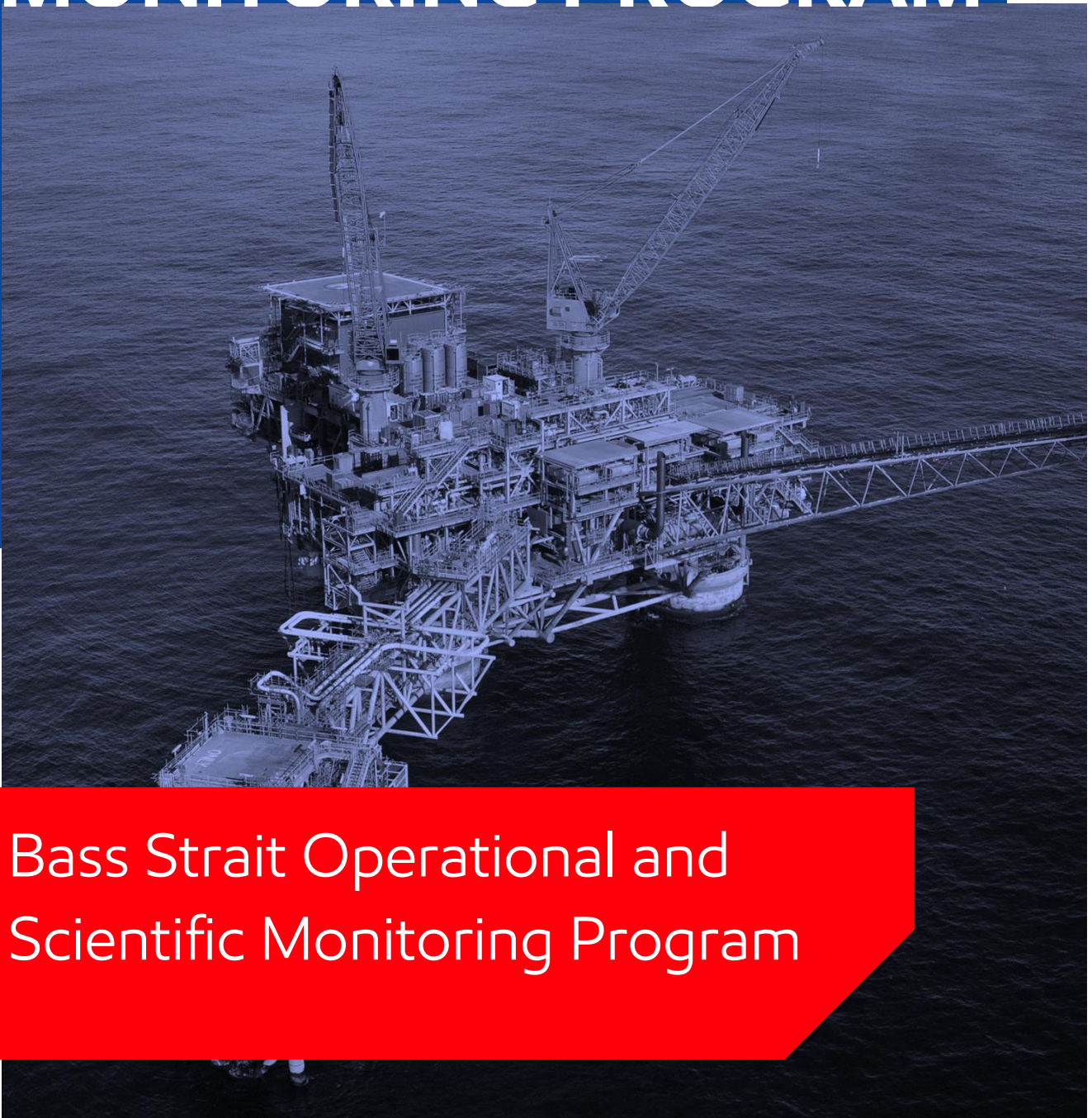


# MONITORING PROGRAM



## Bass Strait Operational and Scientific Monitoring Program



Esso Australia Resources Pty Ltd acknowledges Aboriginal and Torres Strait Islander people as the Traditional Custodians of the land and acknowledges and pays respect to their Elders, past and present. Esso Australia Resources Pty Ltd is committed to safe and inclusive workplaces, policies and services for people of LGBTIQ+ communities and their families.

## REVISION HISTORY

Rev	Document status	Date
6	IFA - Issued for Approval ISSUED FOR NOPSEMA ACCEPTANCE AS PART OF THE BASS STRAIT PRODUCING AND NON-PRODUCING EPS	31 March 2026
5.2	Administrative changes to Sections 1.1, 1.4, 2.7.6, 2.8, 3.4.1, Appendix B & C to capture changes in legislation	21 March 2025
5.1	Document title change to reflect legislative changes; Administrative changes to Sections 1.4, 2.7, 2.8	30 December 2021
5	NOPSEMA OMR for Bass Strait Operations EP	9 December 2020
4.1	Administrative changes to Sections 3.2.2, 3.2.4 and 2.8	27 August 2020
4	NOPSEMA RFFWI for Bass Strait Operations EP	10 June 2020
3	NOPSEMA RFFWI (2) for JUR Drilling EP	30 December 2019
2	NOPSEMA OMR for JUR Drilling EP	2 December 2019
1	NOPSEMA RFFWI for JUR Drilling EP	23 October 2019
0	Issued for acceptance	15 August 2019
A	Issued for Review (IFR)	July 2019

## OIMS MANUAL – DOCUMENT CONTROL DETAILS

Document number:	AUGO-EV-EPL-001
Revision:	6
Document status:	Issued for use
Date of issue:	31/03/2026
Document administrator:	Offshore Environment & Regulatory Advisor
OIMS document category:	Special Controls Mandatory
MPI classification:	None
Retention period:	IND, MIN ACT+10+LC (Indefinite, Retain while current + 10 years, then obtain Law Clearance prior to disposal)
Master storage location:	Document Management System - Aconex

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## TABLE OF CONTENTS

Quick Reference: Operational monitoring initiation and termination criteria .....	12
Quick Reference: Scientific Monitoring Initiation & Termination Criteria .....	17
Quick Reference: Event Level and Monitoring Modules .....	27
<b>1 Introduction .....</b>	<b>29</b>
1.1 Purpose .....	29
1.2 Objectives .....	29
1.3 Scope .....	30
1.4 Regulatory requirements .....	31
1.5 Target audience .....	32
<b>2 OSMP framework and implementation .....</b>	<b>34</b>
2.1 Types of monitoring .....	34
2.2 Initiation and termination of monitoring .....	34
2.3 Implementation guides .....	35
2.4 Roles and responsibilities .....	35
2.5 Training and competency .....	36
2.6 External resources .....	36
2.7 Third-party Oil Spill Management Plan Consultant .....	36
2.8 Communication management .....	50
2.9 Review and revision .....	50
<b>3 Operational monitoring .....</b>	<b>52</b>
3.1 O1: Oil spill surveillance .....	52
3.2 O2: Water and oil sampling .....	55
3.3 O3: Shoreline assessment .....	58
3.4 O4: Fauna observations .....	61
3.5 O5: Air quality .....	63
3.6 O6: Sediment sampling .....	65
<b>4 Scientific monitoring .....</b>	<b>68</b>
4.1 S1: Hydrocarbons in intertidal sediments and water .....	69
4.2 S2: Hydrocarbons in offshore sediments and water .....	72
4.3 S3: Fish and shellfish taint and toxicity for human consumption .....	74
4.4 S4: Short-term impacts to oiled fauna and flora .....	77
4.5 S5: Recovery of commercial, recreational and customary fisheries .....	80
4.6 S6: Recovery of fauna .....	82
4.7 S7: Recovery of subtidal and intertidal benthic habitat .....	84
4.8 S8: Recovery of coastal flora .....	87
4.9 S9: Recovery of Ramsar values .....	89
<b>5 References .....</b>	<b>92</b>

<b>Appendix A: General guidance and approaches for scientific monitoring design .....</b>		<b>94</b>
A.1	Before-after-control-impact approach.....	95
A.2	Impact versus control approach.....	96
A.3	Gradient approach.....	97
A.4	Control chart approach .....	97
A.5	Lines of evidence approach .....	98
<b>Appendix B: Baseline data.....</b>		<b>101</b>
B.1	Rationale and approach.....	102
B.2	Baseline monitoring .....	103
B.3	Existing data .....	103
B.4	Monitoring survey type.....	103
B.5	Impact surveys.....	104
B.6	Recovery surveys .....	104
B.7	Use of operational monitoring data.....	104
B.8	Monitoring methods .....	104
B.9	Monitoring sites .....	104
B.10	Reference sites.....	104
B.11	Control sites.....	105
B.12	Monitoring indicators.....	105
B.13	Determining impacts.....	105
<b>Appendix C: Environmental values and sensitivities .....</b>		<b>115</b>
C.1	Environmental values and sensitivities .....	116
C.2	Scope of the monitoring program .....	116

## LIST OF FIGURES

Figure 1-1	Environmental management framework for offshore petroleum activities in the Gippsland region.....	29
Figure 1-2	Esso assets within the Gippsland region.....	31
Figure 2-1	OSMP modules implementation organogram between Esso and the Third-party OSMP Consultant.....	39

## LIST OF TABLES

Table 1-1	Relevant Commonwealth and State environmental regulations for OSMPs .....	31
Table 2-1	Key roles and responsibilities relating to implementation of the OSMP (IMT).....	35
Table 2-2	Summary of support roles (as required) .....	36
Table 2-3	Third-party OSMP Consultant availability .....	40
Table 2-4	OSMP implementation phases.....	41

Table 2-5	Personnel availability.....	44
Table 2-6	Non-personnel resource requirements .....	48
Table 2-7	NATA accredited laboratories .....	49
Table 2-8	Scope of revision of OSMP .....	51
Table 3-1	Initiation and termination criteria.....	53
Table 3-2	Implementation, logistics and planning .....	53
Table 3-3	Monitoring Team Responsibilities and Competencies .....	54
Table 3-4	Monitoring Team responsibilities and competencies .....	54
Table 3-5	Initiation and termination criteria.....	55
Table 3-6	Implementation, logistics and planning .....	56
Table 3-7	Monitoring team responsibilities and competencies .....	56
Table 3-8	Monitoring team responsibilities and competencies .....	57
Table 3-9	Key resources .....	58
Table 3-10	Initiation and termination criteria.....	58
Table 3-11	Implementation, logistics and planning .....	59
Table 3-12	Sampling techniques and analysis.....	59
Table 3-13	Monitoring team responsibilities and competencies .....	60
Table 3-14	Key resources .....	60
Table 3-15	Initiation and termination criteria.....	61
Table 3-16	Implementation, logistics and planning .....	61
Table 3-17	Sampling techniques and analysis.....	62
Table 3-18	Monitoring team responsibilities and competencies .....	62
Table 3-19	Initiation and termination criteria.....	63
Table 3-20	Implementation, logistics and planning .....	63
Table 3-21	Sampling techniques and analysis.....	64
Table 3-22	Monitoring team responsibilities and competencies .....	64
Table 3-23	Key resources .....	65
Table 3-24	Initiation and termination criteria.....	65
Table 3-25	Implementation, logistics and planning .....	65
Table 3-26	Sampling techniques and analysis.....	66
Table 3-27	Monitoring team responsibilities and competencies .....	66
Table 3-28	Key resources .....	67
Table 4-1	Initiation and termination criteria.....	69
Table 4-2	Implementation, logistics and planning .....	69
Table 4-3	Sampling techniques and analysis.....	70
Table 4-4	Monitoring team responsibilities and competencies .....	71
Table 4-5	Key resources .....	71
Table 4-6	Initiation and termination criteria.....	72

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Table 4-7	Implementation, logistics and planning .....	72
Table 4-8	Sampling techniques and analysis.....	73
Table 4-9	Monitoring team responsibilities and competencies .....	74
Table 4-10	Key resources .....	74
Table 4-11	Initiation and termination criteria.....	75
Table 4-12	Implementation, logistics and planning .....	75
Table 4-13	Sampling techniques and analysis.....	76
Table 4-14	Monitoring team responsibilities and competencies .....	76
Table 4-15	Key resources .....	77
Table 4-16	Initiation and termination criteria.....	78
Table 4-17	Implementation, logistics and planning .....	78
Table 4-18	Sampling techniques and analysis.....	79
Table 4-19	Monitoring team responsibilities and competencies .....	79
Table 4-20	Key resources .....	80
Table 4-21	Initiation and termination criteria.....	81
Table 4-22	Implementation, logistics and planning .....	81
Table 4-23	Sampling techniques and analysis.....	81
Table 4-24	Monitoring team responsibilities and competencies .....	82
Table 4-25	Initiation and termination criteria.....	82
Table 4-26	Implementation, logistics and planning .....	83
Table 4-27	Sampling techniques and analysis.....	83
Table 4-28	Monitoring team responsibilities and competencies .....	84
Table 4-29	Initiation and termination criteria.....	85
Table 4-30	Implementation, logistics and planning .....	85
Table 4-31	Sampling techniques and analysis.....	86
Table 4-32	Monitoring team responsibilities and competencies .....	86
Table 4-33	Initiation and termination criteria.....	87
Table 4-34	Implementation logistics and planning .....	87
Table 4-35	Sampling techniques and analysis.....	88
Table 4-36	Monitoring team responsibilities and competencies .....	88
Table 4-37	Initiation and termination criteria.....	89
Table 4-38	Implementation logistics and planning .....	90
Table 4-39	Sampling techniques and analysis.....	90
Table 4-40	Monitoring team responsibilities and competencies .....	90

## ABBREVIATIONS

Abbreviation	Definition
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
ANOVA	Analysis of Variance
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
AUV	Autonomous Underwater Vehicle
BACI	Before After Control Impact
BoM	Bureau of Meteorology
BRUVs	Baited Remote Underwater Video systems
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CASA	Civil Aviation Safety Authority
DA	Described Area
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEECA	Department of Energy, Environment and Climate Action
DJSIR	Department of Jobs, Skills, Industry and Regions
DOSS	Diocetyl Sodium Sulfosuccinate
DPI	Department of Primary Industry
DPIPWE	Department of Primary Industries, Parks, Water and Environment
ECD	Ecological Character Description
EMBA	Environment that may be affected
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth)
EP	Environment Plan
ERT	Emergency Response Team
EUL	Environment Unit Lead

Abbreviation	Definition
IC	Incident Commander
IMT	Incident Management Team
ITOPF	International Tanker Owners Pollution Federation Limited
IvC	Impact Versus Control
JSA	Job Safety Analysis
LCL	Lower Control Limit
mBACI	Multiple Before After Control Impact
MCP	Marine Coastal Park
MES	Monitoring, Evaluation and Surveillance
MNP	Marine National Park
MNES	Matters of National Environmental Significance
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NSW	New South Wales
OIM	Offshore Installation Manager
OIMS	Operations Integrity Management System
OPEP	Oil Pollution Emergency Plan
OPGGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)
OSC	Operations Section Chief
OSMP	Operational and Scientific Monitoring Program
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
PAH	Poly Aromatic Hydrocarbons
PERMANOVA	Permutational Multivariate Analysis of Variance
PSC	Planning Section Chief

Abbreviation	Definition
PSD	Particle Size Distribution
Ramsar	Convention on Wetlands of International Importance
SCAT	Shoreline Clean-up Assessment Technique
SD	Standard Deviation
SMART	Special Monitoring of Applied Response Technologies
SO	Safety Officer
SQG	Sediment Quality Guidelines
SQGV	Sediment Quality Guideline Values
SSHE	Safety, Security, Health & Environment
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
TRH	Total Recoverable Hydrocarbon
UAV	Unmanned Aerial vehicle
UCL	Upper Control Limit
USA	United States of America
USEPA	United States Environment Protection Agency
USFDA	United States Food and Drug Administration
VFA	Victorian Fisheries Authority
Victorian OPGGS Regulations	Offshore Petroleum and Greenhouse Gas Storage Regulations 2021 (Vic)
VM	Vessel Master

## UNITS

Abbreviation	Unit
g/m <sup>2</sup>	Grams per Square Metre

# Quick Reference: Operational monitoring initiation and termination criteria

Module	Sub-Module(s)	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Implementation Time <sup>2</sup>
O1: Oil spill surveillance	O1.1 Weather and sea state O1.2 Trajectory estimation O1.3 Aerial or underwater observation	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.	Planning Section Chief (PSC) (or delegate).	The IMT IC (or delegate) considers that continuation of monitoring under O11 will not result in a change to the scale or location of active response options, or  Two consecutive aerial or underwater observations show that oil has weathered and dissipated to <0.3g/m <sup>2</sup> ; or Bonn appearance 1, or	Within 4 hours of initiation criteria being met.
	O1.4 Remote observation	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms the event as a Level 2 or Level 3 hydrocarbon spill.		The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or  The Principal Investigator through the Environment Unit Lead (EUL) (or delegate) has advised that continuation of monitoring under O11 may increase overall environmental impact.	Within 24 hours of initiation criteria being met.
	O1.5 Satellite imagery	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms the event as a Level 3 hydrocarbon spill.			Within 24 hours of initiation criteria being met.

Module	Sub-Module(s)	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Implementation Time <sup>2</sup>
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O1 is to commence.			Per above.
O2: Water and oil sampling	O2.1 Collection of an oil sample	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.	PSC (or delegate).	The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, or  The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.	As soon as practicable following initiation criteria being met.
	O2.2 Fluorometry O2.3 Water samples	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms the event as a Level 2 or Level 3 hydrocarbon spill, or  Application of dispersant has been selected as a response option by the IMT IC (or delegate).			Within 48 hours of initiation criteria being met.
	O2.4 Dispersant Monitoring	Application of dispersant has been selected as a response option by the IMT IC (or delegate).			
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O2 is to commence.			Per above.
O3: Shoreline assessment	O3.1 Shoreline segmentation O3.2 Shoreline character	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  Results of Module O1 monitoring predict that shorelines could be impacted.	PSC (or delegate)	The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, or	Within 24 hours of initiation criteria being met.

Module	Sub-Module(s)	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Implementation Time <sup>2</sup>
	O3.3 Oil on shorelines			Results of Module O1 and O3.3 monitoring demonstrate that shorelines have not been impacted and will not be impacted, or  The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or  The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O31 may increase overall environmental impact.	Within 24 hours of initiation criteria being met.
	O3.4 Shoreline profile	Modification of the shoreline profile is identified as a recommended strategy (e.g. through mechanical construction of pits, berms, or bulk waste removal).			
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O2 is to commence.			
O4: Fauna observations	O4.1 Fauna observation (at sea)	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.	PSC (or delegate)	The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, or  The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or  The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O41 may increase overall environmental impact.	Within 4 hours of initiation criteria being met.
	O4.2 Fauna observations (onshore)	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms that data from Modules O1 and/or O3 predicted/confirmed shoreline exposure.			Within 24 hours of initiation criteria being met.
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O4 is to commence.			Per above.

Module	Sub-Module(s)	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Implementation Time <sup>2</sup>
O5: Air quality	O5.1 Personnel and area monitoring	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred	SO (or delegate)	The Safety Officer SO (or delegate) has determined that there is no longer a health and safety risk, or  The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.	Within 12 hours of initiation criteria being met.
	O5.2 Laboratory analysis	Confirmation by the Safety Officer (SO) (or delegate) that a health and safety risk to personnel is present.			
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O5 is to commence.			Per above.
O6: Sediment sampling	O6.1 Sediment samples (intertidal)	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms that data from Modules O1, O2 and/or O3 have predicted/confirmed exposure of intertidal benthic substrate.	PSC (or delegate)	The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, or  The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or	Within 24 hours of initiation criteria being met.
	O6.2 Sediment samples (offshore);	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  IMT IC (or delegate) confirms that data from Modules O1 and/or O2 have predicted/confirmed exposure of offshore benthic substrate.			The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O61 may increase overall environmental impact.

Module	Sub-Module(s)	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Implementation Time <sup>2</sup>
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of O6 is to commence.			Per above.

1 Decision to terminate monitoring can be made for each individual sub-module independently.

2 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

# Quick Reference: Scientific Monitoring Initiation & Termination Criteria

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
S1: Hydrocarbons in intertidal sediments and water	S1.1: Water samples	<p>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred</p> <p>Principal Investigator through the EUL (or delegate) confirms that data from Modules O1 and/or O2 have predicted/confirmed exposure of intertidal waters.</p>	PSC (or delegate)	<p>Ambient hydrocarbon concentrations in intertidal waters have returned to within the expected natural dynamics of baseline state and/or control sites, or</p> <p>Ambient hydrocarbon concentrations in intertidal waters are below relevant ANZECC &amp; ARM CANZ (2000) and ANZG (2018) 99% species protection levels.</p>	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	<p>Sampling and analysis plan to be ready within 48 hours of initiation criteria being met.</p> <p>Mobilisation and monitoring to commence within 48 hours of activation.</p>
	S1.2: Sediment samples	<p>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred</p> <p>Principal Investigator through the EUL (or delegate) confirms that</p>		<p>Ambient hydrocarbon concentrations in intertidal sediments have returned to within the expected natural dynamics of baseline state and/or control sites, or</p> <p>Ambient hydrocarbon concentrations in intertidal</p>			

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		data from Modules O1 and/or O2 have predicted/confirmed exposure of intertidal or shoreline sediments.		sediments are below relevant ANZECC & ARMCANZ SQGV (Simpson et al. 2013), ANZG (2018) DGV/GV-High and/or NAGD (CoA 2009) trigger/guideline levels.			
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S1 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S2: Hydrocarbons in offshore sediments and water	S2.1: Water samples	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) confirms that data from Modules O1 and/or O2 have predicted/confirmed exposure to offshore waters.	PSC (or delegate)	Ambient hydrocarbon concentrations in offshore waters have returned to within the expected natural dynamics of baseline state and/or control sites, or  Ambient hydrocarbon concentrations in offshore waters are below relevant ANZECC/ARMCANZ (2000) and ANZG (2018) 99% species protection levels.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Sampling and analysis plan to be ready within 24 hours of initiation criteria being met.  Mobilisation and monitoring to commence within 24 hours of activation.
	S2.2: Sediment samples	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine		Hydrocarbon concentrations in offshore sediments have returned to within the expected			

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		<p>or coastal waters has occurred</p> <p>Principal Investigator through the EUL (or delegate) has determined that data from operational modules O1, O2 or O6 has confirmed exposure to either benthic substrate or waters within bottom 1m of seabed.</p>		<p>natural dynamics of baseline state and/or control sites, or</p> <p>Hydrocarbon concentrations in offshore sediments are below relevant ANZECC/ARMCANZ SQGV (Simpson et al. 2013), ANZG (2018) DGV/GV-High and/or NAGD (CoA 2009) trigger/guideline levels.</p>			
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S2 is to commence.		Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S3: Fish and shellfish taint and toxicity for human consumption	S3: Fish/shellfish tissue samples	<p>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred</p> <p>Principal Investigator through the EUL (or delegate) has determined that data from operational modules O2/O6 or scientific modules S1/S2 has confirmed either: (a) in-water hydrocarbon</p>	PSC (or delegate)	<p>Two sequential sample sets show ambient hydrocarbon concentrations are below guideline levels for tainting in ANZECC &amp; ARMCANZ 2000) and ANZG (2018), and either</p> <p>PAH and non-hydrocarbon constituent levels in fish and shellfish tissue have returned to within the expected natural dynamics of baseline state and/or control sites, or</p>	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	<p>Sampling and analysis plan to be ready within 7 days of initiation criteria being met.</p> <p>Mobilisation and monitoring to commence within 7 days of activation.</p>

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		<p>concentrations are above guideline levels known to cause tainting (Table 4.4.5 in ANZECC &amp; ARMCANZ 2000); or (b) sediment hydrocarbon concentrations are above SQGV levels (Simpson et al. 2013), ANZG (2018) DGV/GV-High and/or NAGD (CoA 2009) trigger/guideline levels</p> <p>Principal Investigator through the EUL (or delegate) has determined that data from operational modules O2/O6 or scientific modules S1/S2 has confirmed either: (a) in-water non-hydrocarbon constituent concentrations are above guideline levels known to cause tainting (Table 4.4.5 in ANZECC &amp; ARMCANZ 2000); or (b) sediment hydrocarbon concentrations are above SQGV levels (Simpson et al. 2013) ANZG (2018) DGV/GV-High and/or</p>		<p>PAH and non-hydrocarbon constituent levels in fish and shellfish tissue are at or below levels specified by Food Standards Australia New Zealand (FSANZ).</p>			

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		NAGD (CoA 2009) trigger/guideline levels  Agreement has been reached with the Jurisdictional Authority relevant to the spill to initiate the monitoring.					
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S3 is to commence.		Or, Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S4: Short-term impacts to oiled fauna and flora	S4.1: Fauna surveys (vessel-based)  S4.2: Fauna surveys (land-based)  S4.3: Oiled fauna hydrocarbon testing	Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has determined that data from operational modules O4 has confirmed the presence of oiled fauna.	PSC (or delegate)	Disturbance parameters (e.g. mortality, percentage oiled fauna/flora) have returned to within the expected natural dynamics of baseline state and/or control sites, or  Hydrocarbon concentrations from fauna samples have returned to within the expected natural dynamics of baseline state and/or control sites.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Sampling and analysis plan to be ready within 24 hours of initiation criteria being met.  Mobilisation and monitoring to commence within 24 hours of activation.
	S4.4: Flora surveys	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill					

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has determined that data from operational modules O3 has confirmed the presence of oiled shorelines.					
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S4 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S5: Recovery of commercial and recreational fisheries	S5: Desktop review of fishery stock	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has confirmed that either:  (a) Data from S3 confirms tainting in fish or shellfish tissue; or (b) Advice has been provided to	PSC (or delegate)	Catch per Unit Effort (CPUE) for fishery stock assessments have returned to within the expected natural dynamics of baseline state and/or control sites, or  The physiological and biochemical parameters in the studied species have returned to baseline levels.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Desktop assessment to commence within 24 hours of activation.

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		government to restrict, ban or close a fishery, or  (c) Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.					
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S5 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S6: Recovery of fauna	S6: Fauna surveys	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has determined that data from operational module O4 or scientific module S4 has confirmed the exposure of fauna.	PSC (or delegate)	Disturbance parameters (e.g. estimated population) have returned to within the expected natural dynamics of baseline state and/or control sites.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Sampling and analysis plan to be ready within 7 days of initiation criteria being met.  Mobilisation and monitoring to commence within 7 days of activation.
	All sub-modules	The IMT IC (or delegate) has advised that either full		Agreement has been reached with the Jurisdictional			

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		or partial implementation of S6 is to commence.		Authority relevant to the spill to terminate the monitoring.			
S7: Recovery of subtidal and intertidal benthic habitat	S7.1: Habitat mapping S7.2: Macroalgae and sponges S7.3: Benthic infauna monitoring S7.4: Intertidal and subtidal fish monitoring	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has determined that data from operational module O2/O6 or scientific module S1/S2/S4 has confirmed the exposure of either benthic substrate or waters within bottom 1 m of seabed.	PSC (or delegate)	Disturbance parameters (e.g. species composition, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural dynamics of baseline state and/or control sites.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Sampling and analysis plan to be ready within 7 days of initiation criteria being met.  Mobilisation and monitoring to commence within 7 days of activation.
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S7 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S8: Recovery of coastal flora	S8.1: Habitat mapping S8.2: Condition monitoring	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred	PSC (or delegate)	Disturbance parameters (e.g. abundance, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural	Principal Investigator through the EUL, in agreement	Within 24 hours of initiation criteria being met.	Sampling and analysis plan to be ready within 7 days of initiation criteria being met.

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		Principal Investigator through the EUL (or delegate) has determined that data from operational module O3 or scientific module S4 has confirmed the exposure of coastal flora.		dynamics of baseline state and/or control sites.	with the Jurisdictional Authority relevant to the spill.		Mobilisation and monitoring to commence within 7 days of activation.
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S8 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			
S9: Recovery of Ramsar values	S9: Desktop review of wetland values	Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred  Principal Investigator through the EUL (or delegate) has determined that (a) data from operational module O3 has confirmed the exposure of a Ramsar wetland; and (b) data from scientific modules S1, S4, S6, S7 or S8 confirm an impact to water/sediment quality,	PSC (or delegate)	Wetland values that are important to the Ecological Character Description ECD* have returned to within the expected natural dynamics of baseline state and/or control sites.  * as described in relevant Ramsar site documents prepared per the National ECD Framework.	Principal Investigator through the EUL, in agreement with the Jurisdictional Authority relevant to the spill.	Within 24 hours of initiation criteria being met.	Desktop assessment to commence within 24 hours of activation.

Module	Sub-Module	Initiation Criteria	Position responsible for Initiation	Termination Criteria	Position responsible for Termination	Activation Time <sup>1</sup>	Implementation Time
		flora or fauna in the wetland.					
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of S9 is to commence.		Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.			

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

# Quick Reference: Event Level and Monitoring Modules

Spill Event	O1: Oil spill surveillance					O2: Water and oil sampling				O3: Shoreline assessment				O4: Fauna observations		O5: Air quality		O6: Sediment sampling	
	O1.1	O1.2	O1.3	O1.4	O1.5	O2.1	O2.2	O2.3	O2.4	O3.1	O3.2	O3.3	O3.4	O4.1	O4.2	O5.1	O5.2	O6.1	O6.2
	Weather and sea state	Trajectory estimation	Aerial or underwater	Remote observation	Satellite imagery	Collection of an oil sample	Fluorometry	Water samples	Dispersant monitoring	Shoreline segmentation	Shoreline character	Oil on shorelines	Shoreline profile	Fauna observation (at)	Fauna observation	Personnel and area monitoring	Laboratory analysis	Sediment samples	Sediment samples (offshore)
Level 1	X	X	X	P		P	P	P	P	P	P	P	P	X	P	P	P	P	P
Level 2	X	X	X	P	P	X	P	X	P	P	P	P	P	X	P	P	P	P	P
Level 3	X	X	X	X	X	X	X	X	P	P	P	P	P	X	P	P	P	P	P

Key: X = always required; P = possibly required, dependent on selection of response options, the outcomes of operational modelling such as weather and sea state, observations and trajectory estimation that will provide information on the spill's persistence and potential for contact with shorelines/other receptors.

Spill Event	S1: Hydrocarbons in intertidal sediments and water		S2: Hydrocarbons in offshore sediments and water		S3: Fish and shellfish taint and toxicity for human consumption	S4: Short-term impacts to oiled fauna and flora				S5: Recovery of commercial and recreational fisheries	S6: Recovery of fauna	S7: Recovery of subtidal and intertidal benthic habitat				S8: Recovery of coastal flora		S9: Recovery of Ramsar values
	S1.1	S1.2	S2.1	S2.2	S3	S4.1	S4.2	S4.3	S4.4	S5	S6	S7.1	S7.2	S7.3	S7.4	S8.1	S8.2	S9
	Water samples	Sediment samples	Water samples	Sediment samples	Fish/shellfish tissue samples	Fauna surveys (vessel-based)	Fauna surveys (land-based)	Oiled fauna hydrocarbon testing	Flora surveys	Desktop review of fishery stock	Fauna surveys	Habitat mapping	Macroalgae and sponges	Benthic infauna monitoring	Intertidal and subtidal fish	Habitat mapping	Condition monitoring	Desktop review of wetland values
Level 1	P	P	P	P		P	P	P	P		P	P	P	P	P	P	P	P
Level 2	P	P	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Level 3	P	P	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Key: X = always required; P = possibly required, dependent on selection of response options, the outcomes of operational modelling such as weather and sea state, observations and trajectory estimation that will provide information on the spill's persistence and potential for contact with shorelines/other receptors.

# 1 Introduction

## 1.1 Purpose

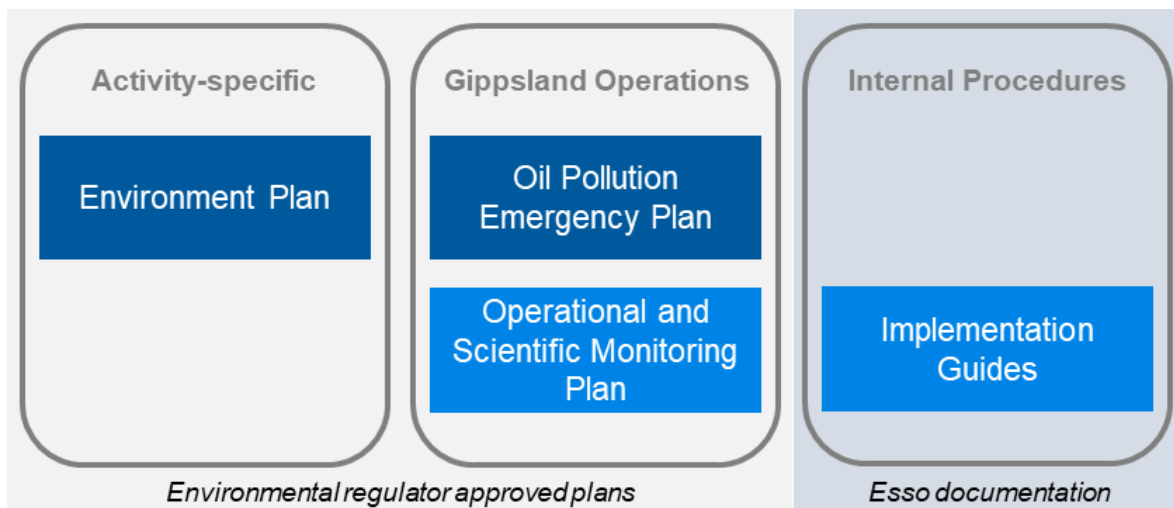
This Bass Strait Operational and Scientific Monitoring Program (OSMP) is a key component of the environmental management framework (which also includes activity-specific Environment Plans (EPs) and the Bass Strait Oil Pollution Emergency Plan (OPEP)) for offshore petroleum activities operated by Esso Australia Resources Pty Ltd (Esso) within the Gippsland region (Figure 1-1).

This OSMP outlines environmental monitoring that may be implemented in the event of a hydrocarbon spill to the marine or coastal environment. Information from operational monitoring provides situational awareness enabling the Incident Management Team (IMT) to make informed decisions regarding response options. Oil spill monitoring modules are the principal tools for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and associated response and/or remediation activities.

Note, this plan focuses on oil spill monitoring of a hydrocarbon spill event only. Hydrocarbon spill risks, prevention and response activities are described in the activity-specific EP and OPEP.

This OSMP is supported by a set of internal implementation guides for each of the oil spill monitoring modules. It is important to note that the implementation guides are not a prescriptive set of procedures that must strictly be followed but are intended to provide Esso and their monitoring providers with sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill. It is expected that individual monitoring plans and operating procedures would only be finalised once a spill event has occurred. This is essential to ensure the finalised monitoring plan/s are fit for purpose and tailored to the specific location, hydrocarbon type, environmental sensitivities, and the nature and scale of the individual spill.

This OSMP is to be read in conjunction with the activity-specific EP and OPEP when considering the existing environment, environmental impacts, risk management, performance standards, reporting compliance, and the decision processes that will apply in the event of a spill occurring.



**Figure 1-1 Environmental management framework for offshore petroleum activities in the Gippsland region**

## 1.2 Objectives

The objectives of this OSMP are:

- identify and describe the oil spill monitoring that may be implemented in the event of a hydrocarbon spill to the marine or coastal environment
- demonstrate an appropriate degree of readiness to implement this monitoring in the event of a hydrocarbon spill to the marine or coastal environment.

## 1.3 Scope

### 1.3.1 Activity types

This OSMP is relevant to all Esso's petroleum activities within the Gippsland region regulated under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) (Environment Regulations) and the Offshore Petroleum and Greenhouse Gas Storage Regulations 2021 (Vic) (Victorian OPGGS Regulations). This includes, but is not limited to:

- vessel operations
- drilling and completions
- well workovers and interventions
- subsea activities
- pipelay activities
- operations
- decommissioning.

The OSMP modules provide for the rapid assessment of the extent of spread of oil from a Level 2 or Level 3 spill and effects on the environment both as a result of the spilt hydrocarbons and any oil spill response activities that may be used in the clean-up of the oil or any monitoring activities that may occur in response to the spill. The OSMP modules include provision for the rapid assessment of impacted and potentially affected wildlife including those listed as Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

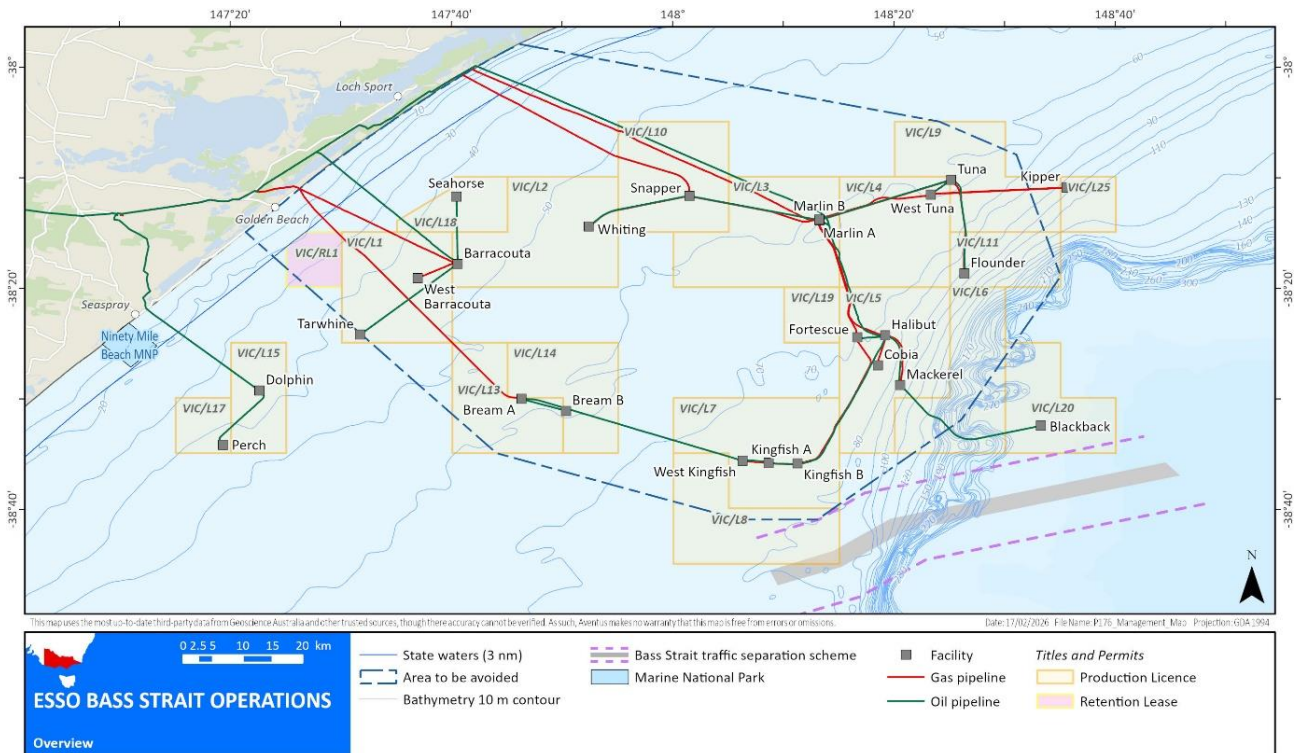
### 1.3.2 Hydrocarbon types and states

Esso's petroleum resources within the Gippsland region include both crude oil and natural gas; and petroleum activity related vessels (which typically use marine diesel oils). This OSMP is relevant to all hydrocarbon types and states (i.e. fresh and weathered); and all potential distributions throughout the environment (i.e. surface, entrained, dissolved and shoreline). Activity specific hydrocarbon properties are provided in the OPEP Appendix D Quick Reference Information.

### 1.3.3 Geographical extent

This OSMP is relevant and applicable to all Commonwealth and State marine and coastal areas that are potentially at risk of exposure to hydrocarbons in the event of a spill resulting from petroleum activities. Petroleum titles and selected environmental features within the vicinity of the Gippsland region are shown in Figure 1-2.

The spatial boundaries of an individual monitoring study will depend primarily on the area potentially or actually affected by the spill. This could vary depending on the characteristics of the spill and the environmental conditions at the time of the spill. To assist in the development of this OSMP and to support offshore environmental impact and risk assessments, Esso have previously engaged RPS to undertake comprehensive oil spill modelling studies which have been used to inform the potential spatial extent of monitoring activities (RPS 2024, RPS 2025). Spatial boundaries will be sufficient to meet monitoring objectives, usually by determining impacted areas and the level of effects, linking effects to the spill source, and supporting decisions on clean-up strategies. Monitoring may also be conducted outside of the modelled spill boundaries if and where monitoring programs require unimpacted reference sites. The spatial extent of a monitoring study would only be finalised once a spill event has occurred.



**Figure 1-2 Esso assets within the Gippsland region**

### 1.4 Regulatory requirements

Under the Environment Regulations Section 22(9) Oil pollution emergency response - the oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution. Additional guidance is contained in the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGs Act) Section 572 (2)(c)(ii) – the registered holder of the title must carry out environmental monitoring of the impact of the escape on the environment. Table 1-1 provides guidance on the OSMP requirements of the Environment Regulations, and Victorian OPGGS Regulations, and reference to the relevant section of this document which addresses that requirement.

This OSMP incorporates regulatory guidance from the following documents:

- Guidance Note – Oil pollution risk management (NOPSEMA 2025)
- Joint Industry Operational and Scientific Monitoring Plan Framework (APPEA 2021)
- Information Paper – Operational and scientific monitoring programs (NOPSEMA 2024).

**Table 1-1 Relevant Commonwealth and State environmental regulations for OSMPs**

Regulation	Relevant section in this OSMP
<b>Environment Regulations</b>	
Part 4, Division 2, Regulation 22 (4)  The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of the employer’s or contractor’s responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.	Sections 2.4 and 2.5

Regulation	Relevant section in this OSMP
<p><u>Part 4, Division 2, Regulation 22 (8)</u></p> <p>The implementation strategy must contain an oil pollution emergency plan and provide for the updating of the plan.</p>	Sections 2, 3, and 4
<p><u>Part 4, Division 2, Regulation 22 (9)</u></p> <p>The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following:</p> <ul style="list-style-type: none"> <li>(a) the control measures necessary for timely response to an emergency that results or may result in oil pollution</li> <li>(b) the arrangements and capability that will be in place, for the duration of the activity, to ensure timely implementation of the control measures, including arrangements for ongoing maintenance of response capability</li> <li>(c) the arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met</li> <li>(d) the arrangements and capability in place for monitoring oil pollution to inform response activities.</li> </ul>	Sections 2, 3, and 4
<p><u>Part 4, Division 2, Regulation 22 (10)</u></p> <p>The implementation strategy must provide for monitoring of impacts to the environment from oil pollution and response activities that:</p> <ul style="list-style-type: none"> <li>(a) is appropriate to the nature and scale of the risk of environmental impacts for the activity</li> <li>(b) is sufficient to inform any remediation activities.</li> </ul>	Sections 2, 3, and 4
<p><u>Part 4, Division 2, Regulation 22 (11)</u></p> <p>The implementation strategy must include information demonstrating that the response arrangements in the oil pollution emergency plan are consistent with the national system for oil pollution preparedness and response.</p>	Sections 2, 3, and 4
<b>Victorian OPGGS Regulations</b>	
<p><u>Part 2.2, Division 3, Regulation 16 (5)</u></p> <p>The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training</p>	Sections 2.4 and 2.5

## 1.5 Target audience

In the event of a hydrocarbon spill, Esso is responsible for the implementation and adherence to this OSMP. This OSMP is intended for use by, but not limited to:

- IMT personnel including:
  - Incident Commander (IC)
  - Operations Section Chief (OSC)

- Planning Section Chief (PSC)
- Environment Unit Lead (EUL)
- Safety Officer (SO).
- Platform Emergency Response Team (ERT) personnel including:
  - Offshore Installation Manager (OIM)
  - Vessel Master (VM)
- Esso Environment team
- Monitoring provider personnel including:
  - Principal Investigator (PI)
  - Monitoring/Field teams.

## 2 OSMP framework and implementation

### 2.1 Types of monitoring

Oil spill monitoring can be undertaken for two distinct, but closely related, purposes (NOPSEMA 2016, NOPSEMA 2024). An integral part of the response to an oil spill comes under Type I, response phase or operational monitoring, with the other type of monitoring commonly referred to as Type II, recovery phase or scientific monitoring (NOPSEMA 2024). These monitoring types are explained herein.

**Operational monitoring (Type I)** collects information about the spill and associated response activities to aid planning and decision making for executing spill response or clean-up operations. Operational monitoring may include both initial response phase monitoring (i.e. rapid qualitative and observational data gathering for situational awareness) and advanced response phase monitoring (i.e. quantitative measurement) (Hook *et al.* 2016). Operational monitoring typically finishes when the spill response is terminated.

Six operational monitoring modules have been identified (see Section 3):

- O1: Oil spill surveillance
- O2: Water and oil sampling
- O3: Shoreline assessment
- O4: Fauna observations
- O5: Air quality
- O6: Sediment sampling.

**Scientific monitoring (Type II)** focusses on evaluating environmental impact and recovery from the spill and response activities. Scientific monitoring may be undertaken over an extended period to fully understand impacts.

Nine scientific monitoring modules have been identified (see Section 4):

- S1: Hydrocarbons in intertidal sediments and water
- S2: Hydrocarbons in offshore sediments and water
- S3: Fish and shellfish taint and toxicity for human consumption
- S4: Short-term impacts to oiled fauna and flora
- S5: Recovery of commercial and recreational fisheries
- S6: Recovery of fauna
- S7: Recovery of subtidal and intertidal benthic habitat
- S8: Recovery of coastal flora
- S9: Recovery of Ramsar values.

Operational monitoring studies inform offshore and nearshore/shoreline response strategies, and information collected during these studies may trigger scientific monitoring. Oil Spill monitoring studies may occur simultaneously (i.e. scientific monitoring can start before a response operation is completed). Note, some data that may be used within scientific monitoring analyses can also only be collected during the initial phase of the oil spill response (e.g. reactive baseline data) (Hook *et al.* 2016).

### 2.2 Initiation and termination of monitoring

Initiation and termination criteria have been defined for each individual operational monitoring (Section 3) and scientific monitoring (Section 4) module. The criteria for the initiation and termination of monitoring modules will be assessed on a daily basis during a response operation, and then as required for any ongoing scientific monitoring modules.

Initiation for operational monitoring modules is typically dependent on the physical presence of a spill; response options being implemented and information from surveillance activities. Termination criteria are typically based on there being no benefit to response planning or a response has ceased, no increase in environmental risk, compliance with relevant environmental guidelines or benchmarks (where available). Termination criteria for operational monitoring also require that any related scientific monitoring initiation criteria have been assessed.

Initiation for scientific monitoring modules is typically dependant on information from operational monitoring results, specifically outcomes of monitoring, evaluation and surveillance (MES) activities, and indications that

relevant environmental guidelines or benchmarks have been exceeded (where available). Scientific monitoring may also be needed to determine if ecological impact criteria as defined in the OPEP for Response Level 1 are met or not (and if not, an incident should be escalated to a higher level). Termination criteria are based on sufficient evidence to demonstrate no impact from hydrocarbon and/or a return to the expected natural dynamics of the area.

All monitoring modules can also be initiated by the IMT IC (or delegate) irrespective of other criteria being met. This may be an independent Esso decision or made in conjunction with the relevant Jurisdictional Authority. Depending on the scenario, these studies may be a full or only partial implementation of the relevant operational or scientific module.

The safety of sampling personnel will be assessed prior to the collection of any samples and will only occur if safe to do so. Sampling collection will only occur in daylight hours and when wind and sea states allow for the safe collection of samples. It may not be safe for a vessel to get close to a spill if there is positive gas detection. Samples will be undertaken when the presence of spilled oil is detectable.

## 2.3 Implementation guides

The implementation guides, which sit behind each of the modules outlined in Section 3 and Section 4, are not a prescriptive set of procedures that must strictly be followed but are intended to provide Esso and their monitoring providers with sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill. The guides include:

- a description of minimum requirements, adopted standards and/or best practice guidance for monitoring design, sampling techniques and reporting requirements
- a list of resources (e.g. equipment, personnel) recommended to implement the monitoring
- draft standard operating procedures.

It is expected that individual monitoring plans and operating procedures would only be finalised once a spill event has occurred. This is essential to ensure the finalised monitoring plan/s are fit for purpose and tailored to the specific location, hydrocarbon type, environmental sensitivities, and the nature and scale of the individual spill.

Where practicable, the draft standard operating procedures are aligned with existing standards and processes (e.g. Hook *et al.* 2016; NOAA 2006).

## 2.4 Roles and responsibilities

The IMT includes key roles (and their associated responsibilities) for the implementation of this OSMP as shown in Table 2-1. Depending on the scale of the event, individual people may perform multiple roles; similarly, multiple people may share the same role.

**Table 2-1 Key roles and responsibilities relating to implementation of the OSMP (IMT)**

Role	Responsibilities
IMT IC	<ul style="list-style-type: none"> <li>• Day to day responsibility for facilitating/coordinating monitoring activities under this OSMP.</li> <li>• Initiation and termination of operational monitoring modules.</li> <li>• Initiation of scientific monitoring modules.</li> </ul>
PSC	<ul style="list-style-type: none"> <li>• Initiating oil spill monitoring modules when initiation criteria met.</li> <li>• Coordination analysis and distribution of data obtained through operational monitoring, including integration of data into the common operating picture.</li> </ul>
EUL	<ul style="list-style-type: none"> <li>• Advising IC on which oil spill monitoring modules should be implemented when initiation criteria met.</li> <li>• Activation and liaison with service providers to implement scientific modules.</li> <li>• Facilitating/coordinating data and reports from monitoring to the IMT for use in response planning.</li> </ul>

Role	Responsibilities
	<ul style="list-style-type: none"> <li>Initiation and termination of operational monitoring modules, based on advice from the Principal Investigator (Third-party OSMP Consultant, as described in Table 2-2).</li> <li>Initiation and termination of scientific monitoring modules, based on advice from the Principal Investigator.</li> <li>Report review and approval for scientific monitoring modules, prepared by the monitoring team.</li> </ul>
OIM/VM	<ul style="list-style-type: none"> <li>Initiation of spill surveillance in the initial response phase of a spill.</li> <li>May undertake day to day responsibilities (e.g. under delegation from the IMT IC).</li> </ul>

## 2.5 Training and competency

Minimum competencies and experience for key OSMP-specific roles for the operational and scientific modules are detailed in the Responsibilities, competencies and resources section of each module in this OSMP. Multiple personnel and their combined competencies may fulfil the requirements of a role. The OSMP specific team will be scaled up in both personnel and skills according to the severity of the incident, the sampling techniques to be used and external capabilities.

The Esso ERT/IMT have completed oil spill response competency and training in accordance with Table 9-2 in Volume 4 of the EP. In addition to this, the EUL is required to have a relevant tertiary degree in engineering, environment science, environmental management or similar. The selection of the EUL is based on relevant experience as an Environment Advisor, with experience and/or training in the implementation of monitoring programs.

## 2.6 External resources

Resources for monitoring (e.g. personnel and equipment) may be outsourced to contractors. Esso currently has a contract in place with a local environmental consultancy to provide this additional environmental support. In the event that additional resources are required, other consultancy capacity will be utilised (as needed) and may extend to specialist contractors such as research agencies engaged in long-term marine monitoring programs.

Esso will also access specialist capabilities as required (e.g. oil spill trajectory monitoring (OSTM) via the Australian Marine Oil Spill Centre (AMOSOC)).

Esso has identified a pool of NATA accredited laboratories with capabilities for undertaking analyses required as part of Oil Spill monitoring scopes (Table 2-7).

## 2.7 Third-party Oil Spill Management Plan Consultant

### 2.7.1 Roles and responsibilities

The Third-party OSMP Consultant has an organisation that allows for considerable support to the field, laboratory and office teams involved in the implementation of the OSMP and its modules. Details of the support roles that may be required for the implementation of the OSMP are provided in Table 2-2.

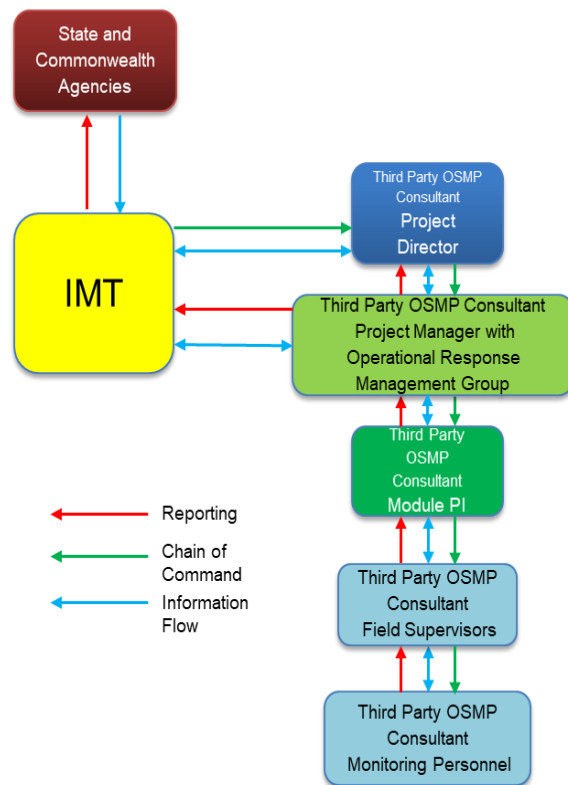
**Table 2-2 Summary of support roles (as required)**

Role	Responsibilities
Third-party OSMP Consultant Project Director	<ul style="list-style-type: none"> <li>Point of contact at a project level for high level contractual and commercial issues.</li> <li>Final approver of key deliverables produced by Third-party OSMP Consultant.</li> <li>During OSMP implementation high level of liaison with IMT.</li> </ul>

Role	Responsibilities
Third-party OSMP Consultant Project Manager	<ul style="list-style-type: none"> <li>• Overall project program, progress, budgets, and reporting.</li> <li>• Management of Third-party OSMP Consultant project team.</li> <li>• Responsible for Third-party OSMP Consultant sub-consultancy, subcontractor and service provision agreements.</li> <li>• Client liaison/coordination at IMT level.</li> <li>• During OSMP implementation:               <ul style="list-style-type: none"> <li>• Command and control of OSMP activities undertaken by Third-party OSMP Consultant.</li> <li>• Liaison with IMT.</li> <li>• Overarching implementing and monitoring the OSMP activities undertaken by Third-party OSMP Consultant.</li> </ul> </li> <li>• Reports to Third-party OSMP Consultant Project Director.</li> </ul>
Third-party OSMP Consultant Operations Officer	<ul style="list-style-type: none"> <li>• Overall coordination and management of OSMP modules undertaken by Third-party OSMP Consultant.</li> <li>• Review and sign off of OSMP deliverables produced from modules undertaken by Third-party OSMP Consultant.</li> <li>• Ensuring technical compliance and maintaining quality of OSMP deliverables.</li> <li>• During OSMP implementation for modules implemented by Third-party OSMP Consultant:               <ul style="list-style-type: none"> <li>• Organise initial response mobilisation</li> <li>• Coordinate OSMP operations</li> <li>• Organise mobilisation/escalation/de-escalation/demobilisation activities.</li> <li>• Assist Planning and Logistical Officers in development of field activity synergies among operational and scientific monitoring modules.</li> </ul> </li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> </ul>
Principal Investigator (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• Ensuring technical compliance and maintaining quality of allocated operational or scientific monitoring module deliverables from modules implemented by Third-party OSMP Consultant.</li> <li>• Review of allocated operational or scientific monitoring module deliverables.</li> <li>• During OSMP implementation assist in coordination and management of allocated operational or scientific monitoring module.</li> <li>• Reports to Third-party OSMP Consultant Operations Officer.</li> </ul>
Field Supervisor (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• During OSMP implementation for modules implemented by Third-party OSMP Consultant responsible for safety, security, health and environment (SSHE) requirements and meeting survey technical objectives during field monitoring.</li> <li>• Reports to Third-party OSMP Consultant Operations Officer.</li> </ul>
SSHE Advisor (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• Third-party OSMP Consultant SSHE Advisory role and monitors compliance.</li> <li>• Review/Approval of SSHE documentation (SSHE Plan, Job Safety Analysis (JSA))</li> <li>• SSHE Incident Investigations and Reporting.</li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> <li>• Supports SSHE and Scientific Program performance reviews.</li> <li>• Prepare SSHE Alerts and deliver SSHE training, briefings.</li> </ul>

Role	Responsibilities
SHHE Focal Point (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• SSHE liaison with Esso.</li> <li>• SSHE performance reports.</li> <li>• Supports project adherence to SSHE Plan.</li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> </ul>
Project Controls Officer (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• Earned value management and reporting.</li> <li>• Scheduling.</li> <li>• Change management, document control, invoicing.</li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> </ul>
Environment and Approvals Officer (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• Environmental approvals.</li> <li>• Licences, permits, statutory approvals.</li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> </ul>
Quality Assurance Officer (Third-party OSMP Consultant)	<ul style="list-style-type: none"> <li>• Internal quality assurance audits.</li> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> </ul>
Third-party OSMP Consultant Logistics Officer	<ul style="list-style-type: none"> <li>• Reports to Third-party OSMP Consultant Project Manager</li> <li>• During OSMP implementation: <ul style="list-style-type: none"> <li>• Organise plant (e.g. aircraft, vessels)</li> <li>• Estimate future service and support requirements</li> <li>• Provision of logistics advice to Operations and Planning Officers.</li> </ul> </li> </ul>
Third-party OSMP Consultant Planning Officer	<ul style="list-style-type: none"> <li>• Reports to Third-party OSMP Consultant Project Manager</li> <li>• During OSMP implementation: <ul style="list-style-type: none"> <li>• Collect, analyse and utilise OSMP information</li> <li>• Risk analysis of technical OSMP service provision (e.g. weather, spill behaviour, projections)</li> <li>• Maintain record of communications and actions including resources requested/allocated/in use.</li> </ul> </li> </ul>
Third-party OSMP Consultant Safety Officer	<ul style="list-style-type: none"> <li>• Reports to Third-party OSMP Consultant Project Manager</li> <li>• During OSMP implementation: <ul style="list-style-type: none"> <li>• Provide SSHE services in support of the OSMP activities.</li> <li>• Review and approve all SSHE documentation in the provision of OSMP services.</li> <li>• Risk analysis of SSHE OSMP service provision (e.g. cyclones, interface issues) and that services are undertaken in a safe manner.</li> </ul> </li> </ul>
Third-party OSMP Consultant Administration Officer	<ul style="list-style-type: none"> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> <li>• During OSMP implementation: <ul style="list-style-type: none"> <li>• Same as role of Project Controls Officer during OSMP implementation.</li> </ul> </li> </ul>
Task Leader	<ul style="list-style-type: none"> <li>• Reports to Third-party OSMP Consultant Project Manager.</li> <li>• Responsible for implementation of a particular operational or scientific monitoring module</li> <li>• Review and/or carry out study's monitoring reporting requirements</li> </ul>

Role	Responsibilities
	<ul style="list-style-type: none"> <li>Provides advice with respect to environmental issues as required, including initiation and termination of monitoring modules.</li> </ul>
Field Teams	<ul style="list-style-type: none"> <li>Reports to Third-party OSMP Consultant Principal Investigator.</li> <li>Implement the operational or scientific monitoring module</li> <li>Data QA/QC and reporting</li> <li>Compliance with the requirements of this OSMP.</li> </ul>



**Figure 2-1 OSMP modules implementation organogram between Esso and the Third-party OSMP Consultant**

2.7.2 OSMP resourcing

In the activation of the OSMP, substantial resources are likely to be required for an extended period of time. Although it is more likely that discontinuous deployment periods are likely, this has not been assumed in developing this resourcing strategy (i.e. continuous requirement assumed). The resourcing needs are based on the likely requirements for information.

The operational modules (OMs) together with S1, S2 and S4 will commence at notification of a spill. Scientific modules have slightly differing needs as their aim is to assess the potential impacts and recovery from a spill. However, there may be a need to collect reactive baseline data prior to hydrocarbons contacting the environment and potentially causing impacts to that environment. There are a number of scientific modules that are therefore initiated soon, if not immediately, after notification of a spill in order to collect a reliable reactive baseline as existing baseline data may not be available.

Generally, the following resourcing procedure will be adhered to:

- The Third-party OSMP Consultant Planning Officer and Third-party OSMP Consultant Operations Officer will develop Survey Plan(s) to meet the objectives of OM(s) survey(s) that are provided by the IMT IC. Surveys may entail carrying out/acquiring information for multiple OMs with individual ground, vessel and aerial survey teams on the same plant to optimise synergies and efficiencies.
- Field personnel and office-based personnel will be sourced from the organisations that comprise the OSMP team (Table 2-3). The Mobilisation Plan will identify a pool of field staff from which to select for mobilisation to meet initial requirements. Thereafter, during escalation and/or maintenance of the OM modules, staff across the pool of field personnel pool will be selected on the basis of availability and capabilities to meet the survey(s) objectives.
- The Task Leaders in consultation with the Third-party OSMP Consultant Logistics Officer will be responsible for organising equipment and laboratory supplies (if needed) for their respective modules. The Operational Response Management Group (ORMG) will support Task Leaders to facilitate the transport of equipment and laboratory supplies.
- Office-based personnel will be mobilised on an 'as needed' basis for data analysis and reporting for all OM modules to ensure timely information flow to the IMT for response planning and assessment.

The Third-party OSMP Consultant has a research vessel and support tender, water and sediment sampling equipment, laboratory equipment, sample storage, marine monitoring equipment, remotely operation vehicle (ROV), unmanned aerial vehicle (UAV) and cameras. A list of available equipment is included in the Third-party Staff and Equipment Register which is reviewed quarterly.

### 2.7.3 Field staff resources available

The Third-party OSMP Consultant has sufficient resources in terms of personnel to meet the staffing needs of the program in both the immediate and longer term. These are detailed in the Third-party Staff and Equipment Register. The Third-party OSMP Consultant has identified personnel and resources that are available to be deployed. This is reviewed quarterly to ensure the Third-party OSMP Consultant has the necessary resources for each worst-case discharge scenario, ensuring that the number of personnel required for each module at different intervals after the spill event can be fulfilled within the required timeframes.

The Third-party OSMP Consultant has resources across its network of Australian Environmental Services Teams (including Melbourne, Sydney, Perth and Brisbane offices) which are experienced in the collection of water and sediment quality samples, remediation and also in flora, fauna and marine environmental surveys. The Third-party OSMP Consultant is able to mobilise personnel from major Australian Offices (Melbourne, Sydney, Perth and Brisbane), assorted regional centres and New Zealand (Auckland, Christchurch and Nelson) if required within a 48-hour time frame. Additional personnel, predominantly from the United States of America can be mobilised after 48 hours to supplement the Australian based teams. Overall, the Third-party OSMP Consultants have a total of 51 personnel.

In summary the Third-party OSMP Consultant team has the resources available to choose from to deploy as shown in Table 2-3.

**Table 2-3 Third-party OSMP Consultant availability**

Module	Number of staff available (<48-hour mobilisation)	Total number of staff available*
01: Oil spill surveillance	20	31
02: Water and oil sampling	20	31
03: Shoreline assessment	20	35
04: Fauna observations	24	32
05: Air quality	3	9

Module	Number of staff available (<48-hour mobilisation)	Total number of staff available*
O6: Sediment sampling	20	31
S1: Hydrocarbons in intertidal sediments and water	20	31
S2: Hydrocarbons in offshore sediments and water	20	31
S3: Fish and shellfish taint and toxicity for human consumption	17	20
S4: Short-term impacts to oiled fauna and flora	12	15
S5: Recovery of commercial and recreational fisheries	8	10
S6: Recovery of fauna	24	32
S7: Recovery of subtidal and intertidal benthic habitat	20	31
S8: Recovery of coastal flora	20	35
S9: Recovery of Ramsar values	6	8

Note: \* Total number of personnel available includes those available to deploy <48 hours and >48 hours and includes where resources are applied across modules.

An annual test of the capability of the Third-party OSMP Consultant to provide these resources is conducted. The Third-party OSMP Consultant maintains a register of the available resources, updated quarterly, including:

- role in OSMP implementation
- provider (company name)
- provider contact details
- contractual arrangement status
- resource (name(s)) identified
- minimum qualification and experience requirements
- whether qualification and experience requirements are met
- completion of OSMP familiarisation training.

#### 2.7.4 Awareness of role in Oil Spill Management Plan implementation

The approach to the OSMP implementation summarised in Table 2-4 shows the activities for the Third-party OSMP Consultant that includes phases prior to and after OSMP activation. The outputs of the Readiness Phase includes the awareness of staff and resources through OSMP familiarisation training.

**Table 2-4 OSMP implementation phases**

Phase	Period	Activity	Purpose	Output
Readiness	Prior to spill	Personnel, contractors and equipment providers prepare for and continue to be prepared for activation of OSMP.  Register of OSMP implementation	Readiness for timely response to implement OSMP.	Register of OSMP implementation personnel.  Awareness by all participants that they are to be available and

Phase	Period	Activity	Purpose	Output
		personnel is maintained and updated quarterly.		ready for OSMP implementation. OSMP familiarisation.
Mobilising	Notification of a Level 2 or Level 3 spill	<p>Third-party OSMP Consultant Project Manager and Initial Field Team mobilise to site.</p> <p>Third-party OSMP to develop Sampling and Analysis Plans (SAPs) to guide response activities related to operational monitoring and scientific monitoring modules.</p> <p>Water and sediment sampling teams report to surveillance vessel(s) for deployment to site.</p> <p>Mobilise monitoring teams based on initiation criteria:</p> <ul style="list-style-type: none"> <li>• mobilise, personnel equipment and vessels to port</li> <li>• load equipment/ supplies on vessel and depart port.</li> </ul>	Initiate modules as quickly as possible and within timeframes required by OSMP.	Timely mobilisation of monitoring program.
Monitoring during spill response	During a spill, before shoreline contact.	Implement relevant operational monitoring modules.	Inform response planning and manage early stages of spill.	Operational data reported regularly throughout response.
		<ul style="list-style-type: none"> <li>• Implement relevant scientific monitoring modules.</li> <li>• Collect reactive baseline data.</li> <li>• Collate and assess existing baseline data.</li> </ul>	Establish baselines and analyse behaviour of spill hydrocarbons.	Baseline data reports for each monitoring study.
	During a spill after shore-line contact.	Continue to implement modules.	Inform response planning and management.	Operational data reported regularly throughout response.

Phase	Period	Activity	Purpose	Output
Spill response termination	At end of spill response.	Terminate modules when criteria met.	Discontinue modules linked specifically to spill response phase.	<ul style="list-style-type: none"> <li>Consolidated data on spill response to IMT IC.</li> <li>Consolidated data to inform later Scientific studies.</li> </ul>
Monitoring post-spill response	From termination of spill response until termination criteria met.	Update SAPs for long-term monitoring.	Modify frequency/number of long-term monitoring sites. (Not if termination criteria met during spill response phase).	Approval of long-term monitoring SAPs.

2.7.5 Staff availability for deployment in initial response

Table 2-5 summarises staff that are available for deployment to respond to the requirements of the OSMP after the initial confirmation of a Level 2 or Level 3 spill. Many staff are capable of performing tasks in a number of modules. Further details are included in the Third-party Staff and Equipment Register which is reviewed on a quarterly basis.

**Table 2-5 Personnel availability**

Module	Minimum PI competency requirement	Number of PIs identified	Minimum field staff competency requirement	Number of staff available (<48 hours mobilisation)	*Total number of staff available (including >48 hours mobilisation)
O1: Oil spill surveillance	<ul style="list-style-type: none"> <li>Level 1 - Familiarisation with relevant requirements of the OSMP.</li> <li>Level 2/3 - Relevant experience in coordination of operational monitoring.</li> </ul>	1	<ul style="list-style-type: none"> <li>Lead observer to be experienced in surveillance techniques.</li> <li>All team members to be familiar with the relevant spill observation, estimation and recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)
O2: Water and oil sampling	<ul style="list-style-type: none"> <li>Level 1 - Familiarisation with relevant requirements of the OSMP.</li> <li>At least 10 years' experience in the collection and analysis of water quality samples.</li> <li>Level 2/3 - Relevant experience or training in coordination of operational monitoring.</li> </ul>	1	<ul style="list-style-type: none"> <li>Familiarisation with oil and water sampling and recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)
O3: Shoreline assessment	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP.</li> <li>A least 10 years' experience in shoreline survey including the analysis of data.</li> </ul>	1	<ul style="list-style-type: none"> <li>Familiarisation with relevant observation and recording techniques.</li> <li>Zoologist for fauna observations.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 35 available)
O4: Fauna observations	<ul style="list-style-type: none"> <li>Level 1 - Familiarisation with relevant requirements of the OSMP.</li> <li>A least 10 years' experience in the collection and analysis of fauna data.</li> </ul>	1	<ul style="list-style-type: none"> <li>Familiarisation with the fauna identification and recording techniques.</li> </ul>	2-3 staff (up to 24 available)	2-3 staff (up to 32 available)
O5: Air quality	<ul style="list-style-type: none"> <li>Level 1 - Experience in implementation of safety or industrial hygiene programs in the oil and gas industry.</li> <li>A least 10 years' experience in the collection and analysis of air quality measurements and data.</li> </ul>	1	<ul style="list-style-type: none"> <li>Trained in use of personnel air monitoring equipment.</li> </ul>	2-3 staff (up to 3 available)	2-3 staff (up to 9 available)

Module	Minimum PI competency requirement	Number of PIs identified	Minimum field staff competency requirement	Number of staff available (<48 hours mobilisation)	*Total number of staff available (including >48 hours mobilisation)
	<ul style="list-style-type: none"> <li>Level 2/3 - Qualifications in occupational health and safety, or industrial hygiene from a recognised institution or equivalent tertiary study in technical area.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>				
O6: Sediment sampling	<ul style="list-style-type: none"> <li>Level 1 - Familiarisation with relevant requirements of the OSMP.</li> <li>At least 10 years' experience in the collection and analysis of sediment quality samples.</li> <li>Level 2/3 Bachelor of Science</li> </ul>	1	<ul style="list-style-type: none"> <li>Familiarisation with sediment sampling and recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)
S1: Hydrocarbons in intertidal sediments and water	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the collection of environmental samples from water and sediments.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> <li>Experienced in sediment and water quality sampling and recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)
S2: Hydrocarbons in offshore sediments and water	<ul style="list-style-type: none"> <li>Doctorate in environmental science,</li> <li>At least 10 years' experience in the collection of environmental samples from water and sediments.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> <li>Experienced in the relevant sampling and/or recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)
S3: Fish and shellfish taint and toxicity	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the collection of fish and shellfish for laboratory analysis.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> </ul>	2-3 staff (up to 17 available)	2-3 staff (up to 20 available)

Module	Minimum PI competency requirement	Number of PIs identified	Minimum field staff competency requirement	Number of staff available (<48 hours mobilisation)	*Total number of staff available (including >48 hours mobilisation)
for human consumption	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>		<ul style="list-style-type: none"> <li>Experienced in the fish/shellfish collection, sampling and recording techniques.</li> <li>Experienced in olfactory analysis.</li> </ul>		
S4: Short-term impacts to oiled fauna and flora	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in fauna survey including the survey of marine fauna.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> <li>Experienced in the relevant sampling and/or recording techniques.</li> </ul>	2-3 staff (up to 12 available)	2-3 staff (up to 15 available)
S5: Recovery of commercial and recreational fisheries	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the collection and analysis of fishery data.</li> <li>Experienced in fisheries data analysis.</li> </ul>	1	<ul style="list-style-type: none"> <li>N/A</li> </ul>	2-3 staff (up to 8 available)	2-3 staff (up to 10 available)
S6: Recovery of fauna	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the survey and analysis of fauna data.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> <li>Experienced in the relevant sampling and/or recording techniques.</li> </ul>	2-3 staff (up to 24 available)	2-3 staff (up to 32 available)
S7: Recovery of subtidal and intertidal benthic habitat	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the collection and analysis of data relating to marine infauna.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 31 available)

Module	Minimum PI competency requirement	Number of PIs identified	Minimum field staff competency requirement	Number of staff available (<48 hours mobilisation)	*Total number of staff available (including >48 hours mobilisation)
	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP.</li> </ul>		<ul style="list-style-type: none"> <li>Experienced in the relevant sampling and/or recording techniques.</li> </ul>		
S8: Recovery of coastal flora	<ul style="list-style-type: none"> <li>Doctorate in environmental science.</li> <li>At least 10 years' experience in the collection and analysis of data on flora including coastal flora. Familiarisation with relevant requirements of the OSMP.</li> </ul>	1	<ul style="list-style-type: none"> <li>Bachelor's degree in environmental science or equivalent tertiary study. Experienced in the relevant sampling and/or recording techniques.</li> </ul>	2-3 staff (up to 20 available)	2-3 staff (up to 35 available)
S9: Recovery of Ramsar values	<ul style="list-style-type: none"> <li>At least 10 years' experience in dealing with Ramsar values including the analysis of changes to those values.</li> <li>Familiarisation with relevant requirements of the OSMP.</li> <li>Experienced in wetland ecology.</li> </ul>	1	<ul style="list-style-type: none"> <li>N/A</li> </ul>	2-3 staff (up to 6 available)	2-3 staff (up to 8 available)

(\*) Total number of personnel available includes those available to deploy <48 hours and >48 hours, where teams will comprise 2-3 staff to support each module.

### 2.7.6 Non-personnel resources

A summary of the likely key non-personnel resource requirements for each module is shown below in Table 2-6. Further information on the resources identified in this table is provided below and in the Third-party OSMP Staff and Equipment Register. The number of resources required will depend on the number of field teams for each module as well as efficiencies where one field team may collect data/samples for multiple modules.

**Table 2-6 Non-personnel resource requirements**

Equipment	O1	O2	O3	O4	O5	O6	S1	S2	S3	S4	S5	S6	S7	S8	S9
Fixed wing aircraft	✓		✓	✓											
Helicopter	✓		✓	✓											
Vehicles		✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	
Vessels	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓		
UAV	✓			✓						✓					
Sampling equipment		✓	✓			✓	✓	✓	✓	✓					
ROV	✓					✓	✓	✓		✓			✓		
Fluorometer		✓ *													
NATA accredited lab		✓	✓		✓	✓	✓	✓	✓	✓					
Oil spill trajectory modelling services	✓														
Satellite imagery services	✓														

\*Fluorometer not required if other sampling methods (O2.3) are demonstrated to be sufficient.

#### 2.7.6.1 Aircraft

There may be a requirement for aircraft to support spill surveillance, shoreline assessment and fauna observations. There is access to helicopters through the Esso-owned and operated helicopter fleet based out of Longford. Esso has agreement with Royal Victorian Aero Club for fixed wing for surveillance only.

#### 2.7.6.2 Vehicles

The Third-party OSMP Consultant has sufficient resources to meet the vehicle needs of the monitoring program in both the immediate and longer term. The Third-party OSMP Consultant has 4WD vehicles available (as detailed in the Third-party OSMP Staff and Equipment Register). The Third-party OSMP Consultant has Australia-wide contracts with rental car providers so that within 24 hours these vehicles can be supplemented with as many 4WD as needed for the duration of the monitoring programs.

#### 2.7.6.3 Vessels

There is a requirement for vessels to allow monitoring to be completed as per the program.

A register of nearshore vessels (available through the Third Party OSMP Consultant or other providers) is detailed in the Third Party OSMP Staff and Equipment Register.

Esso has chartered vessel(s) capable of operating offshore 24 hours per day to provide surveillance and monitoring in the event of a spill. Gippsland ports also have suitable vessels for nearshore response activities.

#### 2.7.6.4 Sampling equipment

The Third-party OSMP Consultant have the required sampling equipment available for water quality and sediment quality, including a flow-through fluorometer. The Third-party OSMP Consultant also has a suite of ROVs and drones (with Civil Aviation Safety Authority (CASA) certified operators) for rapid survey of intertidal reefs. The Third-party OSMP Consultant has fully certified divers with all required equipment including a suite of underwater cameras. All these resources are available for immediate deployment pending other commitments.

#### INITIAL RESPONSE SAMPLING KITS

Given the short implementation time for sub-module O2.1, Esso has identified the following locations as stocking initial response spill sampling kits:

- Longford plant laboratory
- Long Island Point laboratory
- Longford heliport
- Contracted supply vessel
- Pipelines warehouse - Sale

The initial response kits contain equipment necessary to obtain and store an oil sample from the water surface or from land.

Personnel should familiarise themselves with the sampling procedure (see Implementation Guide for O2: Water and oil sampling); but otherwise, no specific training or qualifications are required to use the initial response kits to collect an oil sample.

#### 2.7.6.5 Laboratory access

Esso has identified the following NATA accredited laboratories within the region to support the various operational and scientific monitoring modules. Laboratories with the appropriate capabilities to support specific modules have been identified within the relevant modules.

**Table 2-7 NATA accredited laboratories**

Laboratory	Contact details
Australian Laboratory Services (Melbourne)	4 Westall Road, Springvale VIC 3171 Ph: 03 8549 9600
Australian Laboratory Services (Traralgon)	Hazelwood Road, Traralgon VIC 3844 Ph: 03 5176 4170
Ecotox Services Australia	27/2 Chaplin Drive, Lane Cove NSW 2066 Ph: 02 9420 9481
Eurofins	Eurofins Environment Testing Australia Pty Ltd. 6 Monterey Road Dandenong South VIC 3175 Phone: +61 3 8564 5000 EnviroSales@eurofins.com www.eurofins.com.au/environment
Intertek Australia Melbourne West Footscray	Building 1, 19-23 Paramount Road West Footscray

Laboratory	Contact details
	Melbourne, Victoria 3012 T: +61 3 9316 4600
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167
Longford Plants Laboratory	Garretts Road, Longford VIC 3851 Ph: 03 5149 6259
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Ph: 03 9644 4888

### 2.7.6.6 Modelling and imagery services

Esso is a member of AMOSC. AMOSC membership allows access to RPS to provide predictive modelling capabilities in the event of an oil spill. Predictive oil spill modelling utilising this service was conducted for multiple potential spill locations in November 2024 and August 2025 (RPS 2024, RPS 2025). Alternatively, modelling may also be requested from Oil Spill Response Limited (OSRL).

Esso has tracking buoys available, and additional buoys are available for hire from AMOSC. Esso also has agreements in place to allow access to satellite imagery services for remote observation of the spill.

## 2.8 Communication management

Stakeholder (including regulators) consultation and external reporting requirements are described in the activity-specific EPs. This includes the requirement to consult with the:

- National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) in the event that a hydrocarbon spill is likely to impact MNES
- Parks Australia, Director of National Parks, in the event that a hydrocarbon spill and/or response activity are likely to impact an Australian Marine Park
- Australian Fisheries Management Authority (AFMA).

If the spill may impact Victorian waters, then consultation will occur with:

- Department of Planning and Transport (DTP)

If the spill may impact Tasmanian waters, then consultation will occur with:

- Environment Protection Authority (EPA) Tasmania

If the spill may impact New South Wales (NSW) waters, then consultation will occur with:

- Transport for NSW (Ports and Maritime/Maritime Authority).

## 2.9 Review and revision

Regulation 41 of the Environment Regulations provides for the five-year revision of this OSMP. Review and update of the OSMP may be initiated through findings from drills/exercises, actual events, internal or external assessments, audits, changes to regulation, or via planned periodic review. This document is subject to:

- an annual administrative review
- five-yearly revision and resubmission (in accordance with resubmission of EPs).

Any changes made during review and revision must be tracked and documented in order to demonstrate continued compliance with regulatory accepted versions of this document. Changes made to the OSMP should

be reviewed against Environment Regulations (Regulations 18, 19, 38 and 39) to determine if a resubmission is required.

The annual review should be a general review of the OSMP to ensure it remains applicable to current operations. The annual review of the OSMP will include the annual test of the Third-party OSMP Consultants' capability to provide resources to fulfil the requirements of this OSMP (Section 2.7). Table 2-8 describes the topics that should be considered when completing a mid-cycle update of the OSMP.

**Table 2-8 Scope of revision of OSMP**

Topic	Useful links/references
Reference to most recently published NOPSEMA guidance documents	<a href="https://www.nopsema.gov.au/environmental-management/environment-resources/">https://www.nopsema.gov.au/environmental-management/environment-resources/</a>
Values and sensitivities within the described areas including:	
<ul style="list-style-type: none"> <li>Key ecological features</li> </ul>	<a href="https://www.environment.gov.au/sprat-public/action/kef/search">https://www.environment.gov.au/sprat-public/action/kef/search</a> <a href="http://www.environment.gov.au/marine/publications/south-east-marine-region-profile">http://www.environment.gov.au/marine/publications/south-east-marine-region-profile</a> <a href="http://www.environment.gov.au/topics/marine/marine-bioregional-plans/temperate-east">http://www.environment.gov.au/topics/marine/marine-bioregional-plans/temperate-east</a>
<ul style="list-style-type: none"> <li>MNES</li> </ul>	<a href="https://parksaustralia.gov.au/marine/parks/south-east/">https://parksaustralia.gov.au/marine/parks/south-east/</a> <a href="https://parksaustralia.gov.au/marine/parks/temperate-east/">https://parksaustralia.gov.au/marine/parks/temperate-east/</a>
<ul style="list-style-type: none"> <li>Species profile and threats database</li> </ul>	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl">http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</a>
<ul style="list-style-type: none"> <li>Biologically Important Areas</li> </ul>	<a href="https://environment.gov.au/marine/marine-species/bias">https://environment.gov.au/marine/marine-species/bias</a>
<ul style="list-style-type: none"> <li>Ramsar wetlands</li> </ul>	<a href="http://www.environment.gov.au/cgi-bin/wetlands/alphablist.pl">http://www.environment.gov.au/cgi-bin/wetlands/alphablist.pl</a>
<ul style="list-style-type: none"> <li>Marine protected areas</li> </ul>	<a href="https://parkweb.vic.gov.au/explore/find-a-park/marine-protected-areas">https://parkweb.vic.gov.au/explore/find-a-park/marine-protected-areas</a> <a href="https://www.parks.tas.gov.au/index.aspx?base=397">https://www.parks.tas.gov.au/index.aspx?base=397</a> <a href="https://www.dpi.nsw.gov.au/fishing/marine-protected-areas">https://www.dpi.nsw.gov.au/fishing/marine-protected-areas</a>
Environmental baseline information	<p>Refer to Implementation Plans for a summary of existing baseline data available in the Gippsland Region.</p> <p>Refer to linked references to review existing baseline data and establish if updates to existing baseline data is required.</p>
Stakeholder consultation	Consult with the Stakeholder Engagement Advisor for guidance on any relevant items to be considered.
Lessons learned	Refer to exercise reports for lessons learned to be considered.

### 3 Operational monitoring

The following sections outline the individual operational monitoring modules that may be implemented in the event of a hydrocarbon spill to the marine or coastal environment. The tables describe the key aims, initiation and termination criteria, implementation times, and provide a high-level description of monitoring, reporting and resources. The studies are presented separately below; however, in practice they may be undertaken simultaneously.

These overviews are supported by internal implementation guides for each of the operational monitoring modules. The implementation guides have been prepared to provide Esso and their monitoring providers with sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill.

Operational monitoring has objectives relating to collecting real-time information about the spill extent, location, movement and severity to support planning and decision-making for spill response and clean-up operations. Operational monitoring provides situational awareness to key response personnel including the IMT, IC, PSC, PIs, and Field teams. Consequently, data collection should be timely and spatially comprehensive, and outputs must be rapidly communicated to the IMT to inform response decisions. Data collected during operational monitoring also supports personnel health and safety management, informs the design and implementation of subsequent scientific monitoring programs, and provides information for any other activities that may be required in the event of a hydrocarbon spill. Operational monitoring typically finishes when the spill response is terminated.

Six operational monitoring modules have been identified:

- O1: Oil Spill surveillance
- O2: Water and oil sampling
- O3: Shoreline assessment
- O4: Fauna observations
- O5: Air quality
- O6: Sediment sampling.

Spatial coverage will generally be defined by the spill area and trajectory. However, monitoring priorities may be informed by guidance documents which provide information such as key locations, sensitive receptors and values. Additionally, preemptive hydrocarbon spill response modeling already conducted by Esso will be used to inform operational monitoring. Operational monitoring data will be collected and reported in accordance with established spill response protocols and relevant regulatory requirements. Esso will also consider information from documents that provide guidance for protected areas and will undertake consultation with relevant asset managers as required to ensure operational monitoring activities are appropriately targeted. Data quality objectives for operational monitoring will be established based on the intended use of the data, whether for immediate response decision-making, personnel safety management, or to inform subsequent scientific monitoring programs.

#### 3.1 O1: Oil spill surveillance

##### 3.1.1 Purpose

The development and implementation of effective responses to oil spills depends critically on the knowledge of the extent and likely fate and behaviour of oil once exposed to ambient weather and sea state conditions. The purpose of this module is to:

- track the location, extent and thickness of the surface oil slick to gain situational awareness of the incident and validate and inform forecasting and OSTM
- collect and collate relevant weather and sea state conditions to inform OSTM and response actions
- predict sensitivities at risk and fate/behaviour of the spill to inform response actions and scientific monitoring
- provide location of slick to O2 (water and oil sampling) monitoring team
- provide feedback on the extent, location, appearance and thickness of a dispersed slick (applicable only if dispersants used).

### 3.1.2 Initiation and termination criteria

**Table 3-1 Initiation and termination criteria**

<b>Initiation criteria</b>	O1.1: Weather and sea state O1.2: Trajectory estimation O1.3: Aerial or underwater observation	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.</li> </ul>
	O1.4: Remote observation	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>IMT IC (or delegate) confirms the event as a Level 2 or Level 3 hydrocarbon spill.</li> </ul>
	O1.5: Satellite imagery	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>IMT IC (or delegate) confirms the event as a Level 3 hydrocarbon spill.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of O1 is to commence.</li> </ul>
<b>Termination criteria</b>	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) considers that continuation of monitoring under O11 will not result in a change to the scale or location of active response options, or</li> <li>Two consecutive aerial or underwater observations show that oil has weathered and dissipated to &lt;0.3g/m<sup>2</sup>, or Bonn appearance code 1, or</li> <li>The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or</li> <li>The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O11 may increase overall environmental impact.</li> </ul>	

1 Decision to terminate monitoring can be made for each individual sub-module independently.

### 3.1.3 Implementation

**Table 3-2 Implementation, logistics and planning**

<b>Implementation time<sup>1</sup></b>	<ul style="list-style-type: none"> <li>O1.1, O1.2 and O1.3 within 4 hours of initiation criteria being met.</li> <li>O1.4 and O1.5 within 24 hours of initiation criteria being met.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for O1: Oil Spill Surveillance.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>Results from data collation, visual/remote surveillance, modelling and/or image analysis reported daily to PSC.</li> <li>Final report prepared within one-week of termination criteria being met, report provided to PSC.</li> </ul>

1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.1.4 Monitoring overview

Table 3-1 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O1. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016)
- Aerial Observation of Marine Oil Spills (ITOPF 2014)
- SMART Protocols (NOAA 2006).

**Table 3-3 Monitoring Team Responsibilities and Competencies**

Sub-module	Sampling technique	Data collection and/or analysis
O1.1: Weather and sea state	<ul style="list-style-type: none"> <li>• Data records collation.</li> <li>• Visual surveillance.</li> </ul>	<ul style="list-style-type: none"> <li>• Data records sourced from Bureau of Meteorology (BoM) or local weather stations.</li> <li>• Sea state observations manually recorded from vessels, offshore platform or shore.</li> </ul>
O1.2: Trajectory estimation	<ul style="list-style-type: none"> <li>• Manual estimation.</li> <li>• OSTM.</li> </ul>	<ul style="list-style-type: none"> <li>• Manual estimation can be completed quickly and with limited data (wind and currents, spill origin and/or present location).</li> <li>• OSTM is generally completed by specialist consultants.</li> </ul>
O1.3: Aerial or underwater observation	<ul style="list-style-type: none"> <li>• Visual surveillance.</li> <li>• Remote sensing.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual observations of the location, extent, and appearance of the spill.</li> <li>• Estimates of volume based on percentage cover and oil thickness.</li> </ul>
O1.4: Remote observation	Satellite tracking.	Buoys are deployed and position can be tracked via satellite.
O1.5: Satellite imagery	Satellite imagery analysis.	Remote sensing and image analysis to determine presence of oil slicks.

### 3.1.5 Responsibilities, competencies, and resources

#### 3.1.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the EP.

#### 3.1.5.2 Monitoring team

Table 3-4 lists the minimum personnel requirements from the Third-party OSMP Consultant to implement operational module O1. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-4 Monitoring Team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for O1 in the event of a spill.</li> <li>• Implement O1.</li> <li>• Review and/or carry out reporting requirements.</li> <li>• Compliance with the requirements of O1 and the OSMP.</li> <li>• Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Level 1 - Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Level 2/3 - Relevant experience in coordination of operational monitoring.</li> <li>• Minimum bachelor's degree in relevant subject with hydrocarbon sampling experience.</li> </ul>

Personnel	Responsibilities	Competencies and Qualifications
Field Teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct visual observations.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>Lead observer to be experienced in surveillance techniques.</li> <li>All team members to be familiar with the relevant spill observation, estimation and recording techniques and hold a minimum bachelor's degree in relevant subject with hydrocarbon sampling experience.</li> </ul>

3.1.5.3 Resources

The key resources required for implementation of Module O1 include a fixed wing aircraft and/or helicopter for aerial surveillance. UAVs may be utilised to support aerial surveillance. Vessels may also be required for on-water surveillance of the spill and observations of weather and sea state. Use of a ROV may be required for subsea activities such as detection or tracking of the spill. Access to OSTM services and satellite imagery services may be required for spill modelling and remote surveillance. Further information on access to these resources is provided in Section 2.7.6.

## 3.2 O2: Water and oil sampling

### 3.2.1 Purpose

The purpose of this module is to provide quantitative measures of water quality and oil (hydrocarbon) characteristics to:

- determine the physical and chemical characteristics of the spilled oil to validate trajectory forecasts or models (i.e. provide information regarding the spill source characterisation)
- obtain samples of spilled oil for retention or additional analysis (e.g. fingerprinting)
- establish background concentrations of total petroleum hydrocarbon (TPH) and polyaromatic hydrocarbons (PAH), and non-hydrocarbon constituents in sea water
- determine concentrations of TPH and PAH within the spill plume to validate and enhance OSTM and support assessment of environmental and social impacts
- determine the concentrations of non-hydrocarbon constituents (e.g. heavy metals) within the spill plume
- determine the effectiveness of dispersants in reducing concentrations of oil in the water column (applicable only if dispersants used)
- to inform scientific monitoring.

### 3.2.2 Initiation and termination criteria

**Table 3-5 Initiation and termination criteria**

Initiation criteria		
O2.1 Collection of an oil sample		<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.</li> </ul>
O2.2: Fluorometry O2.3: Water samples		<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>IMT IC (or delegate) confirms the event as a Level 2 or Level 3 hydrocarbon spill, or</li> <li>Application of dispersant has been selected as a response option by the IMT IC (or delegate).</li> </ul>
O2.4: Dispersant Monitoring		<ul style="list-style-type: none"> <li>Application of dispersant has been selected as a response option by the IMT IC (or delegate).</li> </ul>

	All sub-modules	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of O2 is to commence.</li> </ul>
<b>Termination Criteria</b>		<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, and</li> <li>The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or</li> <li>The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O21 may increase overall environmental impact.</li> </ul>

1 Decision to terminate monitoring can be made for each individual sub-module independently.

### 3.2.3 Implementation

**Table 3-6 Implementation, logistics and planning**

<b>Minimum time to implement<sup>1</sup></b>	<ul style="list-style-type: none"> <li>O2.1 as soon as practicable following initiation criteria being met.</li> <li>O2.2, O2.3, O2.4 within 24 hours of initiation criteria being met.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for O2: Water and Oil Sampling
<b>Reporting</b>	<ul style="list-style-type: none"> <li>Results from in-situ analysis of samples reported daily to PSC.</li> <li>Results from laboratory analysis of samples reported as available to PSC.</li> <li>Final report prepared within one-week of termination criteria being met; report provided to PSC.</li> </ul>

1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.2.4 Monitoring overview

Table 3-7 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O2. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016)
- SMART Protocols (NOAA 2006)
- ASTM D4489 2017 Standard Practices for Sampling of Waterborne Oils.

**Table 3-7 Monitoring team responsibilities and competencies**

Sub-module	Sampling technique	Data collection and/or analysis
O2.1: Collection of an oil sample	Surface oil sample collection <sup>1</sup> .	<ul style="list-style-type: none"> <li>Physical characteristics (e.g. wax content, dynamic viscosity, density, volatiles).</li> <li>Chemical characteristics (e.g. PAH).</li> </ul>
O2.2: Fluorometry	Water column profiling.	<ul style="list-style-type: none"> <li>TPH. This method may need not be applied if other methods (O2.3) are demonstrated to be sufficient.</li> </ul>
O2.3: Water samples	Surface and sub-surface water sample collection.	<ul style="list-style-type: none"> <li>Laboratory analysis for hydrocarbons (e.g. TPH, PAH).</li> <li>Laboratory analysis for non-hydrocarbon parameters (e.g. heavy metals).</li> <li>Dispersant (e.g. dioctyl sodium sulfosuccinate (DOSS)).</li> </ul>

Sub-module	Sampling technique	Data collection and/or analysis
O2.4: Dispersant Monitoring	Surface and sub-surface water sample collection.	<ul style="list-style-type: none"> <li>Laboratory analysis for hydrocarbons (e.g. TPH, PAH).</li> <li>Laboratory analysis for non-hydrocarbon parameters (e.g. heavy metals)</li> <li>Dispersant (e.g. DOSS).</li> </ul>

<sup>1</sup> The location of Initial response sampling kits has been identified to facilitate the sampling required under O2.1.

### 3.2.5 Responsibilities, competencies, and resources

#### 3.2.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

#### 3.2.5.2 Monitoring team

Table 3-8 lists the minimum personnel requirements from the monitoring provider to implement operational module O2. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-8 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for O2 in the event of a spill.</li> <li>Implement O2.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of O2 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Level 1 - Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Level 2/3 – Relevant experience or training in coordination of operational monitoring. Minimum bachelor's degree in relevant subject with water quality sampling experience.</li> </ul>
Field Teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with oil and water sampling and recording techniques.</li> <li>Minimum bachelor's degree in relevant subject with water quality sampling experience.</li> </ul>

#### 3.2.5.3 Resources

The key resources required for implementation of Module O2 include vessels for on-water sampling and monitoring as well as vehicles for coastal water sampling. A flow-through fluorometer may be required for monitoring oil in water concentrations (unless an effective alternative water sampling regime is in place). Sampling equipment will be required for sampling of the oil slick itself and sampling of water from both inside and outside the spill area. Further information on access to these resources is provided in Section 2.7.6.

Esso has also identified the following NATA accredited laboratories within the region with the capabilities to support the analysis for operational module O2.

**Table 3-9 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	Main Melbourne Laboratory 4 Westall Road, Springvale VIC 3171 Phone: 03 8549 9600
Australian Laboratory Services (Traralgon)	Hazelwood Road, Traralgon VIC 3844 Phone: 03 5176 4170
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Phone: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

### 3.3 O3: Shoreline assessment

#### 3.3.1 Purpose

This module outlines a Shoreline Clean-up Assessment Technique (SCAT) to be used to directly inform shoreline clean-up, provide recommendations to operations, and ensure the clean-up is completed. The purpose of this module is to:

- determine the physical, biological and dynamic properties of shorelines at risk, in order to:
  - predict the oil behaviour and distribution
  - determine the most appropriate clean-up methods
  - identify sensitive or vulnerable areas or resources
  - determine whether any pre-impact actions are warranted.
- determine the characteristics and distribution of oil on the shoreline in order to predict the potential for oil persistence and/or natural removal
- determine the effectiveness of shoreline response strategies and provide feedback to the IMT.

#### 3.3.2 Initiation and termination criteria

**Table 3-10 Initiation and termination criteria**

<b>Initiation criteria</b>	O3.1: Shoreline segmentation O3.2: Shoreline character O3.3: Oil on shorelines	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.</li> </ul>
	O3.4: Shoreline profile	<ul style="list-style-type: none"> <li>• Modification of the shoreline profile is identified as a recommended strategy (e.g. through mechanical construction of pits, berms, or bulk waste removal).</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of Module O3 is to commence.</li> </ul>
<b>Termination criteria</b>	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, and</li> </ul>	

	<ul style="list-style-type: none"> <li>• Results of Module O1 monitoring demonstrate that shorelines will not be impacted, or</li> <li>• The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or</li> <li>• The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under Module O3<sup>1</sup> may increase overall environmental impact.</li> </ul>
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1 Decision to terminate monitoring can be made for each individual sub-module independently.

### 3.3.3 Implementation

**Table 3-11 Implementation, logistics and planning**

<b>Implementation time</b> <sup>1</sup>	O3.1, O3.2, O3.3, O3.4 within 24 hours of initiation criteria being met.
<b>Implementation Plan</b>	Refer to Implementation Guide for O3: Shoreline Assessment.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Results from data collation, visual surveillance, in-situ monitoring reported daily to PSC.</li> <li>• Final report prepared within one-week of termination criteria being met; report provided to PSC.</li> </ul>

1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.3.4 Monitoring overview

Table 3-12 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O3. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016)
- SMART Protocols (NOAA 2006)
- Shoreline Assessment Job Aid (NOAA 2007)
- Shoreline Clean up Assessment Technique (SCAT) Oil Spill Response Limited (updated)
- The Open Water Oil Identification Job Aid for Aerial Observation (NOAA 2016).

**Table 3-12 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
O3.1: Shoreline character	<ul style="list-style-type: none"> <li>• Visual surveillance</li> </ul>	<ul style="list-style-type: none"> <li>• Physical and biological characteristics (e.g. shoreline dimensions, habitat type, substrate type, wind/wave energy etc.).</li> </ul>
O3.2: Oil on shorelines	<ul style="list-style-type: none"> <li>• Visual surveillance.</li> <li>• Surface and sub-surface water sample collection.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual assessment of oil extent, percent cover, thickness etc.</li> <li>• In-situ or laboratory analysis for hydrocarbon content (e.g. TPH).</li> <li>• Assessment of endpoints from clean-up, identification of suggested clean-up techniques.</li> </ul>

### 3.3.5 Responsibilities, competencies, and resources

#### 3.3.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

### 3.3.5.2 Monitoring team

Table 3-13 lists the minimum personnel requirements from the monitoring provider to implement operational module O3. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-13 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for Module O3 in the event of a spill.</li> <li>Implement Module O3.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of Module O3 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Relevant experience or training in coordination of operational monitoring.</li> <li>Minimum bachelor's degree in relevant subject with shoreline sampling experience.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant observation and recording techniques.</li> <li>Zoologist for fauna observations.</li> <li>Minimum bachelor's degree in relevant subject with shoreline sampling experience.</li> </ul>

### 3.3.5.3 Resources

Depending on the size and location of the spill, fixed wing aircraft or helicopters may be required for aerial surveys to help cover a broader area and to quickly assess remote or difficult to access locations. Similarly, vessels may be required for shoreline assessment to conduct vessel-based surveys or allow access to the shoreline. Vehicles will be required to support ground surveys. Sampling equipment is required for taking water and sediment samples to support visual observations of oil on shorelines.

Esso has also identified the following NATA accredited laboratories within the region with the capabilities to support the analysis for operational module O3:

**Table 3-14 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	Main Melbourne Laboratory 4 Westall Road, Springvale VIC 3171 Phone: 03 8549 9600
Australian Laboratory Services (Traralgon)	Hazelwood Road, Traralgon VIC 3844 Phone: 03 5176 4170
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Phone: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

## 3.4 O4: Fauna observations

### 3.4.1 Purpose

This module is designed to inform responses to spills where there is the potential for exposure to fauna either onshore (e.g. seals or birds on the shoreline) or offshore (e.g. whales or birds in/on the water). Pre-existing baseline information for the modelled spill trajectory area with respect to known significant fauna populations and habitats (notably those with cultural and socio-economic importance) will be incorporated and prioritised where necessary during operational module O4. The purpose of this module is to:

- identify the presence of onshore and offshore fauna, including marine mammals and seabirds, in the response area (i.e. near the oil slick, response vessels or aircraft) in order to implement mitigation strategies, such as reduce vessel speeds, halt operations, move vessels or aircraft from the area, increase flight altitude or consider hazing strategies
- locate potentially oiled fauna for recovery (i.e. by government agencies DEECA and Parks Victoria or as directed)
- determine if any culturally significant or socio-economically important populations have been impacted by the oil spill and if so, implement mitigation strategies.

### 3.4.2 Initiation and termination criteria

**Table 3-15 Initiation and termination criteria**

<b>Initiation criteria</b>	O4.1 Fauna observation (at sea).	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred.</li> </ul>
	O4.2 Fauna observations (onshore).	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• IMT IC (or delegate) confirms that data from Modules O1 and/or O3 predicted/confirmed shoreline exposure.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of Module O4 is to commence.</li> </ul>
<b>Termination criteria</b>	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, or</li> <li>• Results of Module O1 monitoring demonstrate that shorelines will not be impacted, or</li> <li>• The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or</li> <li>• The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under O41 may increase overall environmental impact.</li> </ul>	

1 Decision to terminate monitoring can be made for each individual sub-module independently.

### 3.4.3 Implementation

**Table 3-16 Implementation, logistics and planning**

<b>Implementation time</b> <sup>1</sup>	<ul style="list-style-type: none"> <li>• O4.1 within 4 hours of initiation criteria being met.</li> <li>• O4.2 within 24 hours of initiation criteria being met.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for O4: Fauna Observations.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Results from visual surveillance reported daily to PSC.</li> <li>• Final report prepared within one-week of termination criteria being met; report provided to PSC.</li> </ul>

1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.4.4 Monitoring overview

Table 3-17 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O4. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016)
- Australian National Guidelines for Whale and Dolphin (DoEE 2017).

**Table 3-17 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
O4.1: Fauna observations (at sea)	Visual surveillance.	Regular observations of the location, species, activity, evidence of oiling etc.
O4.2: Fauna observations (onshore)	Visual surveillance.	Regular observations of the location, species, activity, evidence of oiling etc.

### 3.4.5 Responsibilities, competencies, and resources

#### 3.4.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

#### 3.4.5.2 Monitoring team

Table 3-18 lists the minimum personnel requirements from the monitoring provider to implement operational module O4. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-18 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for Module O4 in the event of a spill.</li> <li>• Implement Module O4.</li> <li>• Review and/or carry out reporting requirements.</li> <li>• Compliance with the requirements of Module O4 and the OSM.</li> <li>• Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Level 1 - Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Level 2/3 - Experienced marine fauna observer, with experience using proposed sampling equipment as a Marine Fauna Observer (MFO).</li> <li>• Wildlife handling skills preferred.</li> </ul>
Field teams (1 to 2 people)	<ul style="list-style-type: none"> <li>• Conduct sampling and record data.</li> <li>• Completing field data sheets.</li> <li>• QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarisation with the fauna identification and recording techniques.</li> <li>• Experienced marine fauna observer, with experience using proposed sampling equipment as an MFO.</li> <li>• Wildlife handling skills preferred.</li> </ul>

3.4.5.3 Resources

Fixed wing aircraft and/or helicopters may be required for aerial surveillance of fauna. This would likely be an extension of surveillance and observation undertaken as part of Module O1. Vessels may also be used to support at sea fauna observations. Vehicles will be required to support onshore fauna observations. UAVs could be used for rapid data collection about faunal colonies via video or photographs.

3.5 O5: Air quality

3.5.1 Purpose

In the event of a hydrocarbon spill, people will need to be deployed on site for monitoring and/or response and clean-up operations. Monitoring of air quality is necessary to ensure the protection and safety of human health. The purpose of this module is to:

- establish a safe perimeter prior to any response operations being conducted where personnel may be exposed to hazards of airborne gases and vapours
- identify any hazards from airborne gases and vapours
- determine the need for respiratory protection for environmental monitoring and clean-up workers
- comply with occupational health regulatory requirements.

3.5.2 Initiation and termination criteria

**Table 3-19 Initiation and termination criteria**

<b>Initiation criteria</b>	O5.1 Personnel and area monitoring.	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Confirmation by the Safety Officer (or delegate) a health and safety risk to personnel is present.</li> </ul>
	O5.2 Laboratory analysis.	
	All sub-modules.	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of Module O5 is to commence.</li> </ul>
<b>Termination criteria</b>	<ul style="list-style-type: none"> <li>• The Safety Officer (or delegate) has determined that there is no longer a health and safety risk, or</li> <li>• The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.</li> </ul>	

1 Decision to terminate monitoring can be made for each individual sub-module independently.

3.5.3 Implementation

**Table 3-20 Implementation, logistics and planning**

<b>Implementation time</b> <sup>1</sup>	O5.1 and O5.2 within 12 hours of initiation criteria being met.
<b>Implementation Plan</b>	Refer to Implementation Guide for O5: Air Quality.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Results from personnel monitoring reported daily to the Safety Officer.</li> <li>• Results from laboratory sampling reported as available to the Safety Officer.</li> <li>• Final report prepared within one-week of termination criteria being met; report provided to the Safety Officer.</li> </ul>

1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.5.4 Monitoring overview

Table 3-21 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O5. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Occupational Health Monitoring Plan (Centre for Toxicology and Environmental Health 2011)
- Oil Spill Response Field Manual (ExxonMobil 2014).

**Table 3-21 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
O5.1: Personnel and area monitoring	Direct-read personal or area gas monitoring.	In-situ data collected and compared against known guideline levels.
O5.2: Laboratory analysis	Laboratory analysis of vapour monitors.	Laboratory analysis for hydrocarbons (e.g. BTEX, TPH).

### 3.5.5 Responsibilities, competencies, and resources

#### 3.5.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

#### 3.5.5.2 Monitoring team

Table 3-22 lists the minimum personnel requirements from the monitoring provider to implement operational module O5. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-22 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for Module O5 in the event of a spill.</li> <li>• Implement Module O5.</li> <li>• Review and/or carry out reporting requirements.</li> <li>• Compliance with the requirements of Module O5 and the OSMP.</li> <li>• Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Level 1 – Experience in implementation of safety or industrial hygiene programs in the oil and gas industry.</li> <li>• Level 2/3 - Qualifications in occupational health and safety, or industrial hygiene from a recognised institution or equivalent tertiary study in technical area.</li> <li>• Familiarisation with relevant requirements of the OSMP and OPEP.</li> </ul>
Monitoring personnel	<ul style="list-style-type: none"> <li>• To conduct air quality monitoring to determine safe exposure levels in operating environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Trained in use of personnel air monitoring equipment.</li> </ul>

#### 3.5.5.3 Resources

It is expected that vehicles will be required to support onshore air quality monitoring through both personnel and area monitoring. Laboratory analysis of vapour monitors comprises part of this module. Esso has also identified the following NATA accredited laboratories within the region with the capabilities to support the analysis for operational module O5.

**Table 3-23 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Traralgon)	Hazelwood Road, Traralgon VIC 3844 Phone: 03 5176 4170
Longford Plants Laboratory	Garretts Road, Longford VIC 3851 Phone: 03 5149 6259

## 3.6 O6: Sediment sampling

### 3.6.1 Purpose

The purpose of this module is to provide quantitative measures of sediment quality to:

- establish background concentrations of TPH and PAH, and non-hydrocarbon constituents in sediment
- determine concentrations of TPH, PAH and non-hydrocarbon constituents (e.g. heavy metals) within exposed sediments to inform response strategies
- determine the effectiveness of clean-up operations
- to inform scientific monitoring.

### 3.6.2 Initiation and termination criteria

**Table 3-24 Initiation and termination criteria**

<b>Initiation criteria</b>	O6.1: Sediment samples (intertidal)	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• IMT IC (or delegate) confirms that data from Modules O1, O2 and/or O3 have predicted/confirmed exposure of intertidal benthic substrate.</li> </ul>
	O6.2: Sediment samples (offshore);	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• IMT IC (or delegate) confirms that data from Modules O1 and/or O2 have predicted/confirmed exposure of offshore benthic substrate.</li> </ul>
	All sub-modules	The IMT IC (or delegate) has advised that either full or partial implementation of Module O6 is to commence.
<b>Termination criteria</b>	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has determined that continuation of monitoring under the module is not necessary to meet the objectives of the response, and</li> <li>• The IMT IC (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response, or</li> <li>• The Principal Investigator through the EUL (or delegate) has advised that continuation of monitoring under Module O61 may increase overall environmental impact.</li> </ul>	

1 Decision to terminate monitoring can be made for each individual sub-module independently.

### 3.6.3 Implementation

**Table 3-25 Implementation, logistics and planning**

<b>Implementation time</b> <sup>1</sup>	O6.1 and O6.2 within 24 hours of initiation criteria being met.
<b>Implementation Plan</b>	Refer to Implementation Guide for O6: Sediment Sampling.

<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Results from in-situ sampling reported daily to EUL.</li> <li>• Results from laboratory sampling reported as available to EUL.</li> <li>• Final report prepared within one-week of termination criteria being met; report provided to EUL.</li> </ul>
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1 A module is considered implemented when Esso have (i) Confirmed initiation criteria have been met, (ii) The monitoring providers have been notified, (iii) Sampling and analysis plans (where required) have been completed, and (iv) Mobilisation has commenced.

### 3.6.4 Monitoring overview

Table 3-26 provides an indication of the type of sampling techniques and analysis that may be undertaken during operational module O6. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016).

**Table 3-26 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
O6.1: Sediment samples (intertidal)	Surface and sub-surface sediment sample collection.	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. total recoverable hydrocarbon (TRH), TPH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. total organic carbon (TOC), particle size distribution (PSD), heavy metals, nutrients).</li> </ul>
O6.2: Sediment samples (offshore)	Surface sediment sample collection.	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. TPH, TRH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. TOC, PSD, heavy metals, nutrients).</li> </ul>

### 3.6.5 Responsibilities, competencies, and resources

#### 3.6.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation and termination of this operational monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

#### 3.6.5.2 Monitoring team

Table 3-27 lists the minimum personnel requirements from the monitoring provider to implement operational module O6. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 3-27 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for Module O6 in the event of a spill.</li> <li>• Implement Module O6.</li> <li>• Review and/or carry out reporting requirements.</li> <li>• Compliance with the requirements of Module O6 and the OSMP.</li> </ul>	<ul style="list-style-type: none"> <li>• Level 1 - Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Level 2/3 - Minimum bachelor's degree in relevant subject with sediment quality sampling experience.</li> </ul>

Personnel	Responsibilities	Competencies and Qualifications
	<ul style="list-style-type: none"> <li>Provide advice with respect to environmental issues as required.</li> </ul>	
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with sediment sampling and recording techniques.</li> <li>Minimum bachelor's degree in relevant subject with sediment quality sampling experience.</li> </ul>

### 3.6.5.3 Resources

Sediment sampling will be conducted on both intertidal and offshore sediments with vehicles required to support the intertidal sediment sampling and vessels required to support the offshore sediment sampling. Sediment sampling equipment such as corers and grab samplers will be required to collect sediment samples. Offshore sediment sampling may utilise ROVs. A NATA accredited laboratory will be required to analyse sediment samples. Esso has identified the following NATA accredited laboratories within the region with the capabilities to support the analysis for operational module O6.

**Table 3-28 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	Main Melbourne Laboratory 4 Westall Road, Springvale VIC 3171 Phone: 03 8549 9600
Australian Laboratory Services (Traralgon)	Hazelwood Road, Traralgon VIC 3844 Phone: 03 5176 4170
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Phone: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

## 4 Scientific monitoring

The following sections outline the individual scientific monitoring modules that may be implemented in the event of a hydrocarbon spill to the marine or coastal environment. The sections describe the purpose, initiation and termination criteria, implementation timing, and provide a high-level description of monitoring, reporting and resources required. The modules are presented separately below; however, in practice they may be undertaken simultaneously.

These overviews are supported by internal implementation guides for each of the scientific monitoring modules. The implementation guides have been prepared to provide Esso and their monitoring providers sufficient information to efficiently finalise a monitoring design of an appropriate nature and scale in the event of a hydrocarbon spill.

Scientific monitoring generally has objectives relating to attributing cause-effect interactions of the spill with changes to the surrounding environment. Consequently, such studies are required to account for natural or sampling variation, and study designs must be robust and produce defensible data. Scientific monitoring is typically conducted over a wider study area considering the potentially exposed area, extending beyond the spill footprint, and a longer time period, extending beyond the spill response.

Nine scientific monitoring modules have been identified:

- S1: Hydrocarbons in intertidal sediments and water
- S2: Hydrocarbons in offshore sediments and water
- S3: Fish and shellfish taint and toxicity for human consumption
- S4: Short-term impacts to oiled fauna and flora
- S5: Recovery of commercial and recreational fisheries
- S6: Recovery of fauna
- S7: Recovery of subtidal and intertidal benthic habitat
- S8: Recovery of coastal flora
- S9: Recovery of Ramsar values.

Guidance on various experimental monitoring approaches for scientific monitoring (e.g. use of baseline data in 'before versus after' analyses, and alternative approaches such as 'control versus impact' and 'gradient approach') is provided in Appendix A. Appendix B describes an approach to utilising baseline data where and when available; and a list of known regional studies and/or data sources. Specific guidance and sampling approaches are described within the implementation guides for each scientific monitoring module.

Guidance documents which provide information such as key locations, receptors and values will be used to inform monitoring design. The management plans for both Commonwealth and State protected areas that may be impacted by a spill do not provide guidance as to the levels of acceptable change nor do they state acceptable levels of contaminants including hydrocarbons, however aspects such as key values will be taken into account. Esso will also take into account information from other documents that provide guidance for protected areas such as Corner Inlet and the Gippsland Lakes and in addition will undertake consultation with relevant asset managers of protected areas as well as asset managers responsible for natural assets that are not protected such as commercial and recreational fishery managers. There are also other sources of guidance for the levels of acceptable change such as the Victorian State Environment Protection Policies (Waters) which gives guidance as to levels of change that are considered acceptable for various bodies of water within the state jurisdiction. In addition, the conservation advices/recovery plans for MNES listed under the EPBC Act also provide guidance on levels of acceptable change and the actions that may be required to ensure protection/recovery of listed species and communities including aspects such as spatial and temporal distribution.

Initiation and/or termination criteria for some of the scientific monitoring modules require the use of accepted guidelines and/or benchmark values. Where available, Australian guidelines (e.g. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, ANZG 2018) or regionally relevant data is used. Where these are unavailable or inappropriate for a selected parameter, toxicity screening benchmarks developed by the United States Environmental Protection Agency (USEPA) in response to the Deepwater Horizon incident (e.g. USEPA 2015), or other international guidelines (e.g. USEPA 2017) may be adopted. Specific guidance on benchmark values are described within the overviews below, and in the implementation guides, for each individual scientific monitoring module.

## 4.1 S1: Hydrocarbons in intertidal sediments and water

### 4.1.1 Purpose

The purpose of this module is to provide quantitative measures of intertidal sediment and water quality. Scientific module S1 will assess and monitor concentrations of hydrocarbons and metals in intertidal sediments and water by:

- establishing the baseline concentrations of hydrocarbons and metals in water and sediment at identified pre-impact (if practicable) or control (i.e. un-impacted) intertidal sites
- monitoring concentrations of hydrocarbons, metals and nutrients (if bioremediation techniques used as part of response operations) in intertidal water and sediments at identified control and impact sites.

### 4.1.2 Initiation and termination criteria

**Table 4-1 Initiation and termination criteria**

<b>Initiation criteria</b>	S1.1: Water samples	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) confirms that data from modules O1 and/or O2 have predicted/confirmed exposure of intertidal waters.</li> </ul>
	S1.2: Sediment samples	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) confirms that data from modules O1 and/or O2 have predicted/confirmed exposure of intertidal or shoreline sediments.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of module S1 is to commence.</li> </ul>
<b>Termination criteria</b>	S1.1: Water samples	<ul style="list-style-type: none"> <li>• Ambient hydrocarbon concentrations in intertidal waters have returned to within the expected natural dynamics of baseline state and/or control sites, or</li> <li>• Ambient hydrocarbon concentrations in intertidal waters are below relevant ANZECC and ARMCANZ (2000) and ANZG (2018) 99% species protection levels, or</li> <li>• There has been no demonstrable impact on intertidal water quality from hydrocarbons.</li> </ul>
	S1.2: Sediment samples	<ul style="list-style-type: none"> <li>• Ambient hydrocarbon concentrations in intertidal sediments have returned to within the expected natural dynamics of baseline state and/or control sites, or</li> <li>• Ambient hydrocarbon concentrations in intertidal sediments are below relevant ANZECC and ARMCANZ SQGV (Simpson et al. 2013), ANZG (2018) DGV/GV-High and/or NAGD (CoA 2009) trigger/guideline levels.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• Or agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

### 4.1.3 Implementation

**Table 4-2 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S1 to be activated within 24 hours of initiation criteria being met.
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<b>Implementation time</b>	<ul style="list-style-type: none"> <li>• Sampling and analysis plan to be ready within 24 hours of initiation criteria being met.</li> <li>• Mobilisation and monitoring to commence within 24 hours of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S1: Hydrocarbons in intertidal sediments and water.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Summary report to be provided to Esso Environment Unit Lead following completion of each field survey event.</li> <li>• Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.1.4 Monitoring overview

Table 4-3 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S1. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
- revision of the ANZECC/ARMCANZ Sediment Quality Guidelines (Simpson *et al.* 2013)
- National Assessment Guidelines for Dredging (CoA 2009).

**Table 4-3 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S1.1: Water samples	<ul style="list-style-type: none"> <li>• Surface and sub-surface water sample collection<sup>1</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. TPH, TRH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. metals, nutrients).</li> </ul>
S1.2: Sediment samples	<ul style="list-style-type: none"> <li>• Surface and sub-surface sediment sample collection<sup>2</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. TPH, TRH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. TOC, PSD, metals, nutrients).</li> </ul>

1 Sampling techniques as per operational module O2.3.

2 Sampling techniques as per operational module O6.1.

#### 4.1.5 Responsibilities, competencies, and resources

##### 4.1.5.1 Emergency response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.1.5.2 Esso environmental team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

##### 4.1.5.3 Monitoring team

Table 4-4 lists the minimum personnel requirements from the monitoring provider to implement scientific module S1. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-4 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for module S1 in the event of a spill.</li> <li>Implement module S1.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of module S1 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Minimum bachelor's degree (environmental related).</li> <li>&gt;5 years' experience field monitoring.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>Other member (if required) to have minimum bachelor's degree (environmental related) and &gt;1 - 2 years' experience.</li> <li>Experienced in sediment and water quality sampling and recording techniques.</li> </ul>

#### 4.1.5.4 Resources

Vehicles will be required to support sampling of intertidal sediments and water. Sampling equipment for both sediment and water sampling will be required. Some resources for module S1 can likely be shared with modules O6 and S2. A NATA accredited laboratory will be required for analysis of the intertidal sediment and water samples. Esso has identified NATA accredited laboratories with the capabilities to support the analysis for scientific module S1, including but not limited to:

**Table 4-5 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	4 Westall Road, Springvale VIC 3171 Ph: 03 8549 9600
Eurofins MGT	25 Kingston Town Close, Oakleigh VIC 3166 Ph: 03 8564 5000
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Ph: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

## 4.2 S2: Hydrocarbons in offshore sediments and water

### 4.2.1 Purpose

The purpose of this module is to provide quantitative measures of offshore sediment and water quality. Scientific module S2 will assess and monitor concentrations of hydrocarbons and metals in offshore sediments and water by:

- establishing the baseline concentrations of hydrocarbons and metals in water and sediment at identified pre-impact (if practicable) or control (i.e. un-impacted) offshore sites
- monitoring concentrations of hydrocarbons, metals and nutrients (if bioremediation techniques used as part of response operations) in offshore sediments and water at identified control and impact sites.

### 4.2.2 Initiation and termination criteria

**Table 4-6 Initiation and termination criteria**

<b>Initiation criteria</b>	S2.1: Water samples	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) confirms that data from modules O1 and/or O2 have predicted/confirmed exposure to offshore waters.</li> </ul>
	S2.2: Sediment samples	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational modules O1, O2 or O6 has confirmed exposure to either benthic substrate or waters within bottom 1m of seabed.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of module S2 is to commence.</li> </ul>
<b>Termination criteria</b>	S2.1: Water samples	<ul style="list-style-type: none"> <li>• Ambient hydrocarbon concentrations in offshore waters have returned to within the expected natural dynamics of baseline state and/or control sites, or</li> <li>• Ambient hydrocarbon concentrations in offshore waters are below relevant ANZECC/ARMCANZ (2000) and ANZG (2018) 99% species protection levels.</li> </ul>
	S2.2: Sediment samples	<ul style="list-style-type: none"> <li>• Hydrocarbon concentrations in offshore sediments have returned to within the expected natural dynamics of baseline state and/or control sites, or</li> <li>• Hydrocarbon concentrations in offshore sediments are below relevant ANZECC/ARMCANZ SQGV (Simpson et al. 2013), ANZG (2018) DGV/GV-High and/or NAGD (CoA 2009) trigger/guideline levels.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

### 4.2.3 Implementation

**Table 4-7 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S2 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	<ul style="list-style-type: none"> <li>• Sampling and analysis plan to be ready within 24 hours of initiation criteria being met.</li> </ul>

	<ul style="list-style-type: none"> <li>• Mobilisation and monitoring to commence within 24 hours of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S2: Hydrocarbons in offshore sediments and water.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> <li>• Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.2.4 Monitoring overview

Table 4-8 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S2. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
- revision of the ANZECC/ARMCANZ Sediment Quality Guidelines (Simpson *et al.* 2013)
- National Assessment Guidelines for Dredging (CoA 2009).

**Table 4-8 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S2.1: Water samples	<ul style="list-style-type: none"> <li>• Surface and sub-surface water sample collection<sup>1</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. TPH, TRH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. metals, nutrients).</li> </ul>
S2.2: Sediment samples	<ul style="list-style-type: none"> <li>• Surface sediment sample collection<sup>2</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory analysis for hydrocarbons (e.g. TPH, TRH, PAH, BTEX).</li> <li>• Laboratory analysis for non-hydrocarbon parameters (e.g. TOC, PSD, metals, nutrients).</li> </ul>

1 Sampling techniques as per operational module O2.3.

2 Sampling techniques as per operational module O6.2.

#### 4.2.5 Responsibilities, competencies, and resources

##### 4.2.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.2.5.2 Esso Environmental team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

##### 4.2.5.3 Monitoring team

Table 4-9 lists the minimum personnel requirements from the monitoring provider to implement scientific module S2. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-9 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for S2 in the event of a spill.</li> <li>Implement module S2.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of module S2 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Minimum bachelor's degree (environmental related).</li> <li>&gt;5 years' experience field monitoring.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>Other member (if required) to have minimum bachelor's degree (environmental related) and &gt;1 - 2 years' experience.</li> <li>Experienced in sediment and water quality sampling and recording techniques.</li> </ul>

#### 4.2.5.4 Resources

Vessels and ROVs will be required to support sampling of offshore sediments and water. Sampling equipment for both sediment and water sampling will be required. Some resources for module S2 can likely be shared with modules O6 and S1. A NATA accredited laboratory will be required for analysis of the offshore sediment and water samples. Esso has identified NATA accredited laboratories with the capabilities to support the analysis for scientific module S2, including but not limited to:

**Table 4-10 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	4 Westall Road, Springvale VIC 3171 Phone: 03 8549 9600
Eurofins MGT	25 Kingston Town Close, Oakleigh VIC 3166 Phone: 03 8564 5000
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Phone: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

## 4.3 S3: Fish and shellfish taint and toxicity for human consumption

### 4.3.1 Purpose

The purpose of this module is to:

- provide an understanding of the levels of taint in commercial and recreational fish and/or shellfish species

- undertake a chemical analysis of the level of PAH and non-hydrocarbon constituents (e.g. metals) in fish and/or shellfish tissue to assess the level of risk for human consumption
- determine if differences exist in concentration of PAH and non-hydrocarbon constituents (e.g. metals) in fish and/or shellfish samples collected from impact and control sites
- determine if differences exist in the olfactory status of fish and/or shellfish samples collected from areas exposed to an oil spill (impact) and from control sites
- assess possible sources of specific odours via qualitative evaluation
- determine the persistence of taint over a specified time period.

#### 4.3.2 Initiation and termination criteria

**Table 4-11 Initiation and termination criteria**

<b>Initiation criteria</b>	S3: Fish/shellfish tissue samples	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational modules O2/O6 or scientific modules S1/S2 has confirmed either: (a) in-water hydrocarbon concentrations are above guideline levels known to cause tainting (Table 4.4.5 in ANZECC &amp; ARMCANZ 2000); or (b) sediment hydrocarbon concentrations are above SQGV levels (Simpson et al. 2013, ANZG 2018)</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational modules O2/O6 or scientific modules S1/S2 has confirmed either: (a) in-water non-hydrocarbon constituent concentrations are above guideline levels known to cause tainting (Table 4.4.5 in ANZECC &amp; ARMCANZ 2000); or (b) sediment hydrocarbon concentrations are above SQGV levels (Simpson et al. 2013, ANZG 2018), and</li> <li>• Agreement has been reached with the Jurisdictional Authority relevant to the spill to initiate the monitoring.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of module S3 is to commence.</li> </ul>
<b>Termination criteria</b>	S3: Fish/shellfish tissue samples	<ul style="list-style-type: none"> <li>• Ambient hydrocarbon concentrations are below guideline levels for tainting in ANZECC &amp; ARMCANZ (2000), on two successive sampling occasions, and either</li> <li>• PAH and non-hydrocarbon constituent levels in fish and shellfish tissue have returned to within the expected natural dynamics of baseline state and/or control sites, or</li> <li>• PAH and non-hydrocarbon constituent levels in fish and shellfish tissue are at or below levels specified by Food Standards Australia New Zealand (FSANZ).</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>• Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

#### 4.3.3 Implementation

**Table 4-12 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S3 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	<ul style="list-style-type: none"> <li>• Sampling and analysis plan to be ready within 7 days of initiation criteria being met.</li> <li>• Mobilisation and monitoring to commence within 7 days of activation.</li> </ul>

<b>Implementation Plan</b>	Refer to Implementation Guide for S3: Fish and shellfish taint and toxicity for human consumption.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> <li>• Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.3.4 Monitoring overview

Table 4-13 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S3. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000)
- Protocol for Interpretation and Use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting Due to the Deepwater Horizon Oil Spill (USFDA 2010).

**Table 4-13 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S3: Fish/shellfish tissue samples	<ul style="list-style-type: none"> <li>• Fish and/or shellfish collection.</li> <li>• Biological tissue sampling.</li> </ul>	<ul style="list-style-type: none"> <li>• Physical specimen characteristics (e.g. length, sex, visible lesions etc.).</li> <li>• Laboratory analysis of tissue samples for hydrocarbons (e.g. PAH).</li> <li>• Olfactory analysis.</li> </ul>

#### 4.3.5 Responsibilities, competencies, and resources

##### 4.3.5.1 Emergency response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.3.5.2 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso Environment Lead.

##### 4.3.5.3 Monitoring team

Table 4-14 lists the minimum personnel requirements from the monitoring provider to implement scientific module S3. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-14 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for module S3 in the event of a spill.</li> <li>• Implement module S3.</li> <li>• Review and/or carry out reporting requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Minimum bachelor’s degree (environmental related).</li> <li>• &gt;5 years’ experience field monitoring.</li> </ul>

Personnel	Responsibilities	Competencies and Qualifications
	<ul style="list-style-type: none"> <li>Compliance with the requirements of module S3 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>Other member (if required) to have minimum bachelor's degree (environmental related) and &gt;1 - 2 years' experience.</li> <li>Experienced in relevant sampling and recording techniques.</li> </ul>
Olfactory Analysis Panel (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sensory evaluation of fish and/or shellfish samples.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum bachelor's degree (environmental related).</li> <li>Experienced in olfactory analysis.</li> </ul>

#### 4.3.5.4 Resources

Vessels will be required to support collection of fish and shellfish samples. Equipment required for collection of samples may include baited traps and lure lines. A NATA accredited laboratory will be required for analysis of the fish and shellfish samples. Esso has identified NATA accredited laboratories with the capabilities to support the analysis for scientific module S3, including but not limited to:

**Table 4-15 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	4 Westall Road, Springvale VIC 3171 Ph: 03 8549 9600
Intertek Geotechnical	41-45 Furnace Road, Welshpool WA 6106 Ph: 08 9458 8877
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Ph: 03 9644 4888
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167

## 4.4 S4: Short-term impacts to oiled fauna and flora

### 4.4.1 Purpose

For the purposes of this module, fauna is defined as avifauna (seabirds and shorebirds) and marine megafauna (predominately pinnipeds). Flora is defined as both aquatic flora (e.g. kelp present on subtidal reefs) and coastal flora (e.g. mangroves and saltmarsh).

The purpose of this module is to assess any short-term effects of oiling on marine fauna and flora which may have resulted from an oil spill. In the event that an oil spill is modelled to potentially impact upon culturally significant flora and fauna receptors, stakeholder consultation will be at the discretion of the Esso IMT and Esso EUL. Module S5 is designed to conduct:

- visual inspections of wildlife in the near shore marine environment and assess the number and species of oiled fauna and their health
- visual inspections of wildlife on shoreline environments, including at breeding areas and determine the number and species of oiled wildlife, and their general health
- surveys of coastal, subtidal and intertidal flora populations to identify the species present and record health condition parameters
- fingerprint analysis of oil samples taken from oiled fauna to provide quantitative measures on the composition, type, estimated age and weathering and degradation of the product.

4.4.2 *Initiation and termination criteria*

**Table 4-16 Initiation and termination criteria**

<b>Initiation criteria</b>	S4.1: Fauna surveys (vessel-based).	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that a hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational module O4 has confirmed the presence of oiled fauna.</li> </ul>
	S4.2: Fauna surveys (land-based).	
	S4.3: Oiled fauna hydrocarbon testing;	
	S4.4: Flora surveys.	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational module O3 has confirmed the presence of oiled shorelines.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of module S4 is to commence.</li> </ul>
<b>Termination criteria</b>	S4.1: Fauna surveys (vessel-based).	<ul style="list-style-type: none"> <li>• Disturbance parameters (e.g. mortality, percentage oiled fauna/flora) have returned to within the expected natural dynamics of baseline state and/or control sites, and</li> <li>• Hydrocarbon concentrations from fauna samples have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	S4.2: Fauna surveys (land-based).	
	S4.3: Oiled fauna hydrocarbon testing.	
	All sub-modules.	<ul style="list-style-type: none"> <li>• Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

4.4.3 *Implementation*

**Table 4-17 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S4 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	<ul style="list-style-type: none"> <li>• Sampling and analysis plan to be ready within 24 hours of initiation criteria being met.</li> <li>• Mobilisation and monitoring to commence within 24 hours of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S4: Short-term impacts to oiled fauna and flora.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> </ul>

	<ul style="list-style-type: none"> <li>Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>
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1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.4.4 Monitoring overview

Table 4-18 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S4. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016).

**Table 4-18 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S4.1: Fauna surveys (vessel-based)	<ul style="list-style-type: none"> <li>Visual surveillance.</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative observation records (e.g. presence, abundance, behaviour etc.).</li> </ul>
S4.2: Fauna surveys (land-based)	<ul style="list-style-type: none"> <li>Visual surveillance.</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative observation records (e.g. presence, abundance, behaviour etc.).</li> </ul>
S4.3: Oiled fauna hydrocarbon testing	<ul style="list-style-type: none"> <li>Oil sample collection.</li> </ul>	<ul style="list-style-type: none"> <li>Physical characteristics (e.g. wax content, dynamic viscosity, density, volatiles).</li> <li>Chemical characteristics (e.g. PAH).</li> </ul>
S4.4: Flora surveys	<ul style="list-style-type: none"> <li>Coastal vegetation surveys.</li> <li>Subtidal and intertidal benthic habitat surveys.</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative observation records (e.g. vegetation type, percent cover, health parameters etc.).</li> </ul>

#### 4.4.5 Responsibilities, competencies, and resources

##### 4.4.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.4.5.2 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

##### 4.4.5.3 Monitoring team

Table 4-19 lists the minimum personnel requirements from the monitoring provider to implement scientific module S4. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-19 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for module S4 in the event of a spill</li> <li>Implement module S4.</li> <li>Review and/or carry out reporting requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Minimum bachelor’s degree (environmental related).</li> <li>&gt;5 years’ experience field monitoring.</li> </ul>

Personnel	Responsibilities	Competencies and qualifications
	<ul style="list-style-type: none"> <li>Compliance with the requirements of module S4 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>Other member (if required) to have minimum bachelor's degree (environmental related) and &gt;1 - 2 years' experience.</li> <li>Experienced in relevant sampling and recording techniques.</li> </ul>

#### 4.4.5.4 Resources

Vehicles will be required to support land-based fauna surveys and flora surveys. Vessels will be required for implementation of vessel-based fauna surveys and may be supported by the use of UAVs for rapid collection of data via video or photographs of colonies. ROVs may be required for surveys of subtidal flora. Sampling equipment may be used by trained animal handlers to sample oil found on oiled wildlife and will require a NATA accredited laboratory to analyse the oil samples. Esso has identified NATA accredited laboratories with the capabilities to support the analysis for scientific module S4, including but not limited to:

**Table 4-20 Key resources**

NATA accredited laboratory	Details
Australian Laboratory Services (Melbourne)	4 Westall Road, Springvale VIC 3171 Ph: 03 8549 9600
Intertek Geotechnical	41-45 Furnace Road, Welshpool WA 6106 Ph: 08 9458 8877
Leeder Analytical Pty Ltd	33 Steane St, Fairfield, VIC, 3078 Phone: 03 9481 4167
National Measurement Institute	1/153 Bertie Street, Port Melbourne VIC 3207 Ph: 03 9644 4888

## 4.5 S5: Recovery of commercial, recreational and customary fisheries

### 4.5.1 Purpose

This module provides a semi-quantitative longer-term assessment of whether commercial, recreational and customary fisheries have been impacted by a spill and the level of that impact pertaining to fish catch volume and effort rates. Some commercial, recreational, or customary fishery species may also hold significant cultural or socio-economic importance to local communities. Where practical, consultation may be undertaken with relevant communities, tourism operators, and Aboriginal land and sea ranger groups to identify key populations of significance. Module S5 will assess changes to fishery stocks resulting from oil exposure by:

- determining the catch composition of species in each of the main fisheries following exposure to the spill
- summarise commercial catch volume and effort data post-oil spill and compare to pre-existing (baseline) information provided by the VFA, the New South Wales Department of Primary Industries (NSW DPI),

Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE), and/or Australian Fisheries Management Authority (AFMA)

- calculate catch-per-unit effort for fish/shellfish species to determine any change in abundance.

#### 4.5.2 Initiation and termination criteria

**Table 4-21 Initiation and termination criteria**

<b>Initiation criteria</b>	S5: Desktop review of fishery stock.	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has confirmed that either: (a) data from module S3 confirms tainting in fish or shellfish tissue; or (b) in response from government/State IC advice.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>• The IMT IC (or delegate) has advised that either full or partial implementation of module S5 is to commence.</li> </ul>
<b>Termination criteria</b>	S5: Desktop review of fishery stock.	<ul style="list-style-type: none"> <li>• Catch per unit effort (CPUE) for fishery stock assessments have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>• Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

#### 4.5.3 Implementation

**Table 4-22 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S5 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	Desktop assessment to commence within 24 hours of activation.
<b>Implementation Plan</b>	Refer to Implementation Guide for S5: Long-term impacts to commercial and recreational fisheries.
<b>Reporting</b>	Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.

<sup>1</sup> A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.5.4 Monitoring overview

Table 4-23 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S5. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

**Table 4-23 Sampling techniques and analysis**

<b>Sub-module</b>	<b>Sampling technique</b>	<b>Data collection and/or analysis</b>
S5.1: Desktop review of fishery stock	<ul style="list-style-type: none"> <li>• Desktop review.</li> </ul>	<ul style="list-style-type: none"> <li>• Stakeholder liaison and data collation.</li> <li>• CPUE analyses.</li> </ul>

4.5.5 Responsibilities, competencies, and resources

4.5.5.1 Emergency response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

4.5.5.2 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso Environment Lead.

4.5.5.3 Monitoring team

Table 4-24 lists the minimum personnel requirements from the monitoring provider to implement scientific module S5. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-24 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies/Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Implement module S5.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of module S5 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Minimum bachelor’s degree (environmental related).</li> <li>&gt;5 years’ experience field monitoring.</li> <li>Experienced in fisheries data analysis.</li> </ul>

4.5.5.4 Resources

Module S5 is a desktop review and does not require mobilisation of non-personnel resources.

4.6 S6: Recovery of fauna

4.6.1 Purpose

For the purposes of this module, fauna is defined as avifauna (seabirds and shorebirds) and marine megafauna (predominately pinnipeds).

The purpose of this module is to provide semi-quantitative measures of changes to population dynamics of indicator fauna to assess long-term environmental effects on these species which may result from a hydrocarbon spill (i.e. assess the extent of damage and measure the degree of recovery, where possible). Module S6 will assess and monitor oil impacts to fauna populations by:

- monitoring changes in population dynamics (pup counts, breeding success, population changes over time) at identified control and impact sites
- assessing the impact of a hydrocarbon spill on indicator fauna by analysing pre- and post-impact data on population sizes at control and impact (where existing baseline data is available) sites.

4.6.2 Initiation and termination criteria

**Table 4-25 Initiation and termination criteria**

<b>Initiation criteria</b>	S6: Fauna surveys	<ul style="list-style-type: none"> <li>• Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>• Principal Investigator through the EUL (or delegate) has determined that data from operational module O4 or scientific module S4 has confirmed the exposure of fauna.</li> </ul>
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	All sub-modules	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of module S6 is to commence.</li> </ul>
<b>Termination criteria</b>	S6: Fauna surveys	<ul style="list-style-type: none"> <li>Disturbance parameters (e.g. estimated population) have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	All sub-modules	<ul style="list-style-type: none"> <li>Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

#### 4.6.3 Implementation

**Table 4-26 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S6 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	<ul style="list-style-type: none"> <li>Sampling and analysis plan to be ready within 7 days of initiation criteria being met.</li> <li>Mobilisation and monitoring to commence within 7 days of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S6: Long-term impacts to fauna.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> <li>Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.6.4 Monitoring overview

Table 4-27 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S6. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook *et al.* 2016).
- Or other related scientific studies (e.g. Kirkwood *et al.* 2005; Goldsworth *et al.* 2000).

**Table 4-27 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S6.1: Fauna surveys	<ul style="list-style-type: none"> <li>Visual surveillance.</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative observation records (e.g. population, chicks/pups abundance, behaviour etc.).</li> </ul>

#### 4.6.5 Responsibilities, competencies, and resources

##### 4.6.5.1 Emergency Response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.6.5.2 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso Environment Lead.

#### 4.6.5.3 Monitoring team

Table 4-28 lists the minimum personnel requirements from the monitoring provider to implement scientific module S6. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-28 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>Finalise the sampling and analysis design for module S6 in the event of a spill.</li> <li>Implement module S6.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of module S6 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>Minimum bachelor's degree (environmental related).</li> <li>&gt;5 years' experience field monitoring.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>Other member (if required) to have minimum bachelor's degree (environmental related) and &gt;1 - 2 years' experience.</li> <li>Experienced in relevant sampling and recording techniques.</li> </ul>

#### 4.6.5.4 Resources

Vessels and vehicles will likely be required to access sites for ongoing monitoring of fauna at sea and on land and may be supported by the use of UAVs for rapid collection of data via video or photographs of colonies.

## 4.7 S7: Recovery of subtidal and intertidal benthic habitat

### 4.7.1 Purpose

The purpose of this module is to assess long-term environmental effects on subtidal and intertidal benthic communities which may have resulted from an oil spill or response (i.e. assesses the extent of damage and measure the degree of recovery in benthic communities, where possible). Module S7 will assess and monitor long-term impacts to subtidal and intertidal benthic communities by:

- undertaking habitat extent analysis to rapidly collect and process real-time data on abiotic and biotic parameters to determine subtidal and intertidal habitat classifications
- monitoring seagrass at impact and reference sites to determine extent of change (if any) in biomass and estimated cover due to oil impacts
- monitoring macroalgae and sponge at impact and reference sites to determine extent of change (if any) in biomass and estimated cover due to oil impacts
- monitoring benthic infauna at impact and reference sites to determine extent of change (if any) to species composition and abundance
- monitoring fish at impact and reference sites to determine extent of change (if any) to species composition and abundance.

#### 4.7.2 Initiation and termination criteria

**Table 4-29 Initiation and termination criteria**

<b>Initiation Criteria</b>	S7.1: Habitat mapping. S7.2: Macroalgae and sponges. S7.3: Benthic infauna monitoring. S7.4: Intertidal and subtidal fish monitoring.	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>Principal Investigator through the EUL (or delegate) has determined that data from operational modules O2 and O6 or scientific modules S1, S2 and S4 has confirmed the exposure of either benthic substrate or waters within bottom 1m of seabed.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of module S7 is to commence.</li> </ul>
<b>Termination Criteria</b>	S7.1: Habitat mapping. S7.2: Macroalgae and sponges. S7.3: Benthic infauna monitoring. S7.4: Intertidal and subtidal fish monitoring.	<ul style="list-style-type: none"> <li>Disturbance parameters (e.g. species composition, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

#### 4.7.3 Implementation

**Table 4-30 Implementation, logistics and planning**

<b>Activation time<sup>1</sup></b>	S7 to be activated within 24 hours of initiation criteria being met.
<b>Implementation time</b>	<ul style="list-style-type: none"> <li>Sampling and analysis plan to be ready within 7 days of initiation criteria being met.</li> <li>Mobilisation and monitoring to commence within 7 days of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S7: Long-term impacts to subtidal and intertidal benthic habitat.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> <li>Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

<sup>1</sup> A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.7.4 Monitoring overview

Table 4-31 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S7. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016).

- Or other related scientific studies (e.g. Anderson *et al.* 2009; English *et al.* 1997; Brown *et al.* 2004; Cappo *et al.* 2006).

**Table 4-31 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S7.1: Habitat mapping	<ul style="list-style-type: none"> <li>• Visual and/or remote sensing surveillance (e.g. towed camera, tagging, side-scanning sonar etc.).</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of habitat type and composition.</li> <li>• Mapping of habitat extent.</li> </ul>
S7.2: Macroalgae and sponge	<ul style="list-style-type: none"> <li>• Visual and/or remote sensing surveillance (e.g. towed camera, tagging, side-scanning sonar etc.).</li> </ul>	<ul style="list-style-type: none"> <li>• Population and community parameters (composition, cover, abundance, diversity).</li> </ul>
S7.3: Benthic Infauna monitoring	<ul style="list-style-type: none"> <li>• Infauna sample collection (e.g. sediment grab sampling).</li> </ul>	<ul style="list-style-type: none"> <li>• Population parameters (abundance, composition etc.).</li> </ul>
S7.4: Intertidal and subtidal fish or monitoring	<ul style="list-style-type: none"> <li>• Visual and/or remote sensing surveillance (e.g. divers, baited remote underwater video systems (BRUVs) etc.).</li> </ul>	<ul style="list-style-type: none"> <li>• Population parameters (abundance, composition etc.).</li> </ul>

#### 4.7.5 Responsibilities, competencies, and resources

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.7.5.1 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

##### 4.7.5.2 Monitoring team

Table 4-32 lists the minimum personnel requirements from the monitoring provider to implement scientific module S7. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-32 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for module S7 in the event of a spill.</li> <li>• Implement module S7.</li> <li>• Review and/or carry out reporting requirements.</li> <li>• Compliance with the requirements of module S7 and the OSMP.</li> <li>• Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Minimum bachelor's degree (environmental related).</li> <li>• &gt;5 years' experience field monitoring.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>• Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>• Completing field data sheets.</li> </ul>	<ul style="list-style-type: none"> <li>• One member to have minimum bachelor's degree (environmental related) and &gt;3 years' experience.</li> <li>• Other member (if required) to have minimum bachelor's degree</li> </ul>

Personnel	Responsibilities	Competencies and Qualifications
	<ul style="list-style-type: none"> <li>QA/QC data quality.</li> </ul>	(environmental related) and >1 - 2 years' experience. <ul style="list-style-type: none"> <li>Experienced in relevant sampling and recording techniques.</li> </ul>

4.7.5.3 Resources

Vehicles and vessels will be required to support monitoring of nearshore and offshore benthic habitats and communities respectively. ROVs, BRUVs and towed video systems may be required for remote surveillance of benthic habitats and communities and fish assemblages. Divers may be used if in-situ monitoring is required.

## 4.8 S8: Recovery of coastal flora

### 4.8.1 Purpose

The purpose of this module is to assess potential long-term environmental effects on the extent, composition and health of coastal flora communities which may have resulted from an oil spill (i.e. assess the extent of damage and measure the degree of recovery in coastal flora populations, where possible). Module S8 assesses and monitors long-term impacts to coastal flora by:

- establishing the baseline (background) data on coastal flora community composition, structure and health at identified control and impact sites. Post-spill, pre-impact (reactive baseline) sampling will be undertaken if practicable e.g. if timing permits. This data will augment existing baseline information
- monitoring coastal flora communities over time at identified control and impact sites by assessing community extent, composition, structure and health
- assessing the impact of a hydrocarbon spill on coastal flora communities by analysing long-term pre- and post-impact data at control and impact sites.

### 4.8.2 Initiation and termination criteria

**Table 4-33 Initiation and termination criteria**

<b>Initiation criteria</b>	S8.1: Habitat mapping. S8.2: Condition monitoring.	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>Principal Investigator through the EUL (or delegate) has determined that data from operational module O3 or scientific module S4 has confirmed the exposure of coastal flora.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of module S8 is to commence.</li> </ul>
<b>Termination criteria</b>	S8.1: Habitat mapping. S8.2: Condition monitoring.	<ul style="list-style-type: none"> <li>Disturbance parameters (e.g. abundance, percent cover) and health parameters (e.g. leaf condition) have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

### 4.8.3 Implementation

**Table 4-34 Implementation logistics and planning**

<b>Activation time<sup>1</sup></b>	S8 to be activated within 24 hours of initiation criteria being met.
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<b>Implementation time</b>	<ul style="list-style-type: none"> <li>• Sampling and analysis plan to be ready within 7 days of initiation criteria being met.</li> <li>• Mobilisation and monitoring to commence within 7 days of activation.</li> </ul>
<b>Implementation Plan</b>	Refer to Implementation Guide for S8: Long-term impacts to coastal fauna.
<b>Reporting</b>	<ul style="list-style-type: none"> <li>• Summary report to be provided to Esso Environment Lead following completion of each field survey event.</li> <li>• Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.</li> </ul>

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

#### 4.8.4 Monitoring overview

Table 4-35 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S8. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, sampling and analysis will be undertaken in line with relevant guidance documents, such as:

- Oil Spill Monitoring Handbook (Hook et al. 2016).
- Or other related scientific studies (e.g. English et al. 1997).

**Table 4-35 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S8.1: Habitat mapping	<ul style="list-style-type: none"> <li>• Remote sensing surveillance (e.g. multispectral imagery).</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of habitat type and composition.</li> <li>• Mapping of habitat extent.</li> </ul>
S8.2: Condition monitoring	<ul style="list-style-type: none"> <li>• Visual (e.g. quadrats, photographs).</li> </ul>	<ul style="list-style-type: none"> <li>• Population parameters (e.g. abundance, percent cover etc.).</li> <li>• Health parameters (e.g. leaf cover, leaf damage, etc.).</li> </ul>

#### 4.8.5 Responsibilities, competencies, and resources

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

##### 4.8.5.1 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

##### 4.8.5.2 Monitoring team

Table 4-36 lists the minimum personnel requirements from the monitoring provider to implement scientific module S8. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-36 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Finalise the sampling and analysis design for module S8 in the event of a spill.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarisation with relevant requirements of the OSMP and OPEP.</li> </ul>

Personnel	Responsibilities	Competencies and Qualifications
	<ul style="list-style-type: none"> <li>Implement module S8.</li> <li>Review and/or carry out reporting requirements.</li> <li>Compliance with the requirements of module S8 and the OSMP.</li> <li>Provide advice with respect to environmental issues as required.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum bachelor’s degree (environmental related).</li> <li>&gt;5 years’ experience field monitoring.</li> </ul>
Field teams (2 to 3 people)	<ul style="list-style-type: none"> <li>Conduct sampling, record data and arrange transfer of samples to laboratories.</li> <li>Completing field data sheets.</li> <li>QA/QC data quality.</li> </ul>	<ul style="list-style-type: none"> <li>One member to have minimum bachelor’s degree (environmental related) and &gt;3 years’ experience.</li> <li>Other member (if required) to have minimum bachelor’s degree (environmental related) and &gt;1 - 2 years’ experience.</li> <li>Experienced in relevant sampling and recording techniques.</li> </ul>

4.8.5.3 Resources

Vehicles will be required to support the visual surveys involved in monitoring of coastal flora.

## 4.9 S9: Recovery of Ramsar values

### 4.9.1 Purpose

This module is aimed at establishing whether oil entering Ramsar wetland has resulted in an alteration to the ecological character of the system. The purpose of this module is to:

- assess long-term impacts of an oil spill on the ecological character of Ramsar sites.

### 4.9.2 Initiation and termination criteria

**Table 4-37 Initiation and termination criteria**

<b>Initiation criteria</b>	S9: Desktop review of wetland values.	<ul style="list-style-type: none"> <li>Confirmation by the IMT IC (or delegate) that Level 2 or Level 3 hydrocarbon spill to marine or coastal waters has occurred, and</li> <li>Principal Investigator through the EUL (or delegate) has determined that (a) data from operational module O3 has confirmed the exposure of a Ramsar wetland; and (b) data from scientific modules S1, S4, S6, S7 or S8 confirm an impact to water/sediment quality, flora or fauna in the wetland.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>The IMT IC (or delegate) has advised that either full or partial implementation of module S9 is to commence.</li> </ul>
<b>Termination criteria</b>	S9: Desktop review of wetland values.	<ul style="list-style-type: none"> <li>Wetland values that are important to the ecological character description (ECD*) have returned to within the expected natural dynamics of baseline state and/or control sites.</li> </ul>
	All sub-modules.	<ul style="list-style-type: none"> <li>Or, agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the monitoring.</li> </ul>

\* as described in relevant Ramsar site documents prepared per the National ECD Framework

### 4.9.3 Implementation

**Table 4-38 Implementation logistics and planning**

<b>Activation time<sup>1</sup></b>	S9 to be activated <sup>1</sup> within 24 hours of initiation criteria being met.
<b>Implementation time</b>	Desktop assessment to commence within 24 hours of activation.
<b>Implementation Plan</b>	Refer to Implementation Guide for S9: Long-term impacts to Ramsar values.
<b>Reporting</b>	Final report (including all data and associated interpretation and analysis) prepared following the termination criteria for the module being met.

1 A module is considered activated when Esso have confirmed initiation criteria have been met and the monitoring providers have been notified to initiate planning and implementation tasks.

### 4.9.4 Monitoring overview

Table 4-39 provides an indication of the type of sampling techniques and analysis that may be undertaken during scientific module S9. The final sampling design, including methods and analysis, will be determined by Esso in conjunction with their monitoring providers in the event of a spill.

Where practicable, desktop reviews will be undertaken in line with relevant guidance documents, such as:

- National Framework and Guidance for Describing the Ecological Character of Australian Ramsar Wetlands (DEWHA 2008).

**Table 4-39 Sampling techniques and analysis**

Sub-module	Sampling technique	Data collection and/or analysis
S9: Desktop review of wetland values	<ul style="list-style-type: none"> <li>• Desktop review.</li> </ul>	<ul style="list-style-type: none"> <li>• Data collation (including relevant information from scientific modules S1, S4, S6, S7 and S8 where relevant).</li> <li>• Comparison to known ecological character descriptions of Ramsar wetlands.</li> </ul>

### 4.9.5 Responsibilities, competencies, and resources

#### 4.9.5.1 Emergency response team

The IMT IC and EUL have responsibilities relating to the initiation of this scientific monitoring module. These roles may delegate responsibilities as appropriate (e.g. the ERT VM/OIM) may be responsible for the initiation if the IMT has not yet been established. Roles, responsibilities and competencies of the ERT and IMT teams are as detailed in the OPEP.

#### 4.9.5.2 Esso Environment team

Termination of this scientific monitoring module is the responsibility of Esso EUL.

#### 4.9.5.3 Monitoring team

Table 4-40 lists the minimum personnel requirements from the monitoring provider to implement scientific module S9. The numbers of teams and final number of personnel may vary depending on the nature and scale of the spill.

**Table 4-40 Monitoring team responsibilities and competencies**

Personnel	Responsibilities	Competencies and Qualifications
Principal Investigator (1 person)	<ul style="list-style-type: none"> <li>• Implement module S9.</li> <li>• Review and/or carry out reporting requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarisation with relevant requirements of the OSMP and OPEP.</li> <li>• Minimum bachelor's degree (environmental related).</li> </ul>

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Personnel	Responsibilities	Competencies and Qualifications
	<ul style="list-style-type: none"><li>• Compliance with the requirements of module S9 and the OSMP.</li><li>• Provide advice with respect to environmental issues as required.</li><li>• QA/QC data quality.</li></ul>	<ul style="list-style-type: none"><li>• &gt;5 years' experience field monitoring.</li><li>• Experienced in wetland ecology.</li></ul>

#### 4.9.5.4 Resources

Module S9 is a desktop review and will not require mobilisation of non-personnel resources.

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# Appendix A: General guidance and approaches for scientific monitoring design

This appendix provides guidance on survey design approaches that are likely to be utilised for the scientific monitoring modules:

- impact versus control (IvC)
- gradient of impacts
- before-after-control-impact (BACI)
- control chart
- lines of evidence.

The design of monitoring studies should ensure, as far as possible, that the planned monitoring activities are practicable and that the objectives of the study will be met. The design must result in the collection of meaningful data and, data that are sufficiently powerful to detect ecologically relevant changes.

The final survey design(s) can depend on a variety of factors, included but not limited to:

- scale and pattern of potential effects of the spill
- availability of baseline data and/or ability to rapidly obtain baseline data
- time frame available to gather pre- and post-spill data
- availability of operational monitoring data
- availability of appropriate control sites
- statistical approach proposed for data analysis
- range of possible chronic and acute effects on the parameters of concern, based on the characteristics of the spill
- monitoring frequency required to ensure short-and long-term impacts are detected
- legislative requirements
- available resources and equipment to conduct the work in terms of personnel, logistics, and access.

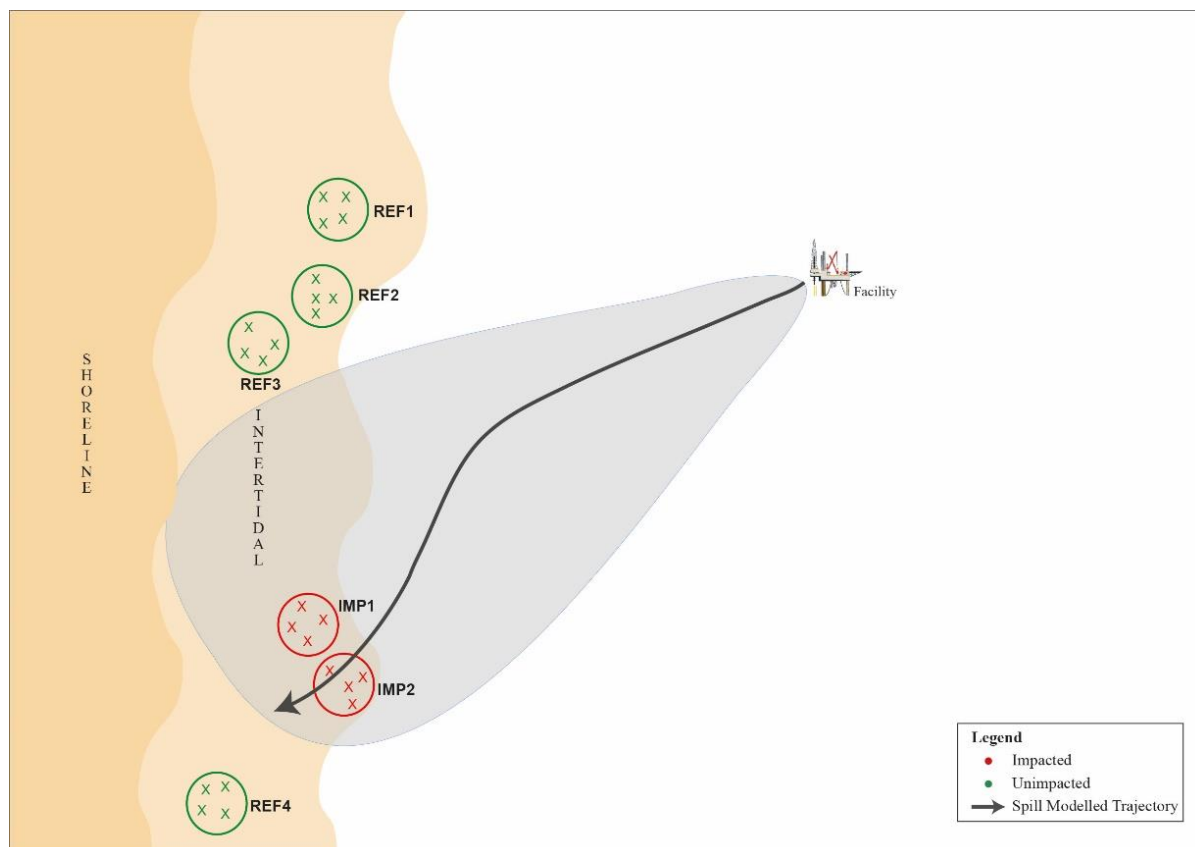
Note: Data collection can depend on several constraints (as outlined above) and on access given logistical and safety constraints applicable to a particular spill event. Therefore, the survey designs recommended within the implementation guides for each scientific monitoring module, may not be able to be implemented exactly as intended. For example, there may be inadequate number of control sites because of the size of the spill and therefore data collected from an expected BACI design may need to be analysed as a gradient approach etc.

## A.1 Before-after-control-impact approach

Where appropriate baseline data are available, consideration should be given to developing a beyond BACI monitoring program design (Underwood 1991; 1994) or similar extended BACI design (mBACI), which monitors a range of control and impact sites over time (Figure A-1). Where robust, appropriate baseline data for exposure sites are not available, pre-exposure sampling of locations that lie within the hydrocarbon spill trajectory should be prioritised to obtain baseline data prior to hydrocarbon exposure.

Exposure sites should be selected first, encompassing a representative selection of locations within the area affected by hydrocarbons. Where practicable, the monitoring program design may consider stratified sampling along environmental gradients (e.g. level of hydrocarbon exposure). Comparable control sites beyond the area affected by hydrocarbons should then be selected, with monitoring conducted at all sites. Obtaining control sites pre-exposure can be challenging and is heavily reliant on predicting the extent of hydrocarbon movement.

The suggested statistical analysis of data collected using the BACI approach includes a univariate or multi-factorial analysis of variance (ANOVA) and equivalent non-parametric tests, all of which will compare between treatment (impact versus reference) and time (before versus after). Partitioning the sum of squares into components of variation can help describe the relative importance of different factors within the analysis.



**Figure A-1 Example of an mBACI design for shoreline and/or intertidal communities**

- 1 A modification to the beyond BACI design, is known as an mBACI design. mBACI designs incorporate multiple impact locations, whereas beyond BACI designs include only one impact location.
- 2 The above design consists of four reference/control locations and two impact locations, with four nested sites in each. The number of replicates (e.g. quadrats or transects) per site should be set based on resourcing, and /or the results of the power analysis (if applicable).
- 3 The area affected by the spill is indicated by the grey shaded area, or the area of influence.
- 4 Design assumes the area of influence has been affected equally.

## A.2 Impact versus control approach

For some locations and receptors, baseline data may not exist, may not be recent or applicable, or was collected using methods that are unrepeatable in the current study. If there is a lack of baseline information that can feed into a BACI design, an IvC approach can be used to assess impacts. However, due to the unknown status of the parameter before impact, there is a higher likelihood of encountering a Type I error (falsely concluding that an impact has occurred) with this approach. For example, if the status of the parameter to be measured was already naturally lower at impact sites than control sites before the impact occurred, but this was not measured, a conclusion may be reached using the IvC approach that an impact has occurred when the difference may actually reflect natural variation. For this reason, sampling designs should always try to collect or use baseline data (i.e. aim for a BACI design), and if an IvC design is used, it is important to ensure that the control sites are comparable to the impact sites in every way possible except for the presence or absence of the studied effect (hydrocarbon). This may include, but not be limited to substrate, current regimes, and community composition.

Because of the higher likelihood of Type I error, it is also useful to collect additional data on physical environmental parameters that may naturally vary between impact and control sites and could therefore confound the assessment. Biological information may also be relevant, such as degree of sub-lethal and lethal impacts to populations. These parameters can be examined later for any potential co-variance with the observed changes in the parameter of interest, to understand whether hydrocarbons or natural variation affected the outcome. The physical and biological information can therefore augment and act as additional evidence to help interpret conclusions from any IvC analyses. As with the BACI approach, when using the IvC approach it is important to

understand the scale of natural variation that may affect the outcome of the assessment by replicating sites within sampling locations and replicating samples within each site.

The suggested statistical approach for analysing the data collected using the IvC approach is a multi-factorial ANOVA (to account for nested data), including PERMANOVA and non-parametric tests, to test whether the level of variation among treatments (IvC) is greater than the level of variation within treatments. Partitioning variance into different sources can help infer whether the effect of hydrocarbons or natural spatial variation was responsible for any detected change in the receptors.

### A.3 Gradient approach

The gradient approach can be used in some instances where a lack of suitable control sites prohibits using a BACI or IvC approach. Sampling sites should be established along a gradient of predicted effect (based on input of data from operational monitoring, surveillance or modelling), with sites established at various distances from the source of impact or along a gradient of magnitudes of concentrations of hydrocarbons. The gradient approach can also be used in combination with a BACI or IvC approach to help infer the cause of a detected impact and describe thresholds of impacts at which a response appears to have occurred. The gradient approach also provides a line of evidence that the source of potential impact (hydrocarbons) was responsible for the observed effect, rather than natural variation. However, care should be taken to identify any natural gradients in the parameter measured and to take these into account when interpreting the data.

When designing a study using a gradient approach, relevant oil spill monitoring data (e.g. water and sediment quality), and modelling should be considered. Prior knowledge or prediction of the likely gradient of effect will greatly improve the efficiency of the sampling design by minimising the collection of data points that provide no additional information in the analysis (e.g. data points showing similar or no effects that do not help to characterise the gradient of effect), though noting these may aid in statistical power of gradient description so shouldn't necessarily be discouraged.

Typically, the level of observed impact will decline with distance from the source of a hydrocarbon release, with this decline likely to be exponential (i.e. large changes close to a release that quickly decrease in severity); therefore, sampling effort can be distributed along the gradient of effect in a way that best characterises the changes in the parameter measured.

If possible, more than two sites could be sampled at each distance along the gradient (if logistics and time permit) to provide an understanding of small-scale variation. Sites should also be sampled at distances where no environmental effect is predicted or observed, if possible, to characterise the full extent of the effect's gradient.

The suggested statistical analysis for the gradient approach includes correlation analysis between hydrocarbon exposure (x-axis) and biological response (y-axis), with associated regression analyses (e.g. least-squares regression) and hypothesis testing to determine if the relationship is significantly different from zero.

### A.4 Control chart approach

The control chart approach is applicable in the following circumstances:

- when long-term (multi-year) datasets exist for the measured parameter
- when a large amount of natural variation exists in the measured parameter
- when predicting the expected range of outcomes from an impact.

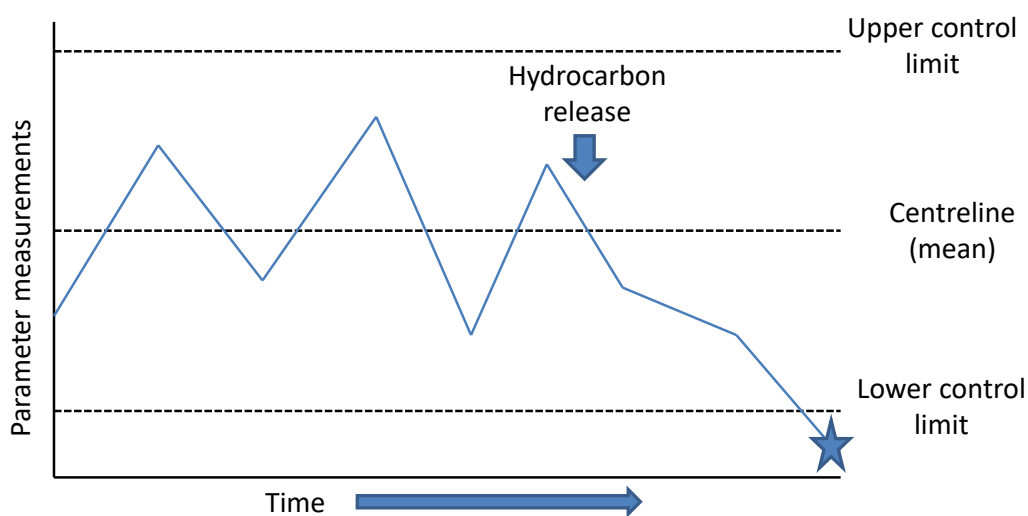
One of the causal criteria described in the lines of evidence approach is strength of association (Hill 1965), exemplified by a 'larger decline in individuals in areas affected by hydrocarbon than in control areas. The control chart approach takes this causal criterion a step further and uses rules to establish whether a detected change in a parameter at impact sites is outside what would be expected to occur naturally. This technique requires tracking a parameter over time and determining whether an observed change is within the bounds of what has been observed to occur naturally at that impact site or at control sites.

A control chart has a central line for the mean, an upper control limit (UCL) for example typically 3 standard deviations (SD) above the mean), and a lower control limit (LCL) (e.g. typically 3SD below the mean), which are typically all determined from historical data (Gotelli and Ellison 2004). The mean line can be constructed using data from i) historical data of an impact site prior to it being affected by hydrocarbons (i.e. what the mean used to be), or ii) control locations, whereby either historical or recent data is used for comparison to other sites (i.e. a control

site historical data compared to impact site). The approach is then based on calculating the mean (ongoing) for an impact site to compare against the control chart. Any observations outside the UCL and LCL indicate values inconsistent with expected natural variation and may provide a simple way to detect change in a system (Figure A-2).

In addition, if ongoing data collection is possible following a potential impact, the control chart approach can be used to examine the direction of change and whether this is consistent or inconsistent with other data. These data and their interpretation may contribute to the weight of evidence for a directional change in a given parameter.

The control chart approach is only useful if there is an adequate knowledge of natural variability in a given parameter whether from historical sources or similar sites/locations. The control chart approach can be particularly effective for detecting impacts in naturally variable systems.



Note: The star represents a measurement beyond the likely anticipated variation, which needs to be investigated.

**Figure A-2** Example control chart showing centreline (mean), UCL (3SD above mean), LCL (3SD below mean), and measurements

## A.5 Lines of evidence approach

The lines of evidence approach:

- can be combined with any of the above monitoring designs to provide inferential evidence of an effect
- are useful to support evidence of effect if there are limited (or only one) impact locations
- are useful to support evidence of effect if the effect radiates outward from source
- are useful to infer cause of change if limited or no baseline data exist
- are useful to infer cause of change if limited or no control sites exist.

When a sampling design is suboptimal, or if conclusions from more formal tests are inconclusive, a line of evidence approach can be used to help infer the cause of an observed change (i.e. attribute change to the hydrocarbon release or to other causes, such as natural variation). Within the lines of evidence approach, inference is developed based on carefully structured arguments. A weakness of this method is that the evidence may be largely circumstantial because it is based on correlations (Downes *et al.* 2002), which does not necessarily imply causation. Each causal argument may be weak when considered independently but combined they may provide strong circumstantial evidence and support for a conclusion (Downes *et al.* 2002).

This approach was originally developed in medicine (Hill 1965) but has been used more recently in ecological studies (e.g. Downes *et al.* 2002; McArdle 1996; Suter 1996; Beyers 1998; Fabricius 2004). Causal criteria have been developed for categorizing arguments from studies of human disease and these can be applied to ecological arguments (Hill 1965). With lines of evidence, there is a need to seek evidence not only to support the impact prediction, but evidence to rule out plausible alternative predictions, such as that the observed difference was due to natural processes (Downes *et al.* 2002; Beyers 1998).

In the lines of evidence approach, a set of descriptions should be developed for all or some of the causal criteria listed in Table A-1 before the survey is undertaken (see Downes *et al.* 2002 for further criteria and examples). Data would then be collected that allows each line of evidence to be tested or objectively questioned. The final assessment of whether an impact is likely to have occurred should be based on the 'weight of evidence' from examining multiple lines of evidence.

Example generalised lines of evidence descriptions are provided in Table A-2. These should be modified and tailored to individual scientific monitoring module, as required and each parameter investigated.

**Table A-1 Hill's (1965) causal criteria and description in the context of ecological impact assessment**

Causal criterion	Description
Strength of association	A large proportion of individuals are affected in the impact area relative to control areas.
Consistency of association	The association was observed by other investigators at other times and places.
Specificity of association	The effect is diagnostic of exposure.
Temporality	Exposure must precede the effect in time.
Biological gradient	The risk of effect is a function of magnitude of exposure.
Biological plausibility	A plausible mechanism of action links cause and effect.
Experimental evidence	A valid experiment provides strong evidence of causation.
Coherence	Similar stressors cause similar effects.
Analogy	The causal hypothesis does not conflict with existing knowledge of natural history and biology.

**Table A-2 Causal criteria and example lines of evidence descriptions that could be used to assess whether a change in a measured parameter was due to the effects of a hydrocarbon release**

Causal criterion	Evidence supportive of a hydrocarbon release impact	Evidence unsupportive of a hydrocarbon release impact
Strength of association	Larger decline in individuals in areas affected by hydrocarbon than in control areas.	Similar declines in individuals in areas affected by hydrocarbon and control areas.
Consistency of association	Consistent finding of declines in a range of biota in areas affected by hydrocarbon.	Inconsistent declines in biota in areas affected by hydrocarbon (e.g. declines in one species but not in other similar species).
Specificity of association	Number of individuals affected correlates with hydrocarbon concentrations.	No correlation between number of individuals affected and hydrocarbon concentration.
Temporality	Decline in individuals immediately preceded by contact with hydrocarbon.	Decline in individuals occurred before or long after hydrocarbon contact.

Causal criterion	Evidence supportive of a hydrocarbon release impact	Evidence unsupportive of a hydrocarbon release impact
Biological gradient	Changes in individuals aligned with exposure to hydrocarbon spills or concentrations.	Decline in individuals occurs with increasing distance from a hydrocarbon spill or hydrocarbon concentrations.
Biological plausibility	Evidence from literature of sensitivity to detected hydrocarbon concentration for species where declines are observed.	Evidence from literature suggests lack of sensitivity to detected hydrocarbon concentration for species where declines are observed.
Experimental evidence	A valid experiment provides strong evidence of causation.	Not applicable (N/A).
Coherence	Evidence of a decline in species abundance, habitat, and food source with increasing hydrocarbon exposure.	Evidence of a decline in species abundance, but no other evidence of expected declines associated with exposure.
Analogy	Apparent declines in hatchling numbers despite no apparent decline in numbers of adults.	Apparent declines in hatchling numbers associated with decreased numbers of adults.

# Appendix B: Baseline data

## B.1 Rationale and approach

Scientific monitoring provides for the quantitative assessment of the environmental impacts associated with a Level 2 or Level 3 spill. The primary goal of the scientific monitoring program is to document the overall impact (short and long term) of the spill on habitats, species and ecosystems and the subsequent post spill recovery.

In the event of a Level 2 or Level 3 spill, scientific monitoring will be activated and individual modules selected and implemented appropriate to the nature, scale and duration of the spill. Activation of these scientific modules during the spill operational response phase may be required to collect pre-contact baseline data or spill impact data at identified receptors. The appropriate scientific modules will be implemented to assess the extent, severity and persistence of environmental impacts associated with the oil spill event.

Baseline monitoring provides information on the condition of ecological receptors prior to, or spatially independent (e.g. if used in control chart analyses) of, a spill event and is used for comparison with the post-impact scientific monitoring where required. This is particularly important for scientific monitoring where the ability to detect changes between pre-impact and post-impact conditions is necessary.

The design of the scientific monitoring program adopts the following framework:

- Where adequate and appropriate baseline data exists, then scientific modules for species and habitats will commence if and when initiation triggers are reached. Given the adequacy of baseline data, the scientific modules will not document the decline of the habitat or species, but will quantify impacts and monitor post-spill recovery
- Where adequate and appropriate baseline data is not available, the options which will be considered include the following:
  - collect baseline data prior to hydrocarbon contact and meet the requirements for a Before/After Assessment<sup>1</sup>, or
  - collect environmental data during the spill event, if practicable, to determine potential impacts.
- In all cases, post-spill scientific monitoring will be undertaken to determine the overall impact of the spill and document post-spill recovery<sup>2</sup>.

*Note 1: Application of the simple BACI sampling design and data analysis programs can be applied to the quantification of oil spill related impacts. See Appendix A*

*Note 2: Spill impact and post impact monitoring data will be collected following 'beyond-BACI' principles which is amenable to statistical techniques that can detect significant difference in recorded parameters (i.e. asymmetrical analysis of variance) following procedures described by Underwood (1994).*

An assessment of available baseline data for environmental receptors within the described area is contained in each of the scientific modules. Within each of those modules there is a description of the scientific monitoring approach which respect to baseline, obtaining data and determining impacts.

There are oil spill monitoring modules that are suited to pre-impact baseline monitoring. In the event of a spill to marine or coastal waters, reactive pre-impact monitoring should, where practicable, be implemented to gather additional data on the current state of the environment. Note: the collection of ongoing baseline data (i.e. under regular operational conditions) is not planned or considered to be practicable.

Understanding priority areas for reactive pre-impact baseline monitoring is important. Stochastic modelling may be used to determine areas likely to be contacted with fresh hydrocarbons above impact thresholds within a specified timeframe. For example, stochastic modelling may indicate a number of shoreline receptors have a high probability of contact with fresh hydrocarbons; these areas would then provide an initial focus for reactive pre-impact monitoring. A summary of activity specific modelling data identifying priority monitoring sites is provided in the OPEP Appendix D Quick Reference Information.

Control sites (i.e. similar to the impact or disturbance location) are sometimes more relevant than reference sites (undisturbed or natural sites) for determining the impact of a hydrocarbon spill as separate from other human or natural stressors (Downes *et al.* 2002). In the event of a spill, existing baseline information should be used to select relevant control sites outside the impact area of a single spill. It is expected that most control sites will be within the predicted environment that may be affected, but outside the impacted area for any given single spill. As all possible permutations or combinations of sites cannot be realistically assessed in advance, control sites should be selected post-spill. The number of samples and/or sampling sites for a particular spill should depend on the extent

of the spill, and the statistical power necessary to determine whether there is an impact and the ability of the monitoring program to determine recovery and termination criteria.

## B.2 Baseline monitoring

Baseline information for the environment has been sourced from existing data and is summarised in each scientific monitoring module. In the event of a spill, where insufficient baseline exists, information will be augmented with 'reactive' baseline studies at control sites or using pre-impact data at the receptor site where appropriate.

Control sites (i.e. similar to the impact or disturbance location) are often more relevant than reference sites (undisturbed or natural sites) for determining the impact of an oil spill as separate from other human or natural stressors (Downes *et al.* 2002). In the event of a spill, existing baseline information will be used to select relevant control sites outside the impact area of a single spill. It is expected that most control sites will be within the described area, but outside the impacted area for any given single spill. Control sites will be selected post-spill based on their representativeness to the potentially impacted site and their ability to provide a reliable comparison for the environmental values being measured.

The number of samples and/or sampling locations will depend on the extent of the spill and the statistical power necessary to detect an impact. The sampling design should also consider the ability of the monitoring program to determine recovery and meet termination criteria.

## B.3 Existing data

Baseline data characterises the existing environment and its variability both in affected sites and unaffected (control or reference) sites.

The EP contains desk study baseline environmental, social and economic values within the described area at a level deemed suitable for risk assessment and identification of mitigation and contingency planning measures as set out in the EP and OPEP. A summary of known baseline data from the Gippsland region and beyond, including New South Wales is shown in Table B-2.

In the event of a Level 2 or 3 spill relevant specific existing data will be obtained as the starting point to scientific monitoring, by the following process:

- relevant scientific monitoring studies are catalogued for identified sensitive locations along with the custodian's contact details
- the monitoring methodology, monitoring sites, and sampling duration and frequency of monitoring studies are provided when appropriate in a tabular format to identify methodological differences, and spatial and temporal gaps in accrued baseline data information
- in the event of a spill data custodians will be contacted and datasets requested. As a contingency, data mining from publicly available information will occur simultaneously for baseline database establishment
- data gaps will be used by the PI to refine the SAP to further optimise the design of the study.

Within each module is a summary of the available baseline information together with implementation strategy to address the assessment of impacts.

The methods used to collect the existing baseline data will be assessed and, where possible, the methods used in the implementation of the monitoring will be consistent with the baseline data methods, such that comparisons can be made. The design of the modules has already drawn upon the information contained within the existing baseline studies that were used to inform both the preparation of the EP and the OSMP and its modules, and as such there is already a degree of conformity between the methods proposed in the modules and that used for the collection of the published baseline data.

## B.4 Monitoring survey type

Establishment of baseline is conducted according to Table B-1.

**Table B-1: Baseline data types**

Type	Description
Baseline field surveys	Field surveys undertaken in advance of the full implementation of the investigations in the modules where baseline information is required. Since the described area is very large and actual spill trajectory dependent on many variables, it is not possible to devise a study programme in advance of a spill that would provide a useful, representative baseline that would cover all spill scenarios.
Reactive baseline surveys	Monitoring surveys mobilised rapidly after a spill to assess baseline conditions at sensitive locations potentially affected by the spill but before spill contact.  Esso recognises that reactive baseline monitoring surveys alone may not be sufficient to serve as a baseline dataset but can provide an important contribution to augment existing 'baseline' with a 'current pre-exposure' condition.
Baseline studies at control sites	Monitoring at sites chosen from within the described area but where spill trajectory estimation predicts no contact.

## B.5 Impact surveys

Impact surveys examine the immediate aftermath of a spill on specific receptors.

## B.6 Recovery surveys

Recovery surveys examine the long-term effects on specific receptors following the spill recovery.

## B.7 Use of operational monitoring data

Findings of operational monitoring will be incorporated into the datasets gathered by scientific monitoring.

## B.8 Monitoring methods

Survey and analytical methods are specific to the environmental value or receptor to be monitored. Methods selected for each module are set out in the relevant subsection of each module.

## B.9 Monitoring sites

Reactive baseline monitoring sites may be required where there is insufficient existing baseline data against which to compare data collected following exposure to a hydrocarbon spill.

Selection of reactive baseline survey sites will need to be flexible and will depend on a range of site-specific, scientific criteria depending on the module. However, in general sites must be:

- representative of the area that is potentially impacted by the hydrocarbon spill
- be located near sites with long-term (or recent) monitoring (notably in Victorian Marine Conservation Areas)
- be free from obvious anthropogenic impacts.

## B.10 Reference sites

Reference sites are those that are representative of undisturbed/natural conditions of similar type, habitat, community, etc. to those affected. Although reference sites for most types of affected environment will exist within the described area, control sites may be more representative in many cases.

## B.11 Control sites

Control sites (i.e. unaffected sites similar to those affected by the spill) are used to determine the impact of an oil spill as separate from other human or natural stressors. In the event of a spill existing baseline information will be used to select relevant control sites outside the impact area of a single spill and must be selected post spill. Control sites will be selected, and details of distribution and number of replicates will be decided after detailed appraisal of baseline data such that an understanding of the variability of the data can be obtained.

## B.12 Monitoring indicators

Indicators are specific species, communities or habitats where changes reflect impacts on the wider environment. Indicators for scientific monitoring were identified and chosen based on the following criteria.

*Typical – Representative of ecological characteristics of the described area*

Monitoring of spill impacts is focussed on species that are known to regularly occur within the described area and for which the described area provides vital habitat. This accords with the ecological principle of 'regularly supports' (United Nations 1971).

*Sensitive – Are sensitive to the impacts of oil spills*

Species and communities can be impacted by both the oil spill and by associated response actions. The mechanisms and cumulative impacts to species and communities have been explored using a stressor model. This does not cover the entire myriad of complexities and pathways associated with oil and response actions in marine, coastal and estuarine environments but provides an overview of the main linkages (Gross 2003).

## B.13 Determining impacts

Data on impacted sites will be compared with baseline data from reference or control locations to determine impacts. Multiple reference/control locations will be selected to provide a robust assessment of the impacts.

If there is sufficient statistical power in the data collected, then post-impact monitoring will be analysed using statistical models such as ANOVA. The data collected during the monitoring may be too variable to establish statistical trends. Such a situation is not uncommon in monitoring programs where limited 'before' data are available.

Generally, determination of an impact involves an experimental approach with sampling before and after the purported impact at both potentially impacted and control (non-impacted) sites – the BACI approach. The BACI approach allows for the detection of impacts that can be identified as statistically separable from the background natural variation that could be causing the observed phenomenon. The soundness of the approach stems from the ability to combine a range of design elements (an assessment of the before situation, replication, use of controls) to ensure the robustness of the assessment.

In many cases, including following an oil spill, it may not be possible to collect information about the pre-impact situation. This may be as a result of adverse weather conditions not allowing a reactive baseline survey to be conducted safely. Thus, a situation can arise where there is insufficient information available as to what the before situation was and indeed what the situation was at any control location either before or after the action. There is also potentially no replication. In such cases an evaluation of the available evidence can be undertaken to see whether there is support for a particular hypothesis or not. Downes *et al.* (2002) in their book on monitoring of aquatic environments present a detailed review of this technique, the weight (levels) of evidence approach. The use of multiple lines of evidence consistent with the integrated assessment philosophy of the revised ANZECC/ARMCANZ (2000a) guidelines as discussed in the CSIRO Handbook for Sediment Quality Assessment (Simpson *et al.*, 2005). A weight of evidence approach can be taken when there is no definitive experimental evidence available to support or not support a hypothesis.

**Table B-2 Regional environmental studies and available baseline data**

Reference	Description	Summary	Relevant location/s	Relevant scientific module
<a href="#">AFMA</a>	Reported landed annual catch from Commonwealth fisheries.	This dataset shows the annual catch for Commonwealth fisheries managed by AFMA. The catch data is provided by fishery, by species and by calendar year.	Commonwealth fisheries	S6
Australian Ocean Data Network (AODN) <a href="#">Open Access to Ocean Data</a>	Numerous biological and physical-atmosphere data.	Australian marine and climate science data and provides the primary access to Integrated Marine Observing System (IMOS) data including access to the IMOS metadata.	NSW, Victoria, Tasmania	S1 S2 S6 S7
<a href="#">Barton et al. (2012)</a>	Marine Natural Values Study Marine Protected Areas of the Flinders and Twofold Shelf bioregions.	An inventory of accessible knowledge about the natural (environmental) values of marine parks and sanctuaries located on the flinders and Twofold shelf bioregions.  For each park area the following are described: Physical parameters, marine habitat classes, marine ecological communities, biological processes, species distribution information, shorebirds, marine mammals, knowledge gaps and existing research.	Wilson's Promontory, Ninety Mile beach, Point Hicks, Cape Howe marine parks and Beware Reef Marine Sanctuary.	S8
<a href="#">Birddata web portal</a>	Access to BirdLife Australia data.	Birddata includes data from the Australian Bird Atlas project and also from various dedicated monitoring projects including Shorebirds 2020.	Gippsland Lakes	S10
<a href="#">Birds Australia</a>	Biennial beach nesting birds count reports.	Every two years, all suitable ocean beach habitat for hooded plovers along the coasts of Victoria, South Australia and NSW, are surveyed across a weekend in mid-November. The aim is to achieve a best estimate of the population and assess the state of the bird's habitat.	Ninety Mile Beach	S5 S7

Reference	Description	Summary	Relevant location/s	Relevant scientific module
Blake <i>et al.</i> (2000)	Seagrass mapping of Victoria's minor inlets	Remote sensing and aerial photograph analysis of seagrass bed extent in six Victorian inlets.		S8
<a href="#">BMT WBM (2011)</a>	Ecological Character Description	This report provides the ECD for the Gippsland Lakes Ramsar site, prepared in accordance with the National Framework and Guidance for Describing the Ecological Character of Australia's Ramsar Wetlands 2008.	Gippsland Lakes Ramsar Site	S10
Boon <i>et al.</i> (2011)	Mangrove and saltmarsh habitat	<p>Victorian mangrove distribution and extent.</p> <p>Victorian coastal saltmarsh distribution and extent.</p> <p>Zonation.</p> <p>Sedimentation and successional change in communities.</p> <p>Relation between mangrove and saltmarsh communities and water and salt.</p> <p>Floristics and structure of coastal vegetation.</p> <p>Mapping of mangrove and coastal saltmarsh extent and current ecological condition.</p> <p>Pre-European distributions.</p> <p>Assessment of distribution under rising sea levels.</p>	VIC	S9
<a href="#">Butler <i>et al.</i> (2002)</a>	Assessment of the conservation values of the Bass Strait sponge beds area	Assessment of the conservation/marine biodiversity values of sponge bed areas across the Bass Strait. Locations and extent unable to be identified by the assessment, however, gives a comprehensive outline of the biodiversity values in sponge based, including broad-scale mapping.	Twofold Shelf	S8
CEE 2003	Marine issues assessment (including benthos) for the Sole Gas Pipeline Extension	Assessment of marine environmental components including (but not limited to) subtidal infauna and epifauna. Field survey included a benthic video survey along the proposed Patricia Baleen pipeline.	Sole/Patricia Baleen	S8

Reference	Description	Summary	Relevant location/s	Relevant scientific module
<a href="#">DEECA</a>	Victorian Biodiversity Atlas	The Victorian Biodiversity Atlas (VBA) is the collated information of flora and fauna sightings across Victoria.	Gippsland Lakes	S10
<a href="#">Edmunds et al. (2005)</a>	Subtidal reef biota monitoring in marine protected areas in the Twofold Shelf region	Long-term Parks Victoria monitoring and mapping program of macroalgae, invertebrates and fish. Quantitative visual census method based on Edgar and Barrett 1997; Edgar et al. 1997) using transects. 18 sites monitored in total including seven sites originally monitored in 2001. Site depth ranged between 4 - 10m.	Twofold Shelf including: Beware Reef Marine Sanctuary, Point Hicks and Cape Howe Marine National Parks	S8
<a href="#">Edmunds et al. (2011)</a>	Victorian Subtidal Reef Monitoring Program: The Reef Biota at Beware Reef Marine Sanctuary,	Inventory of subtidal reef biota at Beware Reef Marine Sanctuary offshore from the Gippsland Coast. Marine habitat classes, marine ecological communities, biological processes, species distribution information, shorebirds, marine mammals, knowledge gaps and existing research.	Beware Reef Marine Sanctuary	S8
<a href="#">Fisheries Research and Development Corporation</a>	Biological, catch and effort information for Australia's key wild catch fish stocks	fish.gov.au provides reports by jurisdiction or species.	Australia-wide	S6
Fullagar et al. (2005)	Historic population data for little penguin colony at Gabo Island	A reconnaissance of Gabo Island to assess the feasibility of a little penguin breeding population survey.	Gabo Island	S5 S7
GlobalArchive (2018)	Online centralised repository of fish image annotation <a href="#">GlobalArchive</a> .	Research quality, global fish image annotation repository, consisting mostly of stereo BRUV data, containing hundreds of BRUV deployments in Bass Strait.	NSW, Victoria Tasmania	S7

Reference	Description	Summary	Relevant location/s	Relevant scientific module
<a href="#">Henry &amp; Lyle (2003)</a>	2000 National Survey of Recreational and Indigenous Fishing (NRIFS).	The first and most comprehensive snapshot of recreational fishing in Australia.	Australia-wide	S6
Higgins & Davies (eds.) (1996)	Handbook of Australian, New Zealand and Antarctic Birds, Volume 3.	Pre-eminent scientific reference on birds in the region, which includes Australia, New Zealand, Antarctica, and the surrounding ocean and sub-Antarctic islands.	Rigby Island, Gippsland Lakes	S5 S7 S10
<a href="#">Institute for Marine and Antarctic Studies (IMAS)</a>	Fisheries and aquaculture reports.	Current and past fishery assessment reports conducted on behalf of DPIPW for the following fisheries: <ul style="list-style-type: none"> <li>• scalefish</li> <li>• rock lobster</li> <li>• abalone</li> <li>• giant crab</li> <li>• Other fisheries including recreational projects.</li> </ul>	Tasmanian fisheries	S6
Integrated Marine Observing System (IMOS) <a href="#">Open Access to Ocean Data</a>	Australian animal acoustic telemetry database.	A national, centralised passive acoustic telemetry repository maintained by the IMOS Animal Tracking Facility and the Australian Ocean Data Network (AODN).	NSW, Victoria Tasmania	S4 S6
<a href="#">Kirkwood et al. (2010)</a>	Continued population recovery by Australian fur seals.	Includes Victorian population data for Australian fur seal up to 2008. Pups were recorded at 20 locations: 10 previously known colonies, three newly recognised colonies and seven haul-out sites where pups are occasionally born.	Gabo Island, The Skerries	S5 S7

Reference	Description	Summary	Relevant location/s	Relevant scientific module
<a href="#">Littnan &amp; Mitchell (2002)</a>	Australian and New Zealand fur seals at The Skerries, Victoria: recovery of a breeding colony	The population size of Australian fur seals ( <i>Arctocephalus pusillus doriferus</i> ) and New Zealand fur seals ( <i>Arctocephalus forsteri</i> ) at The Skerries, Victoria was estimated in two consecutive breeding seasons, 1999-2000 and 2000-2001.	The Skerries	S5 S7
<a href="#">Monk et al. (2011)</a>	Corner Inlet and Nooramunga seagrass mapping project	Commissioned by Parks Victoria this study creates two updated habitat maps for Corner Inlet and Nooramunga Marine and Coastal Park.		S8
<a href="#">NSW DPI</a>	Fisheries spatial portal	NSW revised its fisheries reporting requirements in 2009 so catch and effort data is now more spatially and temporally detailed and as such is likely to be more useful in the assessment of potential impacts from an oil spill.	NSW fisheries	S6
O'Hara et al. (2002)	Baseline monitoring of posidonia seagrass beds in Corner Inlet, Victoria.	<ul style="list-style-type: none"> <li>Obtain qualitative baseline data on Corner Inlet subtidal seagrass communities.</li> <li>Obtain data characterising fish, invertebrate and plant communities of Corner Inlet.</li> <li>Assess status of invertebrate species of conservation concern that occur in Corner Inlet/Nooramunga.</li> </ul>		S8
<a href="#">Overeem et al. (2007)</a>	Contrasting genetic structuring between colonies of the little penguin.	Includes summary of population data for various little penguin, contrasting genetic structuring between colonies of the world's smallest penguin ( <i>Eudyptula minor</i> ) colonies.	Gabo Island	S5 S7
<a href="#">Parks Victoria 2006a</a>	Management plan for Beware Reef Marine Sanctuary.	<p>Management plan developed to help protect and conserve the sanctuary's natural and cultural values, make the sanctuary more widely known and appreciated, and ensure visitors both enjoy and respect its importance for current and future generations.</p> <p>Provides description of species, communities and habitat, however, mostly based on Edmunds et al. (2005).</p>	Beware Reef	S8

Reference	Description	Summary	Relevant location/s	Relevant scientific module
<a href="#">Parks Victoria 2006b</a>	Management plan for Point Hicks Marine National Park.	<p>Management plan developed to help protect and conserve the sanctuary's natural and cultural values, make the sanctuary more widely known and appreciated, and ensure visitors both enjoy and respect its importance for current and future generations.</p> <p>Provides description of species, communities and habitat, however, mostly based on Plummer et al. (2003 and Edmunds et al. (2005).</p>	Point Hicks	S8
<a href="#">Plummer et al. 2003</a>	Marine Natural Values Study – Marine National Parks and Sanctuaries	<p>The Marine Natural Values Study – Marine National Parks and Sanctuaries is an inventory of accessible knowledge about the natural (environmental) values for all 24 of the newly declared Marine National Parks and Sanctuaries in Victoria.</p> <p>For each park area the following are described: physical parameters, marine habitat classes, marine ecological communities, biological processes, species distribution information, shorebirds, marine mammals, knowledge gaps and existing research.</p> <p>Included Ninety Mile Beach Marine National Park and Point Hicks Marine National Park.</p>	Ninety Mile Beach and Point Hicks	S8
Reef Life Survey <a href="#">Survey Data - Reef Life Survey</a>	Abundance data from reef-dwelling species recorded on RLS transects.	A citizen science program in which trained SCUBA divers undertake standardised underwater visual surveys of reef biodiversity on rocky and coral reefs around the world.	NSW, Victoria, Tasmania	S7
Roob and Ball (1997)	Gippsland Lakes seagrass mapping.	<ul style="list-style-type: none"> <li>Assessment of seagrass changes in the Gippsland Lakes through review of historical aerial photographs.</li> <li>Assessment of the spatial distribution of seagrass in the Gippsland Lakes.</li> </ul>	Gippsland Lakes	S8 S10

Reference	Description	Summary	Relevant location/s	Relevant scientific module
Roob <i>et al.</i> (1998)	Corner Inlet and Nooramunga seagrass mapping.	<ul style="list-style-type: none"> <li>Assessment of seagrass changes in Corner Inlet and Nooramunga through a review of historic aerial photographs.</li> <li>Assessment of the spatial distribution of seagrass in Corner Inlet and Nooramunga.</li> </ul>	Corner Inlet Nooramunga	S8
<a href="#">Shorebirds 2020</a>	Shorebird long-term data count.	The shorebirds 2020 database comprises the most complete shorebird count data available in Australia. The data have been collected by volunteer counters and BirdLife Australia staff for approximately 150 roosting and feeding sites, mainly in coastal Australia. The data goes back as far as 1981 for key areas.	Gippsland Lakes, Ninety Mile Beach	S5 S7
<a href="#">Taylor &amp; Roe (2005)</a>	Study on the little tern population on Rigby Island, Gippsland Lakes.	A study of the feeding ecology of little terns ( <i>Sterna albifrons sinensis</i> ) breeding on Rigby Island, Gippsland Lakes. Includes data from the Victorian Little Tern Task Force on little tern numbers and breeding success between 1977 and 2002.	Rigby Island, Gippsland Lakes	S5 S7 S10
<a href="#">VFA</a>	Commercial fish production information bulletin.	Victorian catch and effort data extends back to 1978/1979.	Victorian fisheries	S6
<a href="#">Warry &amp; Hindell (2012)</a>	Fish assemblages and seagrass condition of the Gippsland Lakes	Following a bloom of the blue-green alga in the Gippsland Lakes in 2007 - 2008, there was a widespread decline of seagrass over the same period. The Gippsland Lakes and Catchment Taskforce were concerned with the potential decline in seagrass within the lakes and undertook an assessment of the condition of seagrass (and associated fish assemblages).	Gippsland Lakes	S8 S10
<a href="#">Warry <i>et al.</i> (2013)</a>	Seagrass and fish of the Gippsland Lakes	A summary presentation for the Gippsland Lakes Ministerial Advisory Committee	Gippsland Lakes	S10
<a href="#">West <i>et al.</i> (2015)</a>	Survey of recreational fishing in NSW and the Australian Capital Territory, 2013/2014.	A state-wide survey in NSW to measure changes that had occurred since the NRIFS.	NSW	S6

Reference	Description	Summary	Relevant location/s	Relevant scientific module
NSW DPI online resources	Online marine environment resources tool.	Access to NSW online data with respect to environmental clues for the marine and coastal habitats of NSW.	NSW	S5 S6 S7 S8
Creese <i>et al</i> (2009)	Mapping of the habitats of NSW estuaries.	Detailed habitats mapping for all NSW estuaries with data collected as part of the state-wide estuary management program.	NSW	S7 S8
Birch <i>et al.</i> (2018)	Benthic assemblages in southern NSW estuaries.	Includes an extensive biological and chemical data set from southern NSW estuaries with descriptions of the relationships between the two.	NSW	S7
Taylor <i>et al</i> (2018)	Mangroves and fisheries in southern NSW estuaries.	Mangroves and fisheries in southern NSW estuaries.	NSW	S5 S8
Davis <i>et al.</i> (2016)	Classification scheme for subtidal habitats in NSW estuaries.	Allows for a comparison between the before and after situation with respect to subtidal benthic habitats in NSW estuaries.	NSW	S7
West <i>et al</i> (2016)	Estuarine fisheries data for recreational angling.	Long term data set with regard to recreational fisheries in southern NSW that can be used to compare with past spill data.	NSW	S5
AFMA (2019)	Commonwealth catch data for commercial fisheries in Australia <a href="https://data.gov.au/dataset/reported-landed-annual-catch-from-commonwealth-fisheries">https://data.gov.au/dataset/reported-landed-annual-catch-from-commonwealth-fisheries</a>	Long term data set with regard to commercial fisheries in Australia.	All areas	S5
VFA (2019)	Victorian commercial fisheries catch data <a href="https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production">https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production</a>	Commercial catch data for the State of Victoria covering all fisheries and broken down by fishery and region.	VIC	S5

Reference	Description	Summary	Relevant location/s	Relevant scientific module
NSWDPI (2019)	NSW commercial catch and effort reporting <a href="https://www.dpi.nsw.gov.au/fishing/commercial/catch-effort">https://www.dpi.nsw.gov.au/fishing/commercial/catch-effort</a>	Commercial catch data for the state of NSW covering all fisheries and broken down by fishery and region.	NSW	S5
IMAS (2019)	Tasmanian commercial fishery catch and effort data <a href="http://www.imas.utas.edu.au">http://www.imas.utas.edu.au</a>	Commercial catch data for the state of Tasmania covering all fisheries and broken down by fishery and region.	TAS	S5
SEED (2019)	NSW government shared resource for environmental data <a href="https://www.seed.nsw.gov.au/">https://www.seed.nsw.gov.au/</a>	Detailed mapping of NSW biological and environmental data.	NSW	S5 S6 S7 S8
TAFI (2019)	Mapping of Tasmania's marine environments.	Detailed mapping and datasets for Tasmania's marine and coastal environments. Includes a fisheries, subtidal vegetation and habitats, intertidal areas and megafauna and shorebirds.	Tasmania	S5 S6 S7 S8
UTAS (2019)	Mapping of Tasmania's marine environments.	Detailed mapping and data on Tasmania's marine environments.	Tasmania	S5 S6 S7 S8
Lucieer et al (2007)	Survey of marine habitats by SeaMap Tasmania.	Detailed mapping and data on Tasmania's marine environments.	Tasmania	S5 S6 S7 S8
Edyvane (2016)	Mapping of Tasmanian coastal waters, marine habitat mapping.	Marine habitat mapping.	Tasmania	S6 S7 S8

# Appendix C: Environmental values and sensitivities

## C.1 Environmental values and sensitivities

The monitoring program responding to a spill is dependent on the types of environmental, social and economic values potentially affected by a spill. Those sensitivities identified by in the EP as being present in the Area that May Be Affected (EMBA) are summarised in Table C-1. Linkages between environmental sensitivities, their location, oil spill response options for spill scenarios and OSMP studies are also shown in Table C-1.

## C.2 Scope of the monitoring program

The OSMP modules provide for the rapid assessment of the extent of spread of hydrocarbons from a Level 2 or Level 3 spill and effects on the environment of the spilt hydrocarbons as well as any spill response activities that may be used in the clean-up of the spill. The modules provide for the rapid assessment of impacted and potentially affected wildlife including those listed as MNES und the EPBC Act. These modules were based on the spill impact assessment in the EP and probable exposure pathways and the likelihood of contact with the identified sensitive receptors.

**Table C-1 Sensitivities within Level 3 hydrocarbon spill EMBA with monitoring strategies and potential OSMP response measures to be adopted**

Location	Marine receptors													Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Scientific module	01 02	04 06	04 06	04 06	04 06	04 06	07	07	07	02	04 05	07	07	04 06	04 06	04 06	04	08 09	08 09	04	01	01	01	01	04	07	
<b>OFFSHORE</b>																											
<u>COMMONWEALTH Reserves</u>																											
Australian whale sanctuary	X	X	X	X	X	X	X	X	X	X	X														X		
East Gippsland Australian Marine Park (AMP)	X	X			X	X		X		X																	
Beagle AMP	X	X	X		X	X		X	X	X															X		
Flinders AMP	X	X			X		X	X	X	X																	
Freycinet AMP	X	X			X			X		X																	
Jervis AMP	X	X						X		X															X		
Hunter AMP	X	X			X		X	X		X															X		
Cod Grounds AMP	X	X			X		X	X		X																	

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Solitary Islands AMP	X	X			X		X	X		X																
Central Eastern AMP	X	X			X		X	X		X																
Lord Howe AMP	X	X		X	X	X	X	X		X						X										
Zeehan AMP	X	X			X			X		X																
Apollo AMP	X	X			X			X		X																
Boags AMP	X				X	X		X		X																
Franklin AMP	X				X			X		X																
Huon AMP	X	X	X		X			X		X																
South Tasman Rise AMP	X	X			X	X	X	X	X	X															X	
Gifford AMP	X	X		X	X	X	X	X	X	X																
Norfolk AMP	X	X		X	X	X	X	X	X	X						X									X	
Coral Sea AMP	X	X		X	X	X	X	X	X	X						X									X	

Location	Marine receptors													Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Tasman Frasture AMP	X	X			X	X	X	X	X	X																	
<b>STATE Reserves</b>																											
Wilson's Promontory Marine Park (MP) and Marine National Parks (MNP) (Victoria) <sup>1</sup>	X	X		X	X	X	X	X	X	X				X	X	X				X				X	X	X	
Ninety Mile Beach MNP (Victoria)	X	X	X	X	X	X	X	X	X	X					X								X				
Beware Reef MS (Victoria)	X	X			X	X	X	X	X	X		X	X	X										X	X	X	
Point Hicks MNP(Victoria)	X	X		X			X	X	X	X		X		X									X	X	X	X	
Cape Howe MNP (Victoria)	X	X	X	X	X	X		X		X		X		X									X	X	X		
Bunurong MNP (Victoria)	X							X	X	X		X		X									X		X	X	

Location	Marine receptors												Coastal receptors														
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Cape Byron MP (NSW)	X	X		X	X	X	X	X	X	X				X		X							X		X		
Solitary Islands MP (NSW)	X	X		X	X		X	X	X	X				X									X	X	X		
Batemans MP <sup>2</sup> (NSW)	X	X		X	X	X	X	X	X	X		X		X			X	X	X				X	X	X		
Jervis Bay MP (NSW)		X	X	X	X	X	X	X	X	X		X		X			X		X				X		X		
Port Stephens-Great Lakes MP (NSW)	X	X		X	X		X	X	X	X		X					X	X	X					X	X		
Lord Howe MP and World Heritage Area (NSW)	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X				X	X	X	X	
<b>STATE</b>																											
NSW Aquatic Reserves (Sydney Area)						X	X	X	X	X		X		X						X			X		X	X	

Location	Marine receptors												Coastal receptors														
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Kent Group Marine Reserve (Tasmania)	X	X	X		X	X		X	X	X			X												X	X	
Maria Island Marine Reserve and National Park (Tasmania)	X											X											X		X	X	
<b>SHORELINE</b>																											
<u>International</u>																											
Gippsland Lakes (Ramsar) <sup>3</sup>					X	X						X		X			X	X	X		X	X					
Gippsland Lakes Coastal Park (Victoria) <sup>7</sup>		X	X		X	X	X	X	X	X	X			X									X				
Corner Inlet MNP, MCP & Nooramunga MCP (Ramsar)							X	X				X		X			X	X	X	X		X				X	
Towra Point Nature Reserve Ramsar (NSW)														X			X	X	X								

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Hunter Estuary Wetlands Ramsar (NSW)														X			X	X					X			
Elizabeth & Middleton Reef Ramsar	X	X		X	X		X									X			X							
Moulting Lagoon Ramsar (TAS)														X				X	X	X						
Lavinia Nature Reserve Ramsar														X				X								
Flood Plain Lower Ringarooma River Ramsar														X				X								
Logan Lagoon Ramsar					X	X	X	X	X		X			X				X		X		X				
Apsley Marshes Ramsar					X	X	X	X	X		X			X				X		X						
Western Port Ramsar		X	X		X	X	X	X	X		X	X		X			X	X	X	X		X	X	X		

Location	Marine receptors												Coastal receptors														
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Little Waterhouse Lake Ramsar					X	X			X	X		X											X				
Myall Lakes Ramsar			X		X	X	X	X	X	X		X	X		X			X	X	X	X		X	X	X	X	
Moreton Bay Ramsar	X	X		X	X	X	X	X	X	X		X		X			X	X	X	X		X	X	X	X	X	
Pitt Water-Orielton Lagoon Ramsar					X	X		X	X	X		X		X				X		X		X	X	X			
Port Phillip Bay and Bellarine Peninsula Ramsar					X	X		X	X	X		X					X	X	X	X				X			
<b>TERRESTRIAL PARKS</b>																											
Croajingalong Biosphere Reserve and NP <sup>4</sup>					X	X									X	X			X	X	X		X	X		X	
Wilsons Promontory Biosphere and NP							X							X	X								X			X	

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Cape Conran Coastal Park (Victoria) <sup>6</sup>					X	X	X					X		X						X			X			X
Gabo Island Harbour SMA & Light Station Reserve (Victoria)							X						X	X	X										X	X
Mallacoota SMA (Victoria)							X					X		X					X	X	X		X			X
The Skerries SMA													X	X										X		X
Ben Boyd NP/ Nadgee Nature Reserve (NSW)														X			X	X	X				X			X
Bournda NP (NSW)														X				X	X		X	X				X
Mimosa Rocks NP (NSW)														X				X	X				X			X
Montague Island Nature Reserve (NSW)	X				X		X						X		X											X

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Eurobodalla NP (NSW)														X			X	X	X				X			X
Murramarang NP (NSW)														X									X			X
Meroo NP (NSW)														X									X			X
Conjola NP (NSW)														X				X					X			X
Jervis Bay NP (NSW)														X									X	X		X
Seven Mile Beach NP (NSW)														X						X			X			X
Royal NP (NSW)									X					X			X		X				X			X
Botany Bay/Kamay NP (NSW)									X					X				X								
Sydney Harbour NP (NSW)															X			X					X	X		X
Ku-ring-gai Chase NP															X											X

Location	Marine receptors												Coastal receptors														
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands	
Bouddi NP (NSW)																	X	X	X				X			X	
TERRESTRIAL PARKS <sup>5</sup>																											
Wyrabalong NP (NSW)							X							X					X				X	X		X	
Worimi NP (NSW)														X									X			X	
Tomaree NP (NSW)														X			X	X	X				X	X		X	
Myall Lakes NP (NSW)					X									X			X	X	X	X			X				
Booti NP (NSW)																	X	X	X	X			X			X	
Saltwater NP (NSW)					X									X			X	X	X				X				
Crowdy Bay NP (NSW)														X			X	X					X			X	
Limeburners Creek NP (NSW)														X			X	X					X		X		

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Goolawah NP (NSW)														X									X	X		X
Hat Head NP (NSW)														X									X			X
Kent Group National Park and Judgment Rocks NR (Tasmania)					X								X										X			X
Strezlecki NP (Tasmania)					X									X												X
Mt William NP (Tasmania)					X									X									X			X
Narawntapu NP (Tasmania)														X									X			X
West Moncoeur Island Nature Reserve and East Moncoeur Island (Tasmania)					X								X													X
Curtis Island Nature Reserve and Devils Tower																										

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Nature Reserve (Tasmania)																										
Hogan Island Group (Tasmania)																										
Arakwal National Park and Cape Byron Conservation Area (NSW)					x	x					x			x			x	x		x		x	x			x
Bongil Bongil National Park (NSW)					x	x					x			x			x	x		x		x	x			x
Booderee National Park (NSW)					x	x					x			x			x	x		x		x	x			x
Bribie Island National Park (Queensland)					x	x					x			x			x	x		x		x	x			x
Broadwater National Park, Bundjalung National Park and Iluka Nature Reserve (NSW)					x	x					x			x			x	x		x		x	x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Broulee Island Nature Reserve					x	x						x		x			x	x		x		x	x			x
Bunorong Marine and Coastal Park (Victoria)					x	x						x		x			x	x		x		x	x			x
Byron Coast Group of Nature Reserves (NSW)					x	x						x		x			x	x		x		x	x			x
Cape Howe Marine National Park (Victoria)					x	x						x		x			x	x		x		x	x			x
Cape Liptrap Coastal Park (Victoria)					x	x						x		x			x	x		x		x	x			x
Coffs Coast Regional Park and Moonee Beach Nature Reserve (NSW)					x	x						x		x			x	x		x		x	x			x
Corner Inlet and Nooramunga Coastal Park (Victoria)					x	x						x		x			x	x		x		x	x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Corner Inlet Marine National Park (Victoria)					x	x						x		x			x	x		x			x			x
Cudgen, Wooyung and Billinudgel Nature Reserves (NSW)					x	x						x		x			x	x		x			x			x
Darawank, Khappinghat and Kattang Nature Reserves (NSW)					x	x						x		x			x	x		x			x			x
Five Islands Nature Reserve (NSW)					x	x						x		x			x	x		x			x			x
French Island Marine National Park (Victoria)					x	x						x		x			x	x		x			x			x
Freycinet National Park and Wye River State Reserve (Tasmania)					x	x						x		x			x	x		x			x			x
Gaagal Wanggaan (South Beach)					x	x						x		x			x	x		x			x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
National Park (NSW)																										
Glenrock State Conservation Area and Awabakal Nature Reserve (NSW)					x	x					x			x			x	x		x			x	x		x
Great Otway National Park (Victoria)					x	x					x			x			x	x		x			x	x		x
Hunter Island Group (Tasmania)					x	x					x			x			x	x		x			x	x		x
Jagun Nature Reserve (NSW)					x	x					x			x			x	x		x			x	x		x
K'gari, Great Sandy National Park (Queensland)					x	x					x			x			x	x		x			x	x		x
Lavinia State Reserve (Tasmania)					x	x					x			x			x	x		x			x	x		x
Logan Lagoon Conservation Area (Tasmania)					x	x					x			x			x	x		x			x	x		x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Lord Howe Island Permanent Park Preserve (NSW)					x	x						x		x			x	x		x			x			x
Malabar Headland National Park (NSW)					x	x						x		x			x	x		x			x			x
Maria Island National Park and Ile des Phoques Nature Reserve (Tasmania)					x	x						x		x			x	x		x			x			x
Moreton Island, Southern Moreton Bay Islands South Stradbroke Island National Park (Queensland)					x	x						x		x			x	x		x			x			x
Mornington Peninsula National Park (Victoria)					x	x						x		x			x	x		x			x			x
Munmorah State Conservation Area and Bird Island Nature Reserve					x	x						x		x			x	x		x			x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
and Wallarah National Park (NSW)																										
Muttonbird Island Nature Reserve (NSW)					x	x					x			x			x	x		x		x	x			x
Naree Budjong Djara National Park (Queensland)					x	x					x			x			x	x		x		x	x			x
Narrawallee Creek Nature Reserve (NSW)					x	x					x			x			x	x		x		x	x			x
Noosa National Park (Queensland)					x	x					x			x			x	x		x		x	x			x
Phillip Island Nature Park (Victoria)					x	x					x			x			x	x		x		x	x			x
Point Hicks Marine National Park (Victoria)					x	x					x			x			x	x		x		x	x			x
Port Campbell National Park and					x	x					x			x			x	x		x		x	x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
Bay of Islands Coastal Park (Victoria)																										
Rocky Cape National Park (Tasmania)					x	x					x			x			x	x		x		x	x			x
Sea Acres National Park (NSW)					x	x					x			x			x	x		x		x	x			x
Seal Rocks Nature Reserve					x	x					x			x			x	x		x		x	x			x
South Bruny National Park (Tasmania)					x	x					x			x			x	x		x		x	x			x
South Pacific Heathland Reserve (NSW)					x	x					x			x			x	x		x		x	x			x
Southport Lagoon Conservation Area (Tasmania)					x	x					x			x			x	x		x		x	x			x
Tasman National Park and Reserves (Tasmania)					x	x					x			x			x	x		x		x	x			x

Location	Marine receptors												Coastal receptors													
	Marine open water	Cetaceans/dugongs	Seals	Turtles	Seabirds (protected)	Other birds	Protected sharks/fish or rays	Other sharks, fish of rays	Sub-tidal invertebrates	Plankton	Commercial and recreational fisheries	Inter-tidal invertebrates	Macrophytes (kelp/giant kelp)	Seals (marine) colonies/haul-out (shoreline)	Shoreline and wetland birds	Penguin colonies	Corals	Mangroves	Saltmarsh	Emergent/sub-tidal vegetation (seagrass)	Sheltered inter-tidal flats	Rip-rap	Sand beaches	Inter-tidal rocky platforms	Sub-tidal reefs	Exposed rocky headlands
The Bull Island Nature Reserve					x	x						x		x			x	x		x		x	x			x
The Lakes National Park and Gippsland Lakes Coastal Park (Victoria)					x	x						x		x			x	x		x		x	x			x
Towra Point Nature Reserve (NSW)					x	x						x		x			x	x		x		x	x			x
Yaringa Marine National Park (Victoria)					x	x						x		x			x	x		x		x	x			x
Yuraygir National Park (NSW)					x	x						x		x			x	x		x		x	x			x

Notes:

- 1- This includes the Anser, Kanowna and Glendinnie Groups of Islands which lie off Wilsons Promontory and the terrestrial national park component to the high-water mark (i.e. inter-tidal zone). This is common for ALL Victorian National Marine Parks and Sanctuaries
- 2- Includes shoreline estuaries and creeks to the limit of tidal influence between Bawley Point and Wallaga Lake.
- 3- This includes Lakes Entrance and Lakes Tyers Estuary System
- 4- Park includes the Skerries (excluded from this listing and included in Skerries SMA), Wingan Inlet, Tamboon Inlet, Mallacoota Inlet Special Management Area (excluded from this listing and included in Mallacoota SMA), Bekta River, Cape Howe and Nadgee Wilderness Area

5- Assumption made that terrestrial and coastal parks all contain specified marine and coastal receptors.

6- Cape Conran Coastal Park includes Sydenham Inlet and Yeerung River Estuary.

7- The northern section of Gippsland Lakes Coastal Park is part of the Gippsland Lakes Ramsar site. Ramsar site extends to the adjacent coastline. Adjacent marine sensitivities to the Coastal Park (i.e. white shark BIA, seabird BIA, Southern Right Whale BIA) are also included in this listing.