Gas Export Pipeline Mechanical Completion

Environment Plan Summary

Document No.: F281-AH-PLN-10112
Security Classification: Public

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Ichthys PROJECT

ICHTHYS PROJECT - GAS EXPORT PIPELINE EPCI CONTRACT

DOCUMENT COVER SHEET

Total # of Pages (incl. Doc Cover Sheet)	33 Pages

Company Document No			F281-AH-PLN-10112		**Revision No**	1	
Document Title			Mechanical Completion Environment Plan Summary				
Contract/Purchase Order No			N/A				
Equipment Tag No			N/A				
Contractor Document No					**Contractors Rev No.**		
Prepared	J Pederick	Checked	S Lemmens	Discipline Manager Approval	P. Labbens	Project Director Approval	G Tese'
Date	11 Feb 2015	Date	11 Feb 2015	Date	11 Feb 2015	Date	11 Feb 2015

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REV No.	DATE	ISSUE PURPOSE
1	11 Feb 2015	**Issued for Use**

Revision History to Company's Document Number

REVISION STATUS LOG

Rev.	Date	Pages	Description
1	11 Feb 2015		Issued for use

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1 INTRODUCTION

1.1 BACKGROUND

INPEX Ichthys Pty Ltd (INPEX), on behalf of the Ichthys Upstream Unincorporated Joint Venture Participants intends to develop the Ichthys Field in the Browse Basin off the north-west coast of Western Australia to produce liquefied natural gas, liquefied petroleum gases and condensate for export to markets in Japan and elsewhere.

The Ichthys Field is located within the area covered by production licence WA-50-L, in the northern Browse Basin, approximately 210 km north west of the coast of mainland Western Australia and 820 km south-west of Darwin. Gas from the Ichthys Field will undergo preliminary processing on an offshore central processing facility to remove water and raw liquids, including the greater part of the condensate. This condensate will be pumped to a nearby floating production, storage and offtake facility, from which it will be transferred to tankers for export to overseas markets. The gas will be transferred from the central processing facility via an 889 km gas export pipeline to an onshore processing plant at Bladin Point in Darwin (Figure 1-1).

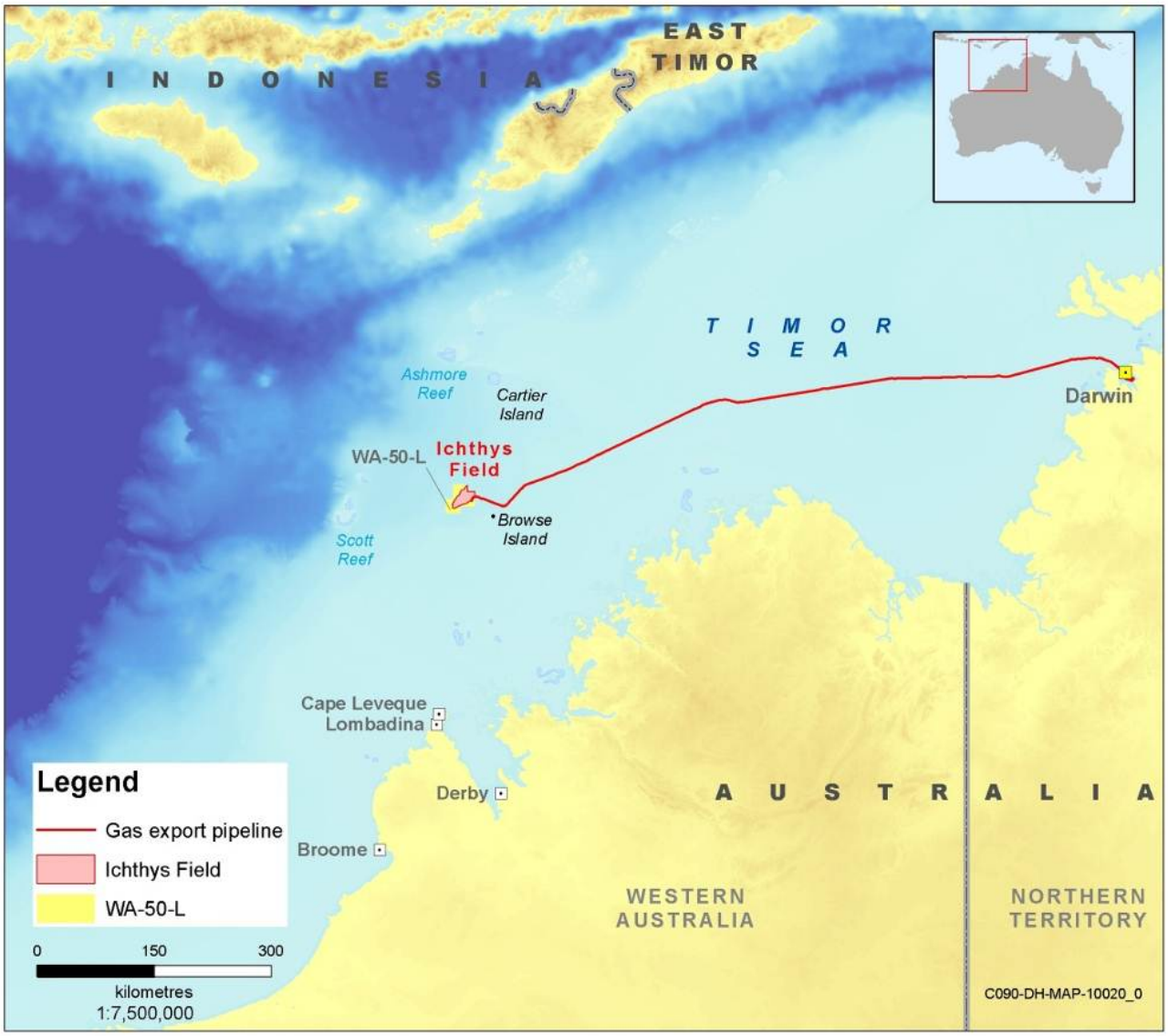

Figure 1-1 Location of the Ichthys Field

1.2 SCOPE

The *Mechanical Completion Environment Plan* (F281-AH-PLN-10089) applies to the flooding, cleaning and gauging (FCG) and hydrotesting of the gas export pipeline. These activities will result in planned discharges to Commonwealth water, originating within production licence WA-50-L at the pipeline end termination (PLET) location (Figure 1-2).

Support-vessel operations within the gas export pipeline construction corridor, which includes the PLET location, have already been risk-assessed and described in the NOPSEMA accepted INPEX *Offshore Gas Export Pipeline Environment Plan* (F281-AH-PLN-10014). A summary of this EP is available on the NOPSEMA website.

There are no additional vessel, or aerial, operations associated with the activities covered by this EP, which have not already been accounted for within the Offshore GEP EP. Consequently, vessel and aerial operations are outside the scope of this EP.

1.3 LOCATION OF THE ACTIVITY

Mechanical Completion of the gas export pipeline will result in planned discharges at the PLET location within the area covered by Petroleum Production Licence WA-50-L, which is located in Commonwealth waters (Figure 1-2).

To complete the activities managed under this plan, an onshore spread will be installed and operated within the Northern Territory (Figure 1-2). The spread is required to flood the gas export pipeline, launch the “pig train”, and pressurise the gas export pipeline. The management and operation of the onshore spread, however, is not within the scope of the Environment Plan.

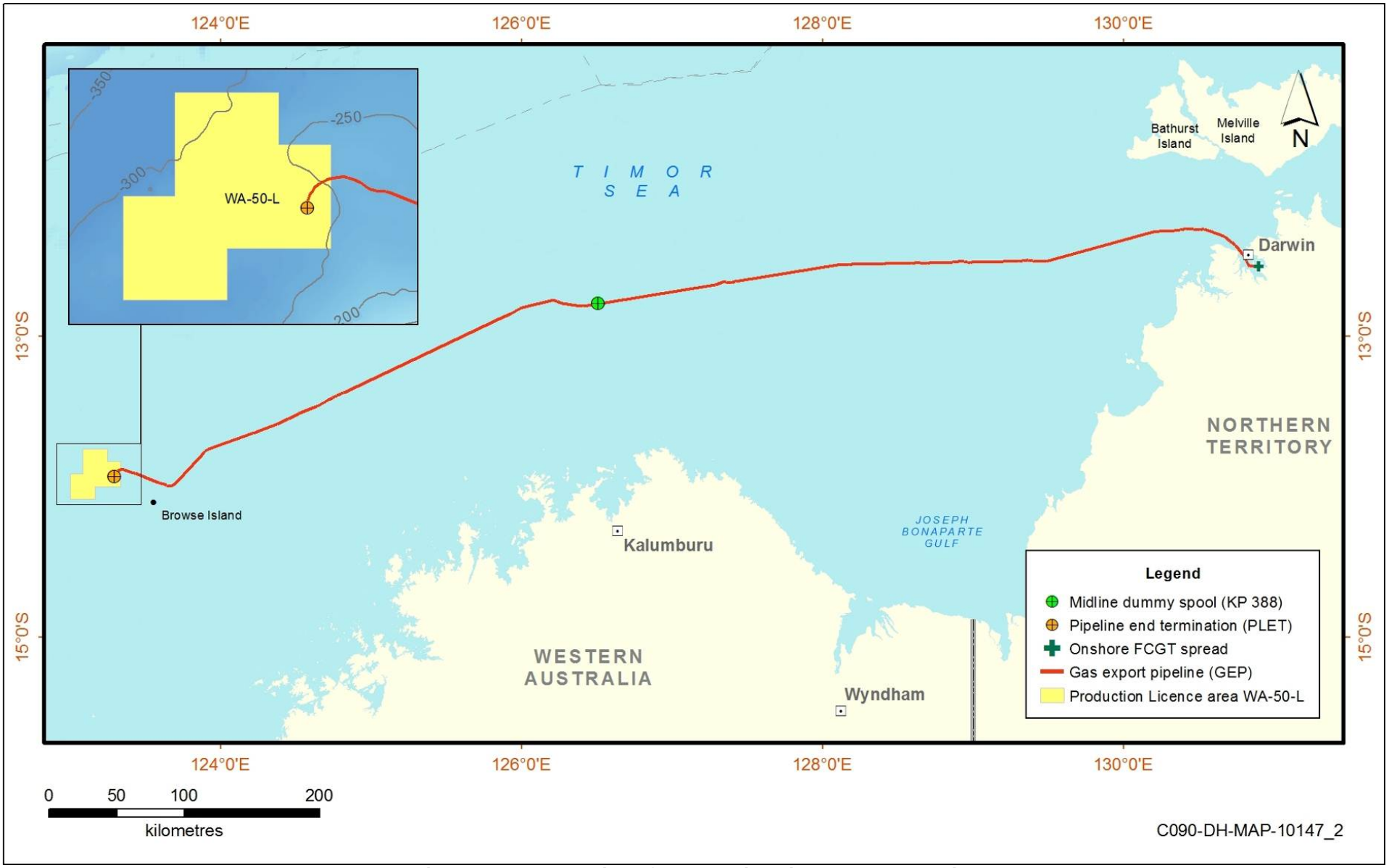

Figure 1-2 Location of PLET and onshore FCGT spread

1.4 SCHEDULE AND TIMING

Mechanical completion (post-lay FCG and post-lay hydrotesting) activities are scheduled to be performed between mid-2015 and mid-2016. Potential changes in the schedule have been accounted for in the risk assessments (Section 5), with the potential environmental impact assessed for all seasons, or the season for which the greatest potential impacts are predicted where impact varies for different seasons. Consequently, should activities be undertaken prior to or after the scheduled time, the impacts and risks are considered to have been adequately evaluated.

1.5 TITLEHOLDER DETAILS

Details of the titleholder's nominated liaison person are provided in Table 1-1:

Table 1-1 Titleholder's nominated liaison person

Name	*Kevin Mundy*
Position	*Lead GEP Environmental Adviser*
Business address	*Level 4, 1101 Hay Street, West Perth, WA 6005*
Telephone number	*+61 8 6213 6000*
E-mail address	*kevin.mundy@inpex.com.au*

2 DESCRIPTION OF ACTIVITY

2.1 OVERVIEW OF ACTIVITIES

Activities to be managed under the Mechanical Completion EP are:

- post-lay flooding, cleaning and gauging of the gas export pipeline; and
- post-lay hydrotesting of the gas export pipeline.

Flooding, cleaning and gauging of the gas export pipeline is achieved by inserting a series of pigs into the pipeline which travel freely, pushing air in front of it and out of the pipeline. Pigs are received at the offshore end of the pipeline, in a pig receiver which is attached to the PLET.

A hydrotest is performed by pumping filtered inhibited seawater (FIS) into the infrastructure until a pre-set pressure is achieved. This ensures that the pipeline welds and mechanical connections have met design specifications. The internal pressure will be held for approximately 14 days to ensure the integrity of the asset. Once the test is accepted, the pipeline will be depressurised. During depressurisation, FIS is discharged at the PLET location.

During the internal pressure holding period, should a drop in pressure indicate the potential for a leak, each mechanical subsea connection (flanges on the midline dummy spool and driverless connector on PLET, as well as Hot Tap Tees) will be inspected and video surveyed by a remotely operated vehicle (ROV) deployed from a support vessel. Dye used in the FIS will enable the ROV to visually monitor for leaks in and around the midline dummy spool and driverless connector on the PLET.

FIS is sea water treated with oxygen scavenger (sodium bisulfite) and biocide (glutaraldehyde) to inhibit corrosion of infrastructure during the preservation period prior to precommissioning and operations. It also contains a dye component (fluorescein) to aid leak detection during hydrotest activities. Biocides are intended to protect against microbiologically induced corrosion, whilst oxygen scavengers are chemicals that react with oxygen to reduce or remove dissolved oxygen from the preservation fluid completely.

2.2 POST-LAY FLOODING, CLEANING AND GAUGING THE GAS EXPORT PIPELINE

Flooding, cleaning and gauging is undertaken to:

- clean the pipeline of any residual construction debris
- gauge the internal bore to confirm that the gas export pipeline is free of dents
- flood the pipeline to remove air, in preparation for post-lay hydrotesting of the gas export pipeline.

The gas export pipeline will be filled with FIS whilst being simultaneously cleaned and gauged by pigging of the pipeline. During post-lay flooding, cleaning and gauging activities, FIS is discharged at the PLET location.

Pigging is undertaken by inserting several sealing devices (or “pigs”) into the pipeline that, when pushed by water, travel freely, pushing the air in front of the pigs out of the pipeline. A pig “train” will consist of six pigs with a batch of approximately 4000 m^3 of FIS pumped in front of the first pig to act as a wetting / flushing agent. Between each pig a batch of FIS, approximately 800 m^3 in volume, will be pumped into the pipeline to separate the pigs (approximately 4000 m^3 in total).

A contingency volume of FIS after the last pig may be pumped to account for instrumentation inaccuracy. Although this is not a planned activity, initial estimates indicate that the contingency discharge could be in the order of 5% of the pipeline, or 35 000 m^3. This contingency would result in FIS being discharged at ambient pressure and at the same velocity as other post-lay FCG discharges.

The estimated total volume of FIS to be discharged to the environment during planned post-lay flooding, cleaning and gauging activities will be approximately 8000 m^3.

Flooding of the GEP is expected to occur over a period of approximately 20-30 days and during this time, 710 000 m^3 of FIS will be pumped into the pipeline to completely fill it. The FIS will remain in the GEP for the duration of the post-lay hydrotesting and preservation phase. It will be removed from the pipeline during precommissioning of the GEP, which is not part of the scope of the Mechanical Completion EP. Precommissioning is detailed in the NOPSEMA-accepted *Gas Export Pipeline Precommissioning Environment Plan* (C050-AH-PLN-10001).

2.3 HYDROTESTING THE GAS EXPORT PIPELINE

A post-lay hydrotest will be completed on the gas export pipeline following flooding, cleaning and gauging. During the hydrotest the internal pressure of the GEP will be increased by pumping FIS from the onshore end, to test the welds and mechanical connections installed offshore.

The gas export pipeline, including the midline dummy spool (Figure 1-2), shall be subject to a post-lay hydrotest between the pressure cap on the PLET and the post-lay hydrotesting flange onshore. The midline dummy spool provides INPEX with future opportunities to tie in a future midline compression platform to the gas export pipeline, when the Ichthys Field reservoir pressure starts to drop and a gas export pipeline pressure booster station is required to boost pipeline production flow rates towards the end of field life.

FIS sourced from the onshore flooding, cleaning, gauging and hydrotesting spread will be used to pressurise the gas export pipeline with approximately 11 000 m^3 of FIS, pumped into the pipeline. The internal pressure will be held for approximately 14 days to ensure the integrity of the asset. During this period, should a drop in pressure indicate the potential for a leak, each mechanical subsea connection (flanges on the midline dummy spool and driverless connector on PLET, as well as Hot Tap Tees) will be inspected and video surveyed by a remotely operated vehicle (ROV). Dye used in the FIS will enable the ROV to visually monitor for leaks in and around the midline dummy spool and driverless connector on the PLET.

Once the test is accepted, the pipeline will be depressurised. During depressurisation, FIS is discharged at the PLET location.

2.3.1 SUMMARY OF DISCHARGES

A summary of the planned discharges associated with the described activities is included in Table 2-1.

Table 2-1: Summary of planned discharges

Activity	Volume of discharge	Purpose	Composition
Post-lay FCG	approximately 4000 m^3	Initial batch pumped in front of the pig train to act as a wetting / flushing agent.	FIS
	5 × 800 m^3 batch (approximately 4000 m^3)	Flooding water between pigs.	FIS
	approximately 35 000 m^3	Contingency volume of FIS after the last pig to account for instrument inaccuracy.	FIS
Post-lay hydrotest	approximately 11 000 m^3	Depressurisation of the GEP.	FIS

3 DESCRIPTION OF THE ENVIRONMENT

An assessment of activities falling within the scope of the Mechanical Completion EP was undertaken to identify the environment that may be affected by this activity. The assessment determined that two locations along the pipeline have the potential to be impacted. These are:

- the PLET—planned discharges
- the midline dummy spool (KP 381)—unplanned discharges.

The extent of potential impact is considered to be within a radius of 750 m of these locations.

3.1 PHYSICAL ENVIRONMENT

Based upon the comprehensive description of the receiving environment contained within the NOPSEMA-accepted Offshore GEP Environment Plan the key environmental and socio-economic sensitivities within the environment that may be affected by this activity have been summarised in Table 3-1.

The EPBC Act Protected Matters Search Tool was used to identify “matter(s) of national environmental significance with the potential to be affected by both planned and unplanned discharges. Protected species identified from these have been summarised in Table 3-1.

Table 3-1: Summary of environmental and socio-economic sensitivities within the EMBA by this activity

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
Key ecological features (KEFs)	There are no KEF within 750m of the PLET location.	Key ecological features (KEF) are those features of the marine environment that are not specifically protected under the EPBC Act, but which are considered to have important or unique characteristics that are potentially deserving of conservation, monitoring or management An EPBC Protected Matters Database Search was undertaken on 05/03/2013, using a 10km buffer around the GEP route and four KEFs were identified in the search as being overlapped by, or in close proximity to, the GEP route. However, only the Cabronate bank and terrace system of the Sahul Shelf KEF was identified as being partially within 750m of the midline dummy spool. The GEP route traverses the Sahul Banks which is the most extensive region of banks and shoals in the Australian EEZ, forming a nearly continuous chain of complex submerged algal banks on the middle and outer shelf. The carbonate bank and terraces are known to be foraging areas for loggerhead, olive ridley and flatback turtles, as well as humpback whales. Green and freshwater sawfish are also likely to occur in the area. The banks are thought to support a high diversity of organisms, including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians and other sessile filter-feedersbanks are regionally important due to their role in enhancing biodiversity and local productivity relative to their surrounds.

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
Benthic Habitats	A single calcarenite outcrop 3 m high, approximately 600 m long and 200 m wide was identified approximately 36 km away from the discharge location, and was the only notable hard substrate area recorded in the offshore end section of the GEP during the geophysical surveys. Occasional sea pens (family Pteroeididae) and sea whips (family Gorgoniidae) were recorded on clay–silt substrate at survey sites 36 km and 81 km away from the discharge location.	Eight drop-camera survey sites were included in this section (between KP 352 and KP 379) in order to investigate the various areas of hard substrate. Rocky outcrops supported epibenthic fauna at relatively high abundances, particularly feather stars. Sea pens, sea fans, sea whips, soft corals of the genus *Dendronephthya*, bryozoans, hydroids, and sponges were also recorded.
Habitats of mainland coastline, islands, reefs and shoals in the potential exposure zone	None identified	None identified
Plankton	The distribution and abundance of zooplankton in the region is influenced by sporadic climatic and oceanographic events, with large interannual changes in the structure of plankton assemblages **[Wilson, et.al 2003].** Zooplankton such as copepods are the dominant primary consumers in the pelagic zone of the Timor Province **[DEWHA, 2008]**, along with secondary consumers which are considered to be found in the greatest abundance in surface waters. Although large numbers of zooplankton are not expected to be exposed to this activity given the depth of the discharge, they are still expected to be present in the EMBA.	
Benthic primary producers	None identified	None identified

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
Protected species		
Marine mammals	Blue whale – *Balaenoptera musculus* – (Endangered and Migratory) Humpback whale – *Megaptera novaeangliae* – (Vulnerable and Migratory) Antarctic minke whale – *Balaenoptera bonaerensis* – (Migratory) Bryde's whale – *Balaenoptera edeni* – (Migratory) Killer whale – *Orcinus orca* – (Migratory) Sperm whale – *Physeter macrocephalus* – (Migratory) There are no biologically important areas associated with these species within the EMBA.	Blue whale – *Balaenoptera musculus* – (Endangered and Migratory) Humpback whale – *Megaptera novaeangliae* – (Vulnerable and Migratory) Bryde's whale – *Balaenoptera edeni* – (Migratory) Killer whale – *Orcinus orca* – (Migratory) Spotted bottlenose dolphin – *Tursiops aduncus* – (Migratory) There are no biologically important areas associated with these species within the EMBA.
Marine reptiles	Loggerhead turtle – *Caretta caretta* – (Endangered and Migratory) Green turtle – *Chelonia mydas* – (Vulnerable and Migratory) Leatherback turtle – *Dermochelys coriacea* – (Endangered and Migratory) Hawksbill turtle – *Eremochelys imbricata* – (Vulnerable and Migratory) Olive ridley turtle – *Lepidochelys olivacea* – (Endangered and Migratory) Flatback turtle – *Natator depressus* – (Vulnerable and Migratory) There are no biologically important areas associated with these species within the EMBA.	Loggerhead turtle – *Caretta caretta* – (Endangered and Migratory) Green turtle – *Chelonia mydas* – (Vulnerable and Migratory) Leatherback turtle – *Dermochelys coriacea* – (Endangered and Migratory) Hawksbill turtle – *Eremochelys imbricata* – (Vulnerable and Migratory) Olive ridley turtle – *Lepidochelys olivacea* – (Endangered and Migratory) Flatback turtle – *Natator depressus* – (Vulnerable and Migratory) The EMBA overlaps a known foraging area for both olive ridley and flatback turtles.

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
Bony fishes and sharks	Great white shark – *Carcharodon carcharias* – (Vulnerable) Whale shark – *Rhincodon typus* – (Vulnerable and Migratory) Shortfin mako – *Isurus oxyrinchus* – (Migratory) Longfin mako – *Isurus paucus* – (Migratory) Giant manta ray – *Manta birostris* – (Migratory) There are no biologically important areas associated with these species within the EMBA.	Great white shark – *Carcharodon carcharias* – (Vulnerable) Whale shark – *Rhincodon typus* – (Vulnerable and Migratory) Shortfin mako – *Isurus oxyrinchus* – (Migratory) Longfin mako – *Isurus paucus* – (Migratory) Giant manta ray – *Manta birostris* – (Migratory) There are no biologically important areas associated with these species within the EMBA.
Birds	Australian lesser noddy – *Anous tenuirostris melanops* – (Vulnerable) Streaked shearwater – *Calonectris leucomelas*[1] – (Migratory) There are no biologically important areas associated with these species within the EMBA.	Streaked shearwater – *Calonectris leucomelas* – (Migratory) There are no biologically important areas associated with this species within the EMBA.
Commonwealth marine area	Both areas are located within a Commonwealth marine area (CMA). This is defined as "any part of the sea, including the waters, seabed and airspace, within Australia's Exclusive Economic Zone and/or over the continental shelf of Australia, that is not state or Northern Territory waters. The CMA stretches 3 to 200 n miles from the coast".	
Commonwealth marine reserves	None identified	None identified
State marine parks	None identified	None identified
Nature and conservation reserves	None identified	None identified
Wetlands of conservational significance	None identified	None identified
Cultural environment	None identified	None identified

[1] The correct name for this species is *Calonectris leucomelas*: see *Systematics and taxonomy of Australian birds* by L. Christidis and W.E. Boles (2008, CSIRO Publishing, Melbourne), whose checklist is available separately online at <http://www.iboc.org.au/info/Christidis%20&%20Boles%202008%20Checklist.pdf> (last accessed 9 December 2014). It was formerly known as *Puffinus leucomelas*, which name appears in the China–Australia Migratory Bird Agreement of 1988.

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
Existing use of the marine environment		
Darwin Coastal Region	None identified	None identified
Petroleum exploration and production	Ichthys Field	None identified
Mining	None identified	None identified
Defence	None identified	None identified
Shipping	Data from 2010 show a single key shipping route approximately 250 km to the north-west of WA-50-L. Within the area covered by Petroleum Production Licence WA-50-L (the Ichthys Field), vessel activity is likely to be dominated by petroleum exploration vessels and petroleum mobile offshore drilling units which remain in the area for extended periods as is indicated by the low density of in-transit reports between the Ichthys Field and other locations.	
Recreational fishing	None identified	None identified
Aquaculture	None identified	None identified
Commercial fishing	Commercial fisheries have the potential to operate within both discharge areas as fishing permits overlap the discharge zone. Five Commonwealth fisheries overlap the GEP route. However, the Northern Prawn Fishery and the North West Slope Trawl Fishery were the only fisheries identified as using areas traversed by the GEP route as outlined below: • Northern Prawn Fishery - occurs over the eastern half of the route beyond 750m from the PLET and Midline spool. Fishing effort takes place well to the east midline dummy spool. • North West Slope Trawl Fishery - The North West Slope Trawl Fishery is a deepwater (>200 m) fishery which coincides with a small section of the GEP (from approximately Browse Island to the Ichthys field). There are only seven permits for the fishery which is open throughout the year, with fishing effort for the year 2004 – 2008 showing no activity along the GEP route.	
Traditional fishing	The PLET lies within an area subject to a memorandum of understanding (MoU) between Indonesia and Australia signed in November 1974. This means that Indonesian and Timorese fishermen are legally permitted to harvest certain marine products within the MoU boundary, representing an area of approximately 50 000 km^2.	None identified

Sensitive Receptors	Within 750 m of the PLET	Within 750 m of the midline dummy spool (KP 381)
	Fishing effort is principally concentrated in shallow-water areas around islands, reefs and shoals, a large component being based on reef-top collection and shallow diving in addition to line-fishing.	

4 STAKEHOLDER CONSULTATION

4.1 CONSULTATION ALREADY UNDERTAKEN

INPEX has been a member of the Australian business community since 1986 and during this time has engaged with stakeholders on a regular basis for a broad range of activities. As such, INPEX has utilised well developed stakeholder engagement processes as outlined in Figure 4-1.

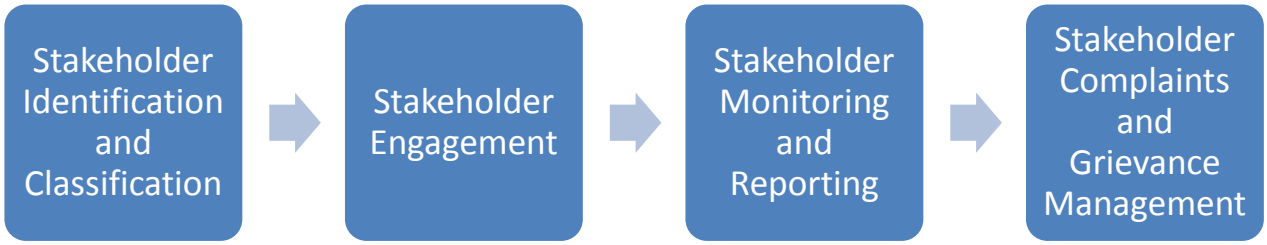

Figure 4-1 Stakeholder management process

The stakeholder engagement process involved the following stages:

Stakeholder identification and classification – This stage involved a workshop to identify relevant stakeholders and assess the levels of interest and influence that each stakeholder would specifically or potentially have in relation to the mechanical completion activities.

Stakeholder engagement – To facilitate the engagement process, all relevant stakeholders were provided with fact sheets that gave a general overview of offshore construction activities and provided key information about the mechanical completion activities including location and schedule (timing and duration).

Stakeholder monitoring and reporting – Stakeholder engagement has been, and will continue to be, monitored during the course of the mechanical completion activities.

Stakeholder complaints and grievance management – Any concerns or complaints received in response to the mechanical completion activities have been treated as issues and dealt with in the course of developing the Mechanical Completion Environment Plan. INPEX has documented any change to the proposed management of an activity, where management or resolution of an issue has required such change.

INPEX used this process to engage with relevant stakeholders that have an interest in, or the potential to be impacted by, the Project

In addition to provision of the factsheets, INPEX has also engaged with stakeholders through face-to-face meetings, emails and phone communications, to provide additional information on the Project and the consultation process.

Stakeholder groups engaged include:

- Commonwealth, state, territory and local government departments and agencies' ministers of relevant portfolios;

- National Native Title Tribunal, relevant Aboriginal and Torres Strait Islander land councils and prescribed bodies corporate, traditional owners and relevant land councils in areas potentially impacted by the mechanical completion activities;
- the commercial fishing industry and its associations, and individual operators (permit or licence holders/lessees) in fisheries potentially impacted by the mechanical completion activities;
- recreational fishing associations; and
- environmental, heritage and marine research groups.

A summary of relevant stakeholders, and if they identified any concerns of merit during the consultation process is provided in Table 4 1.

Table 4-1 Stakeholder consultation summary

Stakeholder	**Concerns raised**
Commonwealth, state, territory and local government departments and agencies' ministers of relevant portfolios	
Chief Minister (Northern Territory)	*No*
Department of Industry (Commonwealth)	*No*
Minister for Industry (Commonwealth)	*No*
National Offshore Petroleum Titles Administrator (Commonwealth)	*No*
Department of the Environment (Commonwealth)	*No*
Minister for Environment (Commonwealth)	*No*
Department of Fisheries (Western Australia)	*No*
Minister for Fisheries (Western Australia)	*Yes*
Department of Mines and Petroleum (Western Australia)	*No*
Minister for Mines and Petroleum (Western Australia)	*No*
Department of Agriculture, Fisheries and Forestry (Commonwealth)	*No*
Minister for Resources and Energy; Tourism (Commonwealth)	*No*
Minister for Primary Industry and Fisheries; Mines and Energy (Northern Territory)	*No*
National Native Title Tribunal, relevant Aboriginal and Torres Strait Islander land councils and prescribed bodies corporate, traditional owners and relevant land councils in areas potentially impacted by the mechanical completion activities	
National Native Title Tribunal	*No*
Indigenous Land Corporation	*No*
Commercial fishing industry and its associations	
Australian Fisheries Management Authority	*No*
The Pearl Producers Association and the Paspaley Pearling Company	*No*
Western Australian Fishing Industry Council	*No*
All individual permit holders whose fishing permits overlap the environment that may be affected.	*No*

Recreational fishing associations	
Recfishwest	*No*
Environmental, heritage and marine research groups	
Centre for Whale Research (WA) Inc.	*No*

4.2 SUMMARY OF CONCERNS

During stakeholder consultation for this activity, the Department of Fisheries (Western Australia) raised a concern regarding the potential impacts of FIS on marine species and requested that water quality be tested before its release. In response, INPEX described that:

- the discharge will be assessed under the NOPSEMA EP; and
- a chemical selection process will be implemented so that impacts associated with discharges are kept to as low as reasonably practicable (ALARP).

INPEX met with Department of Fisheries (Western Australia) following this response to describe the project and monitoring proposed to be undertaken during the activity. The outcomes from this engagement confirmed that no additional monitoring other than that described in the environment plan were required by Department of Fisheries (Western Australia).

No additional concerns regarding the activities have been raised during stakeholder consultation.

4.3 ONGOING CONSULTATION

INPEX will maintain communications and continue consultation with relevant stakeholders throughout the duration of the activity. Additional consultation will be undertaken for three main reasons:

- to provide a general update on all activities associated with the Ichthys Project;
- where there is a significant change in the project scope (see Section 6.3.2); or
- where an additional request for information / feedback is requested from stakeholders that have been previously engaged.

5 ENVIRONMENTAL HAZARDS AND CONTROLS

INPEX has a risk management process to guide activities and ensure they are undertaken such that risks and impacts are managed to ALARP. A risk assessment has been undertaken for all activities within the scope of the Mechanical Completion Environment Plan in accordance with INPEX procedures as well as the procedures outlined in the Australian and New Zealand Standards AS/NZS ISO 31000:2009, Risk management – Principles and guidelines. A summary of the risk assessment process and its outcomes in relation to mechanical completion activities is detailed below.

5.1 RISK ASSESSMENT PROCESS DESCRIPTION

5.1.1 Step 1 – Risk and Impact Identification

- Identify events: Identification of planned and credible unplanned events which have the potential to impact on the environment.
- Identify impacts: Identification of adverse or beneficial changes to environmental or socio-economic receptors resulting from events (planned and credible, unplanned interactions).
- Identify primary controls.

5.1.2 Step 2 – Risk and impact analysis

- Determine consequence severity rating: With primary controls in place, a determination is made of the maximum credible consequence severity rating assuming credible failure of controls (informed by the history of occurrence within an individual company or the industry as a whole).
- Determine likelihood rating: Considering primary controls are in place, the likelihood rating that best describes the chance of the selected consequence severity level actually occurring is determined. A likelihood rating is not assigned to a known impact.
- Determine risk rating: Risk rating is selected from the INPEX Risk Matrix, based on the consequence and likelihood ratings.

5.1.3 Step 3 – Risk evaluation

ALARP evaluation: Impacts that have a low risk rating or known impacts with a consequence severity rating of ‘Insignificant’ are considered ‘broadly tolerable’ and managed through the use of primary controls. These are subject to a high level ALARP evaluation.

For potential impacts that are of a moderate, high or critical risk rating, or known impacts with a consequence severity rating between A and D, a detailed evaluation is performed of secondary controls which could reduce the potential impacts and known impacts to ALARP.

Step 2 of the risk assessment process is then repeated in consideration of secondary controls to determine whether a risk has been reduced to ‘broadly tolerable’ or ‘tolerable’ if ALARP categories and a known impact has been reduced to D, E or F consequence severity rating.

Acceptability evaluation: Following the ALARP evaluation, further evaluation is performed with consideration to the outcomes of stakeholder consultation; the INPEX environment policy; potential changes in legislation or in technology; and social, cultural or political sentiment. This evaluation may result in the commitment to additional secondary controls which are above those considered reasonably practicable.

5.2 SUMMARY OF EVENTS

The credible events associated with the mechanical completion of the Gas Export Pipeline were limited to discharges of FIS to the marine environment.

To determine the concentrations at which the discharge was predicted to have no effects, ecotoxicity information was sourced for each active constituent within the FIS. As biocide was identified as having the highest toxicity, it was used to determine the worst case extent associated with the discharge. This information identified a no effects concentration of 0.32 ppm for the discharge. Given the expected final concentration of the biocide, a safe dilution factor of 313 is required to reach the no effects concentration (0.32 ppm).

Hydrodynamic modelling was undertaken by Asia Pacific Applied Science Associated to predict near-field and far-field dilutions, to inform the extent and duration of safe dilutions.

The models indicate that the plumes for both activities move mainly with the tidal axis in east south east and west north west directions and will result in a localised reduction in water quality and toxicity to marine organisms within the discharge plume. The reason for this is the predominance of persistent tidal currents in the area (APASA, 2013).

Modelling results presented below are:

- Post-lay flooding, cleaning and gauging modelling;
- Post-lay FCG over pump/ contingency discharge; and
- Post-lay hydrotest modelling.

5.2.1 Modelling summary – post-lay flooding cleaning and gauging

During any season in the far field, minimum dilution factors of 400 and 800 were experienced within 300 m and 750 m of the discharge location respectively. For all seasons 95% dilution occurs in the far field within 50 m of the discharge location.

5.2.2 Modelling summary – post lay FCG over pump/ contingency discharge

The precommissioning discharge model has been used as a conservative proxy for the post-lay FCG over pump/ contingency discharge and is summarised below. Near-field modelling provides an indication of the initial dilution, with 95% dilution experienced within 53 m of the discharge. This is comparable with the other discharges in this plan, 95% dilution within 50 m.

The precommissioning model indicates that a discharge volume, 20 times as large as the over pump / contingency discharge, is expected to reach a safe dilution factor of 313 within 830 m of the discharge location in 20 hours upon ceasing the discharge. The total duration of exposure associated with the over-pump contingency discharge is therefore less than the 96-hour exposure NOEC (discharge – 35 hours; and dissipation – 25 hours) and the potential impact extent associated with this contingent discharge expected to be within 830 m of the discharge location. Given that the post-lay over pump / contingency discharge is a significantly smaller discharge volume than that used in the precommissioning modelling, the extent of impact associated with this discharge is expected to less than 830 m and comparable to the other discharges within this plan.

5.2.3 Modelling summary – post-lay hydrotest

Modelling results indicate that at slower currents (0.04 m•s^{-1}) a minimum dilution factor of 27 is reached at the end of the near field as far as 9 m away from the discharge location.

During any season in the far field, minimum dilution factors of 400 and 800 were experienced within 300 m and 750 m of the discharge location respectively. As such, a conservative estimate for the extent of the potential impact associated with a discharge from post-lay hydrotest discharge is approximately 750 m from the discharge location.

5.3 IMPACT AND RISK ASSESSMENT SUMMARY

5.3.1 Planned FIS discharges

Based on the modelling and ecotoxicity information, the extent of impacts are limited to within 750 m of the discharge point. Potential impacts and risks in this area were identified to be:

- a temporary decline in water quality due to the discharge of oxygen depleted water and associated impacts to marine organisms;
- toxicity to marine organisms due to the chemical biocide, oxygen scavenger or fluorescein dye within the water column; and
- a potential decline in fish stocks resulting in an impact on commercial fishing activities.

A conservative approach has been used in the assessment of potential impacts associated with this activity. The conservatism arises from assessing the impact against the initial dosing concentrations of chemicals, and not final concentration which is likely to have up to 10% biodegradation prior to discharge.

There are sparse benthic (infaunal) communities within the plume extent (750 m from the discharge location) with the seabed consisting of soft sediments. However, there are no protected or sensitive benthic habitats that have been identified with the potential to be exposed to these discharges. Benthic epifauna is expected to be sparse, scattered and representative of a variety of typically common and widespread taxa.

There are no known breeding grounds or sensitive habitats critical to EPBC-listed species within the plume extent (750 m from the discharge location). However, turtles, whales and whale sharks have been previously recorded passing through this area. Given the trapping depth of the plume (200 m) and as these species are not known to regularly dive to these depths, they are not expected to be exposed to this discharge in a manner that would result in an impact.

Mobile pelagic organisms (such as fish and squid) that depend on oxygen dissolved in sea water would be expected to avoid areas of low oxygen concentrations. Given that oxygen levels return to near-normal levels within 50 m, that the trapping depth of the plume is 200 m, and that the exposure area lies in a deepwater environment surrounded by large expanses of similar habitat, it is considered unlikely that pelagic animals will be threatened by anoxia.

As zooplankton can be expected to be present within the plume extent (750 m from the discharge location) it is expected that this discharge will result in a decrease in abundance of a very small portion of the local population. However, given that the presence of zooplankton is expected to be relatively

homogeneous in adjacent waters, any impacts are expected to diminish quickly. Impacts to zooplankton are therefore expected to be localised and temporary in nature.

Although commercial fisheries have the potential to operate within the plume extent (750 m from the discharge location) consultation did not identify any specific areas targeted by commercial fisheries in this area. In addition to this, given the nature and scale of the activity (a non-continuous discharge over a number of days) and limited exposure expected to targeted commercial species, impacts to commercial fisheries are considered to be insignificant.

From the assessment provided above, there appears to be the potential for epibenthic fauna, benthic infauna, benthic fish species and zooplankton to be exposed to the discharges. However, given the sparse and scattered nature of the animal species occurring in the exposure area, it is expected that the discharges have the potential to result in a minor and temporary impact to the environment

5.3.1.1 Consequence

In accordance with INPEX's risk matrix, impacts to benthic and pelagic organisms are considered to result in a local scale event with a short term impact on the environment. Further, impacts to protected species are expected to be limited to minor and temporary impacts to a small fraction of their population. As a result, the consequence severity level is considered to be Minor (E).

5.3.1.2 Likelihood

As the activities are planned discharges with a known impact, likelihood has not been assigned.

5.3.1.3 Control measures

Controls aimed at minimising the environmental impacts from discharges are based on compliance with procedures governing:

- the selection and use of FIS ; and
- the methods used during postlay FCG and postlay hydrotesting activities

A summary of the control measures to be implemented are:

- Mechanical completion activities will be undertaken such that pigging speeds are limited to 1m/s; the hydrotest pressure shall not exceed 233.8 bar.a and the hydrotest depressurisation rate will be limited to 15 kPa/min, and thus the water discharge rate will be limited accordingly.
- All chemicals proposed to treat FIS have been selected according to a procedure that includes the concept of ALARP for environmental performance. To select the preferred chemical treatment option, a variety of technical and health, safety and environmental criteria were used. The key selection criteria used to assess and select chemicals were as follows::
    - They possess a hazard quotient category of Silver or better in accordance with the UK Offshore Chemical Notification Scheme (OCNS).
    - They contain chemical components included on the Cefas list of notified chemicals in accordance with the OSPAR Commission's recommendation on a Harmonised Offshore Chemical Notification Format (HOCNF).

  - Their use will allow the residual oxygen level in the treated water to be reduced to five parts per billion (ppb) or lower to avoid oxygen-induced corrosion.
  - The chosen biocide will act in such a way that under the pipeline exposure conditions (e.g. ambient temperature variation) biological activity is reduced to an acceptable level (i.e. no corrosion due to bacterial activity) throughout the residence period.

- In the event that an alternative chemical is proposed, the chemical shall be subject to the same level of risk assessment as documented in the Mechanical Completion EP. Records of the assessment will be maintained and documented within the management of change process to determine if the change is significant in accordance with Regulation 17 of the OPGGS (Environment) Regulations.
- Concentrations of the FIS products (upon injection to the pipeline) will be limited to the following:
  - HYCOR SB - 420 ppm
  - HYCOR OX 67 - 89 ppm
  - HYCOR FLS - 40 ppm.

5.3.1.4 Demonstration of ALARP

Additional control measures were investigated to evaluate their feasibility and practicability to further reduce the potential environmental impact associated with FIS discharges. Those controls deemed infeasible or not practicable to implement have been described below to demonstrate that the potential impact has been reduced to ALARP.

5.3.1.5 Demonstration of acceptability

The potential impacts and risks associated with the planned discharges are considered to be acceptable as:

- no significant impacts to water quality and marine organisms are expected;
- further opportunities to reduce the impacts have been investigated and the adopted controls reduce the impacts and risks to As Low As Reasonably Practicable;
- the proposed controls are consistent with regulatory requirements and INPEXs Environment Policy; and
- no objections were identified by any stakeholder during consultation efforts.

5.3.2 Unplanned FIS discharges

During the pressurisation of the GEP for the post-lay hydrotest, there is the potential for an unplanned discharge of FIS along the pipeline. The only credible scenario is an unplanned release of FIS at the midline dummy spool.

A leak at the midline dummy spool would be small in nature, with an estimated volume of around 1000 m^3, potentially lost over a period of approximately 14 days and therefore expected to be diluted and dispersed rapidly. Asafe dilution factor for FIS would be reached approximately 300 m away from the midline spool.

As described in Section 3, there are no protected or sensitive benthic habitats identified as having the

potential to be exposed within this area. Although the area overlies the Key Ecological Feature - carbonate bank and terrace system of the Sahul Shelf—a “key ecological feature” under the Marine bioregional plan for the North-west Marine Region, this feature is not expected to be impacted by this discharge.

Benthic epifaunal life is found in this area at relatively high abundances around rocky outcrops, with sea pens, sea fans, sea whips, soft corals of the genus *Dendronephthya*, bryozoans, hydroids, and sponges having been recorded in this area. Given the location of the leak, these animal forms have the potential to be exposed.

The midline dummy spool is located on the western edge of the Joseph Bonaparte Gulf, which is a known foraging habitat for two species of marine turtle. Consequently, solitary foraging marine turtles are expected to transit periodically through this area. No other breeding grounds or sensitive habitats critical to EPBC listed species have been identified in the environment that may be affected by a leak at this location.

Although the leak may occur over a period of approximately 14 days, the pressure and size of release indicate the leak would be subject to rapid dilution and consequently the extent of exposure would be small.

It is not expected that any marine animals would be exposed for a prolonged duration given the small nature of the leak. It is therefore expected that a leak from the midline dummy spool would only result in a local-scale temporary impact on the environment with inconsequential ecological significance to protected species.

5.3.2.1 Consequence

In accordance with the INPEX Risk Matrix, the impacts to benthic and pelagic organisms are considered to have a severity level of Insignificant (F) given that there will be a local scale event with only a temporary impact on the environment.

5.3.2.2 Likelihood

In accordance with the INPEX Risk Matrix, the likelihood of the event occurring is considered Highly Unlikely (5) given the controls that are in place.

5.3.2.3 Control measures

Controls aimed at minimising the environmental impacts from unplanned discharges at the midline dummy spool are:

- Flange assemblies are hydrotested prior to installation to minimise the potential for failure during operations.
- If an FIS leak is detected at the midline spool, the pipeline will be depressurised to stop the leak of FIS. Given that significant intervention work would be required to repair the leak, the intervention and management of this activity would be managed under a separate EP.
- Pressure will be monitored during the hold period associated with the hydrotest of the gas export pipeline to identify any drops in pressure that indicate potential leaks from the midline dummy

spool.

- Where pressure drops indicate the potential for a leak, the midline dummy spool will be visually inspected to confirm and detect the location of the leak.

5.3.3 Demonstration of ALARP

No additional controls are considered practicable to further reduce the potential impact and risk associated with this activity . Consequently, the potential impacts and risks associated with this activity are considered to be as low as reasonably practicable

5.3.4 Demonstration of acceptability

The potential impact associated with unplanned discharge of FIS during hold period of hydrotesting of the GEP is considered to be acceptable on the following bases:

- No significant impacts are expected;
- Further opportunities to reduce the impacts have been investigated and the adopted controls will reduce the impacts and risks to As Low As Reasonably Practicable;
- The proposed controls are consistent with regulatory requirements.

6 MONITORING ENVIRONMENTAL PERFORMANCE

INPEX maintains the Health, Safety, Environment Management System based on the Plan, Do, Check, Act model as described within AS/NZS 4801:2001, Occupational health and safety management systems—*Specification with guidance for use, OHSAS 18001, Occupational Health And Safety Management Systems* Requirements and AS/NZS ISO 14001:2004, Environmental management systems—Requirements with guidance for use. A summary of the Check / Act components is provided below to demonstrate how environmental performance is monitored.

6.1 CHECK

6.1.1 Inspections and Audits

INPEX will undertake readiness reviews, weekly environment inspections and internal audits throughout the duration of the activities covered within the Environment Plan. Specifically:

- INPEX will undertake a readiness review of the contractor to ensure that the environmental performance outcomes and environmental performance standards as documented in this plan can be achieved; and
- the Contractor and/or INPEX Health, Safety, Environment advisers will conduct weekly inspections of facilities associated with mechanical completion activities.

The above programs will audit the Mechanical completion EP, specifically targeting the collection and/or collation of quantitative and qualitative information to demonstrate compliance with this EP and evaluate environmental performance of the program.

6.1.2 Premobilisation Checks (Readiness Review)

INPEX and Contractor will implement a premobilisation check or readiness review prior to commencing activities associated with these Mechanical Completion activities. Contractor will make a presentation to INPEX GEP management on the status and completion of the following:

- HSE deliverables
- HSE HAZID and risk assessments specific to mobilisation
- HSE organisational capability
- HSE training program
- HSE system and program development.

Once the readiness review has been completed, Contractor will confirm to INPEX its intention to commence activities and that Contractor's systems and resources are both satisfactory and competent, to ensure HSE requirements will be met. This will be done by INPEX's approval of Contractor's Mobilisation Plan - Mechanical Completion.

6.1.3 Weekly HSE Inspection

The purpose of inspections is to identify hazards that may lead to an environmental event and to perform an assessment of compliance with performance measures, as identified in detail in this EP. Contractor and/or INPEX HSE advisers will conduct weekly inspections of the flooding, cleaning, gauging and hydrotesting spread (onshore) associated with mechanical completion activities.

Inspection summaries will be provided back to management through the routine operational meetings, and to personnel through toolbox or pre-start meetings or HSE noticeboards, and will be included in HSE performance reporting to project management.

6.1.4 Operational Monitoring of Planned Discharges

Operational monitoring for mechanical completion activities will record the following:

- the volumes of treatment chemicals used in seawater treatment and subsequently discharged (input);
- the volume of FIS discharged (input);
- the discharge rates and velocities;
- the discharge durations.

6.2 PREVENTIVE AND CORRECTIVE ACTIONS

Preventive and corrective actions may be identified as a result of environmental events, premobilisation checks, HSE inspections, operational monitoring or management reviews.

Preventive and corrective actions arising from premobilisation checks, HSE inspections, operational monitoring or management reviews will be identified, documented and their completion verified via Contractor's central action-tracking register, or the INPEX Unifier Action Tracking system, as relevant to the party responsible for ensuring implementation of the action.

Contractor will report on completion of actions through internal routine reporting processes.

6.3 MANAGEMENT REVIEW AND ASSESSMENT (ACT)

6.3.1 Review of Environmental Performance

Once this information is collected, and in accordance with Regulation 14 (3)(b) of the OPGGS (Environment) Regulations, an assessment will be undertaken to confirm that the control measures detailed in the environment plan were effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level. This assessment will include:

- an evaluation against environmental performance standards associated with planned discharges;
- an evaluation against assumptions used in the modelling (that formed the basis of this risk and impact assessment) which are:
    - discharge volumes
    - key model parameters (limited to discharge velocities, rates, volumes, durations).

Where monitoring data collected is obviously different from assumed data provided in the plan, a management of change process will be triggered (Section 6.3) to evaluate the difference in potential impacts and risks associated with the discharge parameters. The results of this assessment will be included in the Environmental Performance Report.

Where actual impacts and risks are assessed as having a greater severity to that assessed in this plan, the activity will be recorded as a recordable incident and reported to NOPSEMA.

6.3.2 Management of Change

Any amendments to activities associated with the following will be subject to a risk-assessment process, to evaluate any likely environmental impacts and risks, to verify whether a revised version of this EP is required. The assessment will identify:

- changes to the HSE management practices or operational management of the activities
- changes to regulatory requirements, corporate requirements, industry codes and standards, including changes to the controls detailed in the management plans submitted for approval as required by EPBC Act approval 2008/4208
- the introduction of new, or significant modification of activities accepted under this EP
- a new significant environmental impact or risk is identified.

If the risk assessment process indicates a significant increase in the level of impact or environmental risk, then a revised EP will be submitted to NOPSEMA under Regulation 17 of the OPGGS (Environment) Regulations.

Given that any change in chemicals may result in engineering considerations or a change to the environmental impact, the Management of Change (MoC) process will be triggered. In accordance with the MoC process, INPEX will assess the potential change in impact or risk against the EP, to enable a decision to be made on the significance of any change. Given the nature and scale of the activity, should there be a change to any of the chemicals, an impact and risk assessment in the same format and structure as that provided in the EP will be undertaken, with the outputs captured in the MoC documentation. The continued applicability of the impact and risk assessment will be assured by enabling an easy comparison with that provided by the EP and the potential changes in impact or risk will be easily demonstrated.

7 OIL POLLUTION EMERGENCY PLAN

No vessel operations are included in the scope of this EP, and all the credible spill scenarios associated with vessel operations in the GEP Construction Corridor have been risk assessed and described in a NOPSEMA-accepted *Offshore Gas Export Pipeline Environment Plan* (F281-AH-PLN-10014) and NOPSEMA-accepted *Offshore GEP Oil Spill Contingency Plan* (F281-AH-PLN-10050).

As there are no credible spill scenarios associated with the offshore petroleum activity as described in this EP, an oil pollution emergency plan has not been developed.

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