation with DCCEEW, DoT, and NOPSEMA, the following criteria has been met: • Overall impacts to inter-tidal and sub-tidal benthic habitats from hydrocarbon exposure have been quantified; • Recovery of impacted benthic habitats have been evaluated; • Agreement with relevant stakeholders and regulators, based upon the nature and scale of the spill impacts are no longer attributable to the spill.
Competencies	Existing baseline data reports will be drawn upon for sub-tidal and intertidal benthic habitats. Pre-exposure (reactive) baseline sampling may be undertaken where practicable and if timeframes permit.

Strategy Component	Description
Reporting	PI will be an experienced marine scientist with vessel-based marine benthic expertise. MP will be experienced and qualified marine scientists with experience in undertaking marine benthic surveys including inter-tidal and sub-tidal monitoring and habitat analysis. Dive teams with Australian standard commercial certification to AS2815.1. Wet laboratory services will be required for organism sampling processing Commercial certified / surveyed vessels
Review & Audit	Random internal review of SSM3 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) with duration between reviews no longer than 2 months; Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates inter-tidal and subtidal benthic habitat monitoring. • Day-to-day coordination and review of monitoring results • Communicates with authorities on results (as required). • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final), the IP and revision for the Long-Term Monitoring Phase Report PI: • Daily implementation of IP. • Plan, coordinate and implement surveys; • Review, approve and disseminate monitoring information; • Review t survey reports and final report; • Daily communication between MP and CGG Project Manager; • Develop the long-term monitoring phase revision of the IP. MP: • Undertake monitoring activities; • Undertakes data analysis; • Report preparation; • Store and archive data.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) AS2815.1 – Commercial Scuba to 30 m AS2299.1:2015 – Occupational Diving Operations

3.3.4 SSM4: Marine megafauna surveys

Strategy Component	Description
Rationale	Oil spills have the potential for long-term impacts to marine fauna (includes whales, dolphins, turtles). Hydrocarbon contact with marine and shoreline fauna due to surface oil may have the potential to impart lethal and sub-lethal impacts to individual and populations of species. This may include behavioural (e.g. migratory deviation, foraging displacement); physiological (digestion disruption) and/or physical effects.

Strategy Component	Description
Monitoring Performance Outcomes	Monitor marine fauna to: • Utilising data collected (mortality, stranding or oiling of mobile marine species), via population analysis determine (infer) potential impacts to marine fauna species populations.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM4	PI and MP to be sourced from resources.
2. Acquisition and dissemination of existing marine fauna baseline data.	PI has arrangement in place with vessel providers
3. Acquisition of marine megafauna survey data during the spill and for 1 week after the spill cessation	PI responsible for the acquisition of existing marine mega-fauna data from various sources (refer baseline data references) as per the procedure in the SMM4 IP to establish the baseline dataset. Monitoring data will observe all KPIs, objectives and values within species recovery plans or conservation advices have been met.
4. Assess impact of hydrocarbon release on marine fauna and provision of performance report	PI to provide SSM4 Marine Fauna Monitoring Baseline Data Report (within 8 weeks of spill) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 2 weeks of submission and distribute to other PIs (as appropriate).
5. Regulatory Compliance Reporting	MP collect and analyse marine fauna data from within the spill EMBA at predicted impact sites and reference sites (sufficient distance from EMBA which will not be impacted) at frequencies prescribed in the SSM4 IP (i.e. every 1-2 days) during the spill. MP to store / archive field records. Monitoring will observe all KPIs, objectives and values within species recovery plans or conservation advices are met. Note initial data collection will be via vessel MFOs.
Initiation Trigger	Module will be initiated in any Level 2 spill incident.
Termination Trigger	The OSMP Program Manager (or delegate) will terminate field activities, in consultation with DCCEEW, DoT, DNP, AMSA and NOPSEMA, when the following criteria has been met: • Hydrocarbon release has ceased; • No visible sheens are present; and • Modelling predicts no further surface sheens.
Baseline	Existing baseline data reports which can be drawn upon for marine fauna presence and abundance.
Competencies	• PI with post-graduate research in marine fauna management. Field experience in managing marine fauna surveys (aerial, boat-based, telemetry, acoustic). Experience in leading marine mega-fauna technical studies and reporting. • MP (vessel and aerial-based) will include experienced and qualified marine zoologists with at least five years' experience in surveys of marine mega-fauna. • MP (office) to be experienced marine mega-fauna analysts for SSM4 office-based analyses. • MFOs appropriately qualified to undertake initial sighting data from vessel; • Commercial certified / surveyed vessels

Strategy Component	Description
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following • SSM4 Baseline Data Report. • SSM4 Survey Reports. • SSM4 Survey Final Impact Report.
Review & Audit	• Random internal review of SSM4 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates non-avian marine fauna monitoring. • Day-to-day coordination and review of monitoring results • Communicates with DoT, DNP, AMSA and other authorities on results (as required). • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final) for external issue. • Report any injuries or fatalities of marine megafauna to the relevant regulator ASAP from survey activities (not spill-related). PI: • Daily implementation of IP. • Plan, coordinate and implement surveys; • Review, approve and disseminate monitoring information; • Review baseline, survey and final reports; • Daily communication between MP and CGG Project Manager; • Develop the long-term monitoring phase revision of the IP. MP: • Undertake monitoring activities; • Report any injuries or fatalities of marine megafauna to the OSMP Program Manager (or delegate) within 2 hours of sighting • Undertakes data analysis; • Report preparation; • Store and archive data.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) Australian Marine Mammal Centre (AMMC, 2019)

3.3.5 SSM5: Shorebird and seabird population monitoring

Strategy Component	Description
Rationale	Oil spills have the potential for long-term impacts to seabird/shorebird populations. Hydrocarbon contact with avifauna may impart lethal or sub-lethal impacts to individual birds and populations of species through direct contact with oiled surfaces; transfer of oil to eggs from contaminated plumage or ingestion during foraging or ingesting contaminated prey.
Monitoring Performance Outcomes	Monitor shorebird and seabird populations to assess potential impacts to, and subsequent recovery following a hydrocarbon release • Quantify the level of exposure and impact to affected bird populations; • Determine the recovery of affected populations after spill

Strategy Component	Description
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM5	PI and MP to be sourced from resources. PI has arrangement in place with vessel providers.
2. Acquisition and dissemination of existing shorebird and seabird baseline data.	PI responsible for the acquisition of existing shorebird and seabird population baseline data from various sources (refer baseline data references) as per the procedure in the SMM5 IP to establish the baseline dataset. Monitoring data will observe all KPIs, objectives and values within species recovery plans or conservation advices have been met. PI to provide SSM5 Marine Fauna Monitoring Baseline Data Report (within 8 weeks of spill) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 2 weeks of submission and distribute to other PIs (as appropriate).
3. Acquisition of shorebird and seabird population monitoring data during the spill and for 3 months after the spill cessation	MP collect and analyse shorebird and seabird population data from priority sensitive locations, predicted impact and reference sites at frequencies prescribed in the SSM5 IP (i.e. daily during spill; after spill termination (if shoreline contacted by hydrocarbons) - fortnightly for 3 months). MP to store / archive field records. Monitoring will observe all KPIs, objectives and values within species recovery plans or conservation advices are met. Note initial data collection within the marine spill zone will be via vessel MFOs. During spill: PI to provide a short data report summarising each field survey, ASAP but within 1 day of survey completion to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve ASAP but within 1 day of submission and distribute to DoT, DCCEEW, AMSA, NOPSEMA, DNP and other relevant authority as identified by CGG. Post spill (if shorelines contacted): PI to provide short data reports summarising each field survey within 2 weeks of the survey completion to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 1 week of submission and distribute to DoT, DCCEEW, AMSA, NOPSEMA and other relevant authority as identified by CGG
4. Assess impact of hydrocarbon release on shorebird and seabird populations and provision of performance report	PI responsible to assess and to report on monitoring of shorebird and seabird populations for each survey (single survey), the spill activity (data to date) and final (all data) reports relative to the established baseline condition and reference sites (as relevant). PI to prepare and provide the OSMP Program Manager (or delegate) with a Shorebird and Seabird Population Monitoring Assessment Report, quantifying impacts to shorebird and seabird populations within 4 months of field activity termination. The OSMP Program Manager (or delegate) to approve a Shorebird and Seabird Population Monitoring Assessment Report within 1 month of final report receipt for regulator dissemination.
5. Revise IP for long-term monitoring phase of shorebird and seabird populations after the hydrocarbon release and carry out long-term monitoring phase	PI to consider final information / results from SSM9 (Hind-cast Modelling for Impact Assessment) and Shorebird and Seabird Population Monitoring Assessment Report in the revision of the IP for the long-term monitoring phase of shorebird and seabird populations after cessation of spill. PI revises SSM5 IP for long-term monitoring phase of shorebird and seabird populations within 4 weeks after the Shorebird and Seabird Population Monitoring Assessment Report and SSM9 Final Report approval and provides to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve revision to SSM5 IP for long-term monitoring phase of shorebird and seabird populations within 4 weeks of receipt after consultation with DCCEEW, NOPSEMA and DoT; and disseminates to MP. PI responsible for implementation of revised long-term phase SSM5 IP

Strategy Component	Description
6. Regulatory Compliance Reporting	Final Impact Report: OSMP Program Manager (or delegate) to provide regulators (NOPSEMA, DoT, DNP, and DCCEEW) with the Shorebird and Seabird Population Assessment Report and any reports arising from the implementation of a long-term monitoring program (i.e. revised SSM5 IP). Seabird & Shorebird Injury during Survey: MP to inform OSMP Program Manager (or delegate) of any injuries or mortality of shorebirds and seabirds within 12 hours of observation. OSMP Program Manager (or delegate) to report any injuries or mortality of avifauna to relevant regulators ASAP but within 72 hours of incident.
Initiation Trigger	Scientific Monitoring: Module will be implemented in a level 2 spill event if: • Dead, oiled or injured bird species are recorded as part of the spill response activity; or • Operational monitoring identifies shoreline contact of surface hydrocarbons above 1 g/m2 or shoreline residue > 100 g/m2 at sensitive shoreline colony locations.
Termination Trigger	The OSMP Program Manager (or delegate) will terminate the study when, in consultation with DCCEEW, DoT, AMSA and NOPSEMA: • Impacts to seabird and shorebird populations from hydrocarbon exposure have been quantified; • Recovery of impacted seabird and shorebird populations has been evaluated and is reasonably satisfied; and • Agreement with relevant stakeholders and regulators, based upon the nature and scale of the spill impacts are no longer attributable to the spill
Baseline	Existing baseline data which will be drawn upon for avifauna includes the following: • Birdlife Australia (Birdata, Atlas Program, Shorebirds 2020) • Australian Wader Study Group (awsg.org.au) • Atlas of Living Australia (ala.org.au)
Competencies	• PI will be an experienced marine zoologist with at least 5 years' coastal seabird experience. • MP (vessel-based) will be qualified marine zoologists with experience in vessel-based monitoring activities. • MP (office) to be experienced shorebird and seabird analysts for SSM5 office-based analyses. • MFOs appropriately qualified to undertake initial sighting data from vessel. • Commercial certified / surveyed vessels.
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following • SSM5 Baseline Data Report. • SSM5 Survey Reports. • SSM5 Shorebird and Seabird Population Monitoring Assessment Report. • Revised SSM5 IP for Long-term Monitoring Phase; • Survey Reports supporting Revised SSM5 IP (as detailed in that program); • Revised IP SSM5 Final Report
Review & Audit	• Internal review of SSM5 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate):

Strategy Component	Description
	• Facilitates shorebird and seabird monitoring in areas of active response during and post spill. • Day-to-day coordination and review of monitoring results • Communicates with authorities on results (as required). • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final) for external issue. • Report any injuries or fatalities of avifauna to the relevant regulator ASAP from survey activities (not spill-related). PI: • Daily implementation of IP. • Plan, coordinate and implement surveys; • Review, approve and disseminate monitoring information; • Review baseline, survey and final reports; • Daily communication between MP and CGG Project Manager; • Develop the long-term monitoring phase revision of the IP. MP: • Undertake monitoring activities; • Report any injuries or fatalities of marine megafauna to the OSMP Program Manager (or delegate) within 2 hours of sighting • Undertakes data analysis; • Report preparation; • Store and archive data.
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) Watson, J.E.M., Joseph, L.N. and Watson, A.W.T. 2009. A rapid assessment of the impacts of the Montara field oil leak on birds, cetaceans and marine reptiles. Prepared on behalf of the DEWHA by the Spatial Ecology Laboratory, University of Queensland, Brisbane.

3.3.6 SSM6: Hydrocarbon monitoring of representative Commercial fish species

Strategy Component	Description
Rationale	Oil spills have the potential to impact on commercial fisheries via a number of pathways such as physical contamination (e.g. tainting); toxic effects (i.e. fish health) and by disrupting business activity.
Monitoring Performance Outcomes	Fish exposed to hydrocarbons may not be killed but may suffer sub-lethal impacts which may impact upon the saleability of fish.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM6	PI and MP to be sourced from resources. PI has arrangement in place with vessel providers (or a commercial fishing vessel may be specifically engaged to undertake target species catch). PI to have arrangement in place with accredited laboratory (e.g., CSIRO) for analysis of fish toxicological samples.
2. Acquisition and dissemination of existing commercial and recreational fishing baseline data.	PI responsible for the acquisition of existing commercial fishing baseline data from various sources (refer baseline data references) as per the procedure in the SMM6 IP to establish the baseline dataset. PI to provide SSM6 Marine Fauna Monitoring Baseline Data Report (within 4 weeks of spill) to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve within 2 weeks of submission and distribute to other PIs (as appropriate). A baseline of no hydrocarbon contamination has been assumed for this study for commercial fishing stock for this area.

Strategy Component	Description
3. Acquisition of data for hydrocarbon monitoring of representative commercial and recreational fish species during the hydrocarbon release and for 3 months after the cessation of the hydrocarbon release	MP collect and analyse fishery impact data from commercial catches at the point of landing. If this is not possible fish, lobster and abalone sampling will be conducted in conjunction with SSM2 studies (Marine Water Quality monitoring). Frequencies of monitoring are prescribed in the SSM6 IP (i.e. Day 1-2 of spill and 7 days following initial sampling, and on a monthly basis for 3 months after the cessation of the spill). CGG will liaise with the DPIRD Fisheries and AFMA regarding sampling and analysis of commercial fish/shellfish stock. MP to store / archive field records. Laboratory analysis of fish samples at accredited laboratory (e.g., CSIRO). CoC to confirm sample collection, transport to appropriate laboratories, and sample receipt notification from the accredited laboratory to confirm arrival of fish samples within holding times. Documents stored / archived at secure site by MP. Laboratory Analysis Report issued by accredited laboratory with analysis techniques as defined in IP (within 3 weeks of sample collection) and stored / archived by MP. PI to provide a short report for each Survey (within 4 weeks of completion of field survey) to OSMP Program Manager (or delegate). Oil Project Manager (or delegate) to approve within 1 week of submission and distribute to other PIs (as relevant) and government authorities.
4. Assess impact of hydrocarbon release on representative commercial and recreational fish species and performance reporting	PI responsible to assess and to report on monitoring of hydrocarbons in representative commercial fish species for each survey (single survey), the spill activity (data to date) and final (all data) reports relative to the established baseline condition. PI to prepare and provide the OSMP Program Manager (or delegate) with a Commercial Fishing Assessment Report, quantifying impacts to commercial fish populations within 4 months of field activity termination. The OSMP Program Manager (or delegate) to approve the Monitoring Assessment Report within 1 month of final report receipt for regulator dissemination.
5. Revise IP for long-term monitoring phase of hydrocarbon monitoring of representative commercial and recreational fish species after the hydrocarbon release and carry out long-term monitoring phase	PI to consider final information / results from SSM9 (Hind-cast Modelling for Impact Assessment) and Commercial Fishing Assessment Report in the revision of the IP for the long-term monitoring phase of commercial fisheries after cessation of spill. PI revises SSM6 IP for long-term monitoring phase of commercial fisheries (as required) within 4 weeks after the Commercial Fishing Assessment Report and SSM9 Final Report approval and provides to OSMP Program Manager (or delegate). OSMP Program Manager (or delegate) to approve revision to SSM6 IP for long-term monitoring phase of commercial/recreational fisheries within 4 weeks of receipt after consultation with AFMA, DPIRD Fisheries, DCCEEW, NOPSEMA, DoT and any other relevant regulator; and disseminates to MP. PI responsible for implementation of revised long-term phase SSM5 IP.
6. Regulatory Compliance Reporting	OSMP Program Manager (or delegate) to provide regulators with the Commercial Fishing Assessment Report and any reports arising from the implementation of a long-term monitoring program.
Initiation Trigger	Module will be initiated in a Level 2 spill incident.
Termination Trigger	The OSMP Program Manager (or delegate) will terminate the study when, in consultation with AFMA, NOPSEMA, DPIRD Fisheries, DCCEEW and DoT: • The hydrocarbon spill has ceased; • Impacts to the quality/safety of fish species from hydrocarbon exposure have been quantified and information provided to relevant stakeholders and regulators for the management of any affected fisheries; and • Recovery of affected commercial fish from hydrocarbon has been assessed and the hydrocarbon levels in representative commercial fish tissue are below relevant seafood standards for marine waters and pose a minimal risk.

Strategy Component	Description
Baseline	• Australian Fisheries Management Authority (Commonwealth Fisheries). • WA Department of Primary Industries and Regional Development – Fisheries (WA Fisheries).
Competencies	• PI will be a fisheries scientist with at least 5 years' professional experience in epidemiological studies of marine fish and aquaculture species. • MP (field) sampling teams include experienced and qualified marine scientists with experience in the collection of fish samples. • MP (office) to be experienced fish analysts for SSM6 office-based analyses. • Laboratory services are NATA-accredited • Commercial certified / surveyed vessels
Reporting	PI and MP responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following: • SSM6 Baseline Data Report. • SSM6 Survey Reports. • SSM6 Commercial and Recreational Fishing Assessment Report. • Revised SSM6 IP for Long-term Monitoring Phase; • Survey Reports supporting Revised SSM6 IP (as detailed in that program); • Revised IP SSM6 Final Report
Review & Audit	• Internal review of SSM6 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Facilitates sampling of representative commercial and recreational fish in areas of active response during and post spill. • Day-to-day coordination and review of monitoring results • Communicates with Commonwealth and State Fisheries Departments regarding the sampling and monitoring of fish. • Communicates with NOPSEMA. • Approve all reporting (Survey, Baseline & Final) for external issue. • Approves and long-term revisions to the SSM6 IP. PI: • Daily implementation of IP. • Plan, coordinate and implement surveys at commercial and recreational charter boat landings; • Review, approve and disseminate monitoring information; • Review baseline, survey and final reports; • Daily communication between MP and CGG Project Manager; • Develop the long-term monitoring phase revision of the IP (as required). MP: • Coordinate fish sampling at home ports; • Undertakes fish sampling activities; • Coordination of laboratories; • Undertakes data analysis; • Report preparation; and • Store and archive data.

Strategy Component	Description
Relevant References and Guidelines	Oil Spill Monitoring Handbook (Hook et al, 2016) ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines Yender et al. (2002). Managing Seafood Safety after an Oil Spill Reilly & York. (2001). Guidance on Sensory Testing and Monitoring of Seafood for Presence of Petroleum Taint Following an Oil Spill Gagnon et al. (1999). Biochemical and Chemical Parameters for Aquatic Ecosystem Health Assessments Adapted to the Australian Oil and Gas Industry

3.3.7 SSM7: Hindcast modelling

Strategy Component	Description
Monitoring Performance Outcomes	This study aims are to: • Conduct hind-cast simulations of a hydrocarbon spill, validated with information / data from other OSMP studies to refine post-incident impact assessment and to inform long-term scientific monitoring specifications (as required); and • To support assessments of the impacts and recovery of environmental sensitivities.
Monitoring Performance Standard	**Measurement Criteria**
1. Readiness to implement SSM7	CGG to initiate contract with modelling service provider (RPS) for 6 months after termination criteria for OPM1 (Operational Forecast Modelling). RPS to be operationally ready to provide hind-cast modelling services within 2 weeks after the cessation of OPM1 (Operational Forecast Modelling). SSMP9 IP (Hindcast Modelling) updated by RPS and approved by the OSMP Program Manager within 1 week of OPM1 ceasing.
2. Conduct hind-cast simulations to inform post-incident impact assessment.	PIs of relevant studies to provide RPS available pertinent information / data from OPM2 (Hydrocarbon Spill Surveillance and Tracking), SSM1 (Hydrocarbon Monitoring in Marine Waters) and SSM2 (Hydrocarbon Monitoring in Marine Sediments) in digital format with accompanying meta-data documents within 4 weeks after cessation of OPM1 (Operational Forecast Modelling). RPS to provide the Hind-cast Modelling Impact Assessment Modelling Report on simulated estimates of environmental impacts in terms of surface slick, entrained hydrocarbon and dissolved aromatic exposures; and shoreline accumulation within 3 months after cessation of OPM1 (Operational Forecast Modelling).
3. Refined post-incident impact assessment informs long-term monitoring specifications	Provision of report to PIs of SSM2-SSM9 to inform modelling assessment of hydrocarbon distributions from incident to be considered in the long-term monitoring specifications (e.g., locations, frequency). RPS to run workshop with PIs from SSM2-SSM6 and OSMP Program Manager (or delegate) to provide subsequent Workshop Report on recommendations based on hind-cast modelling of long-term modelling specifications within 4 months after cessation of OPM1 (Operational Forecast Modelling).
Initiation Trigger	Module will be initiated immediately after the cessation of OPM1 (Operational Forecast Modelling) by the OSMP Program Manager (or delegate).
Termination Trigger	The OSMP Program Manager (or delegate) approves Hind-cast Modelling Impact Assessment Modelling Report submitted by RPS and the Hind-cast Modelling Impact Assessment Workshop is conducted.
Baseline	N/A

Strategy Component	Description
Competencies	RPS is the recognized industry leader in predictive modelling of hydrocarbon incidents and holds the current contract with AMSA to undertake response modelling. No competency test and training is warranted.
Reporting	RPS responsible for the preparation, and OSMP Program Manager (or delegate) responsible for the approval and dissemination of the following: • SSM9 IP Update. • SSM9 Hind-cast Modelling Impact Assessment Modelling Report. • SSM9 Hind-cast Workshop Report • SSM8 Final Hind-cast Modelling Impact Assessment Modelling Report
Review & Audit	• Internal review of SSM8 IP (methodology, procedures, processes, records, reporting and QA/QC) by OSMP Program Manager (or delegate) once during spill incident; • Non-conformances recorded with follow-up by OSMP Program Manager (or delegate) within 2 weeks.
Responsibilities	CGG technical operations manager: • Overall responsibility for implementation of the strategy and IP. OSMP Program Manager (or delegate): • Provide relevant OPM2, SSM1 and SSM2 reports to RPS • Review and approve the Final Hind-cast Modelling Impact Assessment report • Provide Final Hind-cast Modelling Impact Assessment Report to PIs of scientific studies SSM1 (Hydrocarbon Monitoring in Marine Waters), SSM2 (Hydrocarbon Monitoring of Marine Sediments), SSM3 (Sub-tidal & Inter-tidal Benthic Habitat Monitoring), SSM4 (Marine Megafauna Surveys), SSM5 (Shore and Seabird Population Monitoring) and SSM6 (Hydrocarbon Monitoring of Fish) and to assist in refinements to their long-term monitoring specifications (as triggered). • Coordinate Hind-cast Modelling Impact Assessment workshop (led by RPS) for PIs (SSM1-SSM6). • Communicates with NOPSEMA and other relevant regulators. • Approve all reporting (Survey, Baseline & Final) for external issue. • Approves and revisions to the SSM7 IP. PI: • Ensure modelling 'readiness' within 2 weeks of study initiation. • Lead the Hind-cast Modelling Impact Assessment workshop, organized by the CGG Project Manager; • Provide hind-cast modelling after cessation of OPM1 (Operation Forecast Modelling) and associated reporting to estimate the impacts from the hydrocarbon spill to inform the long-term scientific monitoring program. PIs of Studies OPM2, SSM1 & SSM2 are responsible for: • Provision of validation data and meta-data document for hind-cast modelling to RPS.
Relevant References and Guidelines	American Society for Testing and Materials (ASTM) 2013. F2067-13 Standard Practice for Development and Use of Oil-Spill Trajectory Models, ASTM International, West Conshohocken (PA). ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

4 References

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

[ASTM] American Society for Testing and Materials 2013. F2067-13 Standard Practice for Development and Use of Oil-Spill Trajectory Models, ASTM International, West Conshohocken (PA)

Australian Parks & Wildlife Service (n.d.) – A survey of potential Marine Reserve locations in Bass Strait, Final Report, Ocean Rescue 2000, Project D701, For Australian National Parks and Wildlife Service

Black, K. P., Brand, G. W., Grynberg, H., Gwyther, D., Hammond, L. S., Mourtikas, S., Richardson, B. J. & Wardrop, J. A. (1994) Environmental implications of offshore oil and gas development in Australia - production activities. IN: Environmental implications of offshore oil and gas development in Australia. APEA, Sydney.

Commonwealth of Australia (2009) National Assessment Guidelines for Dredging. Department of the Environment, Water, Heritage and the Arts, Canberra, ACT

Gagnon, M.M, Grice, K. & Kagi, R.I. (1999) Biochemical and Chemical Parameters for Aquatic Ecosystem Health Assessments Adapted to the Australian Oil and Gas Industry. APPEA Journal, 39:584-599

Hinwood, J. B., Potts, A. E., Dennis, L. R., Carey, J. M., Houridis, H., Bell, R. J., Thomson, J. R., Boundrea, P. & Ayling, A. M. (1994) Environmental implications of offshore oil and gas development in Australia - drilling activities. IN: SWAN, J.M., NEFF, J.M. & YOUNG, P.C. (eds.). Environmental implications of offshore oil and gas development in Australia, pp. 696. APPEA, Sydney

Hook, S., Batley, G., Holloway, M., Irving, P., Ross, A. (2016) – Oil Spill Monitoring Handbook, CSIRO, 2016, Clayton South, VIC

Reilly, T.I & R. K. York. (2001). Guidance on Sensory Testing and Monitoring of Seafood for Presence of Petroleum Taint Following an Oil Spill. NOAA Technical Memorandum NOS OR&R 9

Underwood, A. J. (1994). On beyond BACI: Sampling designs that might reliably detect environmental disturbances. Ecological Applications, 4(1): 3-15

Watkins, D. (1993). A National Plan for Shorebird Conservation in Australia. Wader Studies Group of the Royal Australasian Ornithologists Union. Melbourne

Watson, J.E.M, Joseph, L.N. & Watson, A.W.T. (2009). A Rapid Assessment of the Impacts of the Montara Oil Leak on Birds, Cetaceans and Marine Reptiles. Prepared on behalf of the Department of the Environment, Water, Heritage and the Arts by the Spatial Ecology Laboratory, University of Queensland, Brisbane

Yender, R., J. Michel & C. Lord. (2002). Managing Seafood Safety after an Oil Spill. Seattle: Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 72 pp