Tasmanian
Gas Pipeline

ENVIRONMENT PLAN (EP) SUMMARY

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1. INTRODUCTION

1.1 Environment Plan (EP) Summary

This Environment Plan (EP) Summary has been prepared by OSD Asset Services Pty Ltd (OSDAS) under Sub-regulation 11(3) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS Regs).

This document provides a summary of the Tasmanian Gas Pipeline (TGP) Offshore Environment Plan (EP) (QR4-007PA-EP, Revision 9), which was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 16 October 2014.

The TGP Offshore EP has been prepared for the operational phase of the TGP. It identifies the environmental aspects of offshore TGP operations with the potential to have a significant effect on the physical, biological, social and cultural aspects of the environment. The Offshore EP focuses on the Bass Strait subsea section of the TGP from the low water mark at Ninety Mile Beach, about one kilometre (km) east of Seaspray, Victoria, to the low water mark at Five Mile Bluff on the coast of Tasmania, including a portion of the drilled crossings at the Victorian and Tasmanian landfalls.

1.2 TGP Management

The TGP is a natural gas transmission pipeline system that extends from Longford in Victoria, across Bass Strait to Bell Bay in north-east Tasmania. Additional onshore pipelines extend from Bell Bay to Port Latta in north-west Tasmania and to Bridgewater in the south.

In July 2011, Palisade Investment Partners Ltd (Palisade) acquired Tasmanian Gas Pipeline Pty Ltd and its asset, the TGP. Palisade has kept the asset ownership and licence title “Tasmanian Gas Pipeline Pty Ltd” (TGPPL).

OSDAS has a Management Agreement with TGPPL to act as the owner’s representative for the TGP and has the responsibility for the day-to-day management and operation of the TGP asset. This contract has a five year term from 15 March 2012 with the option for further extensions. One extension for 12 months has already been granted by TGPPL, with a contract expiry date of 30 June 2018.

A Field Services Agreement between Zinfra Group (Zinfra) and TGPPL is currently in place to perform maintenance activities on the TGP. Zinfra carry out certain onshore maintenance functions and emergency response on behalf of TGPPL. A new agreement was executed in February 2014 for a five year period, with an option to extend the contract for a further three years.

The new Field Services Agreement with Zinfra now incorporates the provision of Control Room Services, provided under a separate sub-agreement with Jemena, primarily to operate the Supervisory Control and Data Acquisition (SCADA) system for the pipeline and assist with the management of any emergency event arising on the TGP.

Offshore integrity and asset management is coordinated by OSDAS using specialist consultants and contractors to provide expert advice and engineering assistance when required. Agreements and contracts are in place with specialists for subsea related works.

Figure 1 below provides a summary of organisational relationships and roles between all TGP parties.

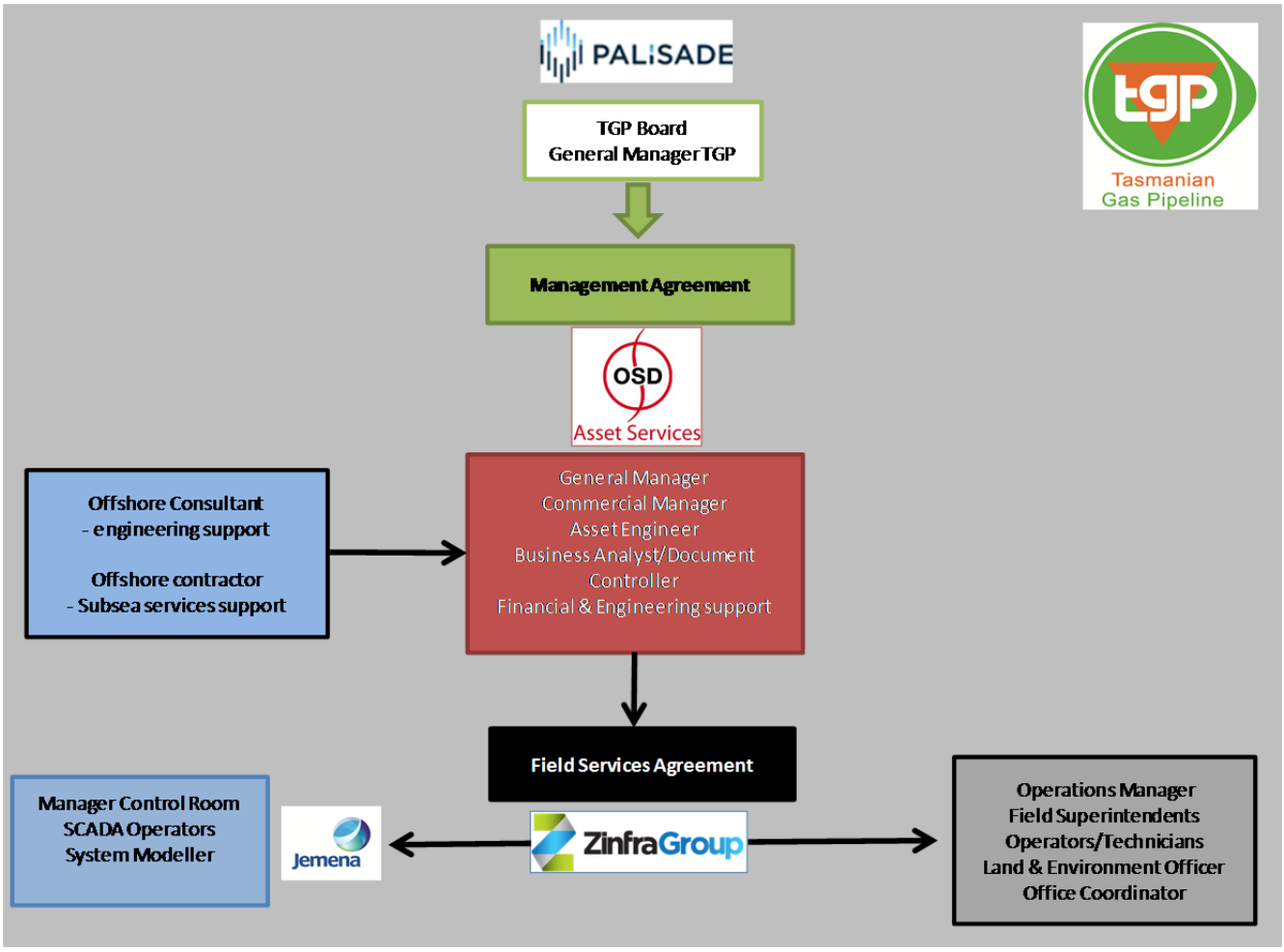

Figure 1 TGP Organisational structure and roles

2. LOCATION OF THE ACTIVITY

The key function of the TGP is to supply sales quality natural gas from the Longford Compressor Station in Victoria to Tasmania. The pipeline was commissioned in 2002 and has a current capacity of 47 PJ per year, of which only 22 PJ per year is currently used.

The TGP offshore section commences at the high water mark along Ninety Mile Beach, Seaspray and crosses Bass Strait to the low water mark at Five Mile Bluff, Tasmania where it continues onshore. The offshore section of the pipeline is approximately 302 kilometres (km) in length, with maximum water depth along the route of approximately 77 metres (m). The TGP route is shown in **Figure 2**.

There are two drilled crossings where the pipeline meets the Victorian and Tasmanian landfalls, which were constructed using horizontal directional drilling (HDD). The Victorian HDD section is 1080 m long, commencing at Kilometre Point (KP) – 0.265 and exiting the seabed at KP 0.815, at approximately 10 m water depth. The Tasmanian HDD section is some 859 m long, entering the seabed at KP 300.181 in 10.5 m (LAT) water depth.

The rest of the offshore component of the TGP sits on the Bass Strait seabed. The seabed along the pipeline route across Bass Strait is mostly flat and featureless with the steepest slopes occurring between KP 289 and KP 290, where the seabed rises approximately 14 m over a distance of 90 m (slope angle 9°). Accordingly, this section of the pipeline design is not reliant on burial and the pipeline was not laid on the seabed. It is expected that some sections of the pipeline will partially or fully self-bury with time.

A 500 m safety zone has been applied by the Australian Maritime Safety Authority (AMSA) over the submerged section of the TGP.

The TGP offshore pipeline route co-ordinates (grid and geographic) are provided in **Table 1.** The route length is defined by KP and the pipeline route curves are defined by length Intersection Points (IP) and associated Tangent Points (TP).

Table 1 TGP Offshore Route Co-ordinates (Grid and Geographic)

Feature	KP	WGS 84 (Zone 55)		AMG 66 (Zone 55)		Geographic WGS 84	
		Eastings (m)	Northings (m)	Eastings (m)	Northings (m)	Latitude	Longitude
VIC End							
HDD Entry	21.647	517,842.2	5,753,741.4	517,730.0	5,753,558.0	-38.125157	147.121525
HDD Exit	22.735	518,167.2	5,752,703.4	518,055.0	5,752,520.0	-38.222522	147.122873
IP 1A		518,645.3	5,751,176.5	518,533.1	5,750,993.1	-39.231473	147.124858
IP 1B		520,368.0	5,749,364.1	520,255.8	5,749,180.7	-38.241339	147.135978
IP 1		526,271.2	5,738,832.4	526,159.0	5,738,649.0	-38.295452	147.180459
IP 2		502,979.2	5,631,602.4	502,867.0	5,631,419.0	-39.275455	147.020468
IP 3		491,100.2	5,462,000.4	490,988.0	5,461,817.0	-40.593526	146.533908
IP 3A		491,244.7	5,460,138.7	491,132.5	5,459,955.3	-41.003564	146.534517
HDD Exit	322.344	491,082.2	5,458,505.2	490,970.0	5,458,321.8	-41.012861	146.533813
HDD Entry	323.303	490,997.1	5,457,650.4	490,884.9	5,457,467.0	-41.015633	146.533444
TAS End							

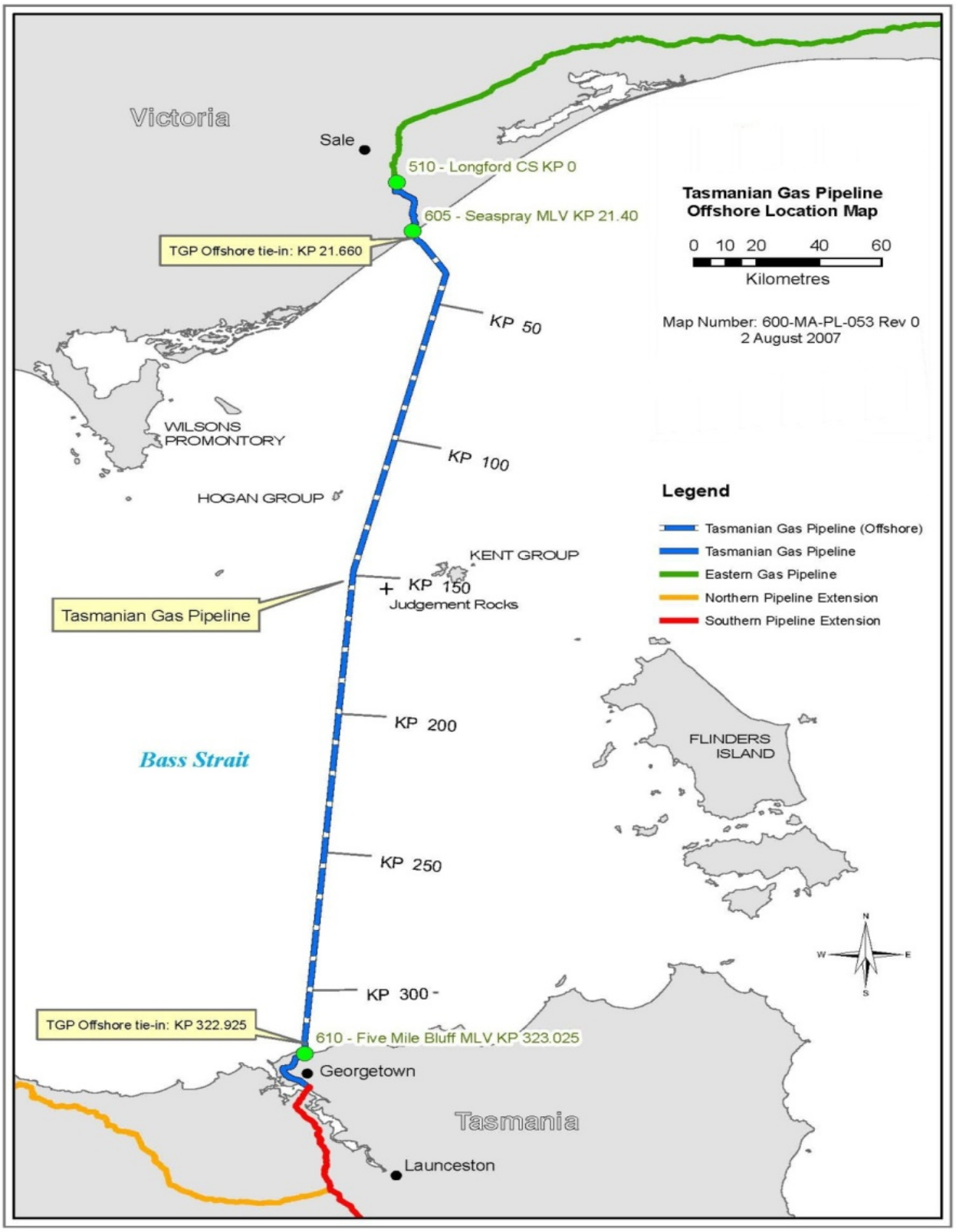

Figure 2: TGP Offshore Route

The Offshore TGP route is adjacent and to the west of the East Australian Pipeline Limited (EAPL) / Broken Hill Proprietary Company Limited (BHP) Perch and Dolphin pipeline easement. The TGP design provides a minimum separation of 230 m between the Offshore TGP and the EAPL/BHP Perch and Dolphin pipelines. The Offshore TGP route is to the east of the Basslink subsea 400 kV DC electricity Interconnector.

The TGP design provides minimum offshore separation between the Offshore TGP and the Basslink Interconnector of approximately 3.3 km. There are no foreign crossings of the offshore TGP section.

3. DESCRIPTION OF THE ACTIVITY

The TGP is an operating pipeline transporting natural gas from Victoria to Tasmania and, therefore, there are no daily activities on the pipeline itself apart from continuous monitoring of pipeline flows and pressures by the Control Room.

Surveys of the pipeline, to assess pipeline integrity and any maintenance requirements, are undertaken on a periodic basis and occur approximately every 2 to 5 years.

Consequently, temporary facilities are only on location during subsea survey and emergency repair works if, and when, they arise.

3.1 Pipeline Design and Operating Parameters

Made of high tensile steel, the TGP has been designed and constructed in accordance with ASME B31.8: Gas Transmission and Distribution Piping Systems design code, applicable Australian Standards (e.g. AS 2885.2 Welding) and regulations of the Commonwealth, Victoria and Tasmania. Design parameters and operating conditions for the TGP are summarised in **Table 2**.

Table 2 TGP Design Parameters and Operating Conditions

Parameter	Unit	Value
Pipeline Length	km	301.6
Size	NB	350
Outside Diameter	mm	355.6
Pipe Wall Thickness	mm	11.1
Wall Thickness (shore crossing)[1]	mm	12.7
Grade		X65
Maximum Allowable Operating Pressure (MAOP)	MPa(g)	15.3
Offshore Pipeline Average Design Temperature	° C	13

Notes:
1. 12.7 mm wall thickness used for section of pipeline through the shore crossing and along the shore approach lengths to provide additional strength, wall thickness and stability.

The pipeline has been designed in accordance with a pipeline integrity study to ensure it can withstand conditions expected in Bass Strait, including currents, temperature, sedimentation, marine growth and seabed conditions.

The pipeline has fully welded joints along its entire length and has no tees. As a result there are no flanges, with the exception of the HDD tie-in flanges offshore at the Victorian and Tasmanian ends.

The pipe is protected externally by a 0.4 mm fusion bonded epoxy anti-corrosion coating. In addition, the subsea section is further protected by a nominal 38 mm concrete weighted coating, which also serves to stabilise the pipe and act as an effective barrier between any third party impacts and the pipe wall. The pipe also has a cathodic protection (CP) system comprising sacrificial aluminium anodes attached at approximately every 12 to 15 field joints (approximately every 180 m).

The Victorian HDD section is protected by a galvanic anode CP system with an onshore anode ground bed. Conversely, the Tasmanian HDD section is protected by 38 mm thick sacrificial anodes installed on every pipe joint through the bore hole.

The TGP route is shown in **Figure 2**. There are no permanent offshore facilities (platforms, mooring buoys) associated with the TGP. Ancillary facilities occur at the Victorian and Tasmanian ends beyond the offshore section of the TGP:

- Seaspray (Main Line Valve) KP 21.40
- Five Mile Bluff (Main Line Valve) KP 323.025.

A section of the pipeline was trenched during the installation stage from the Victorian HDD exit point at KP 22.78 to approximately 11 m water depth at KP 25.988. The Tasmanian HDD exit point at KP 322.344 was not trenched due to hard rock. The trench on the Victorian side was not mechanically backfilled but left open to backfill naturally. To date, this is the only section of the pipeline that is fully buried.

3.2 Pipeline Operation

The TGP transports sales quality Natural Gas from Longford, Victoria to Tasmania. TGP Natural Gas comprises largely methane (approximately 91.14%) and ethane (5.21%) and is dry and free from significant impurities under normal operating conditions. Other components include carbon dioxide (2.26%), nitrogen (0.74%), propane (0.5%) and minor quantities of oxygen, butane, pentane and hexane (in quantities less than 0.1%).

Jemena's Control Room in Mt. Waverley, Victoria operates the pipeline 24 hours per day, 7 days per week, 365 days a year via the Master SCADA system. As noted previously in Section 1.2, the Control Room services for TGPPL are now managed by Zinfra under a new Field Services Agreement.

The SCADA system monitors flow in the pipeline and provides information on, and remote management of, the CP system, pressures, temperatures, valve status, metering selections, alarms, gas quality, flow rates, condition monitoring and site entry monitoring. The status of the entire system can be determined and operators can respond to changing conditions, faults and emergencies.

The SCADA system ensures that all relevant alarms and protective systems are in place so that pipeline integrity, and safety of personnel and the public, is not compromised and that security of supply is maintained. Remote shutdown, opening and closing of mainline valves (MLVs) and other ancillary functions are all conducted from the Control Room using SCADA.

Gas pressure in the pipeline is monitored continuously from the Control Room. In the event of detection in pressure drop, the affected pipeline section will be immediately isolated by closure of the appropriate MLVs at Seaspray, Victoria and Five Mile Bluff in Tasmania.

Smoke, flame, and/or gas detection systems have been installed in onshore pipeline facility control huts and are also monitored by the Control Room via SCADA. There are no offshore facilities and accordingly no smoke, flame and/or gas detection systems are installed on the offshore pipeline. The SCADA system provides real time flow and pressure data which is modelled to enable abnormal operating conditions, pipeline leak, to be alarmed.

3.3 Field Inspection and Maintenance Activities

Field inspections and maintenance activities for the offshore TGP are performed in accordance with the TGP 'Offshore Operations and Maintenance Management Plan' (NM2-014PA-OMP) and include:

- Periodic subsea surveys using remotely-operated vehicles (ROV) / autonomous underwater vehicle (AUV), side scan sonar (SSS) and diver inspections to detect existing or potential pipeline damage, and for the determination of maintenance and operational requirements;
- An intelligent pipeline pigging activity, whereby an electronically-equipped device (pig) is inserted into the pipeline to detect metal loss in the pipeline wall; and
- Maintenance activities conducted on an as-needs basis following surveys or identified issues.

Major event driven inspections and maintenance may be conducted in a similar fashion to the regular surveys to determine damage from physical impact or adverse weather, and will be undertaken as required (refer to Section 3.3.3 below).

Inspections and maintenance activities are performed by specialist contract organisations that are required to supply an environmental management plan (EMP) and risk assessment as part of OSDAS's contractor engagement process. This EMP is subject to approval from OSDAS and Regulatory Authorities, as required. Any inspection and maintenance work must also be carried out in a manner that matches the objectives set down in the TGP Offshore EP.

Offshore pipeline activities are discussed in detail in subsequent sub-sections. Where the offshore TGP joins the terrestrial component of the pipeline, operations and maintenance activities undertaken in the coastal areas are discussed in more detail in TGP 'Onshore Environment Management Plan' (QR4-006PA-EMP).

3.3.1 Support Vessels

Maintenance and inspection of the offshore TGP is undertaken with the aid of support vessels. Vessels are contracted from international or national suppliers, when required, and will vary depending on the proposed activity (nature of the survey) and vessel availability.

Vessels range in weight (300 – 1500 tonnes (t) - gross tonnage) and fuel capacity (48 - 530 cubic metres (m^3)). An example vessel, used in March 2013 for pipeline surveys, is the 'Silver Star' (refer to **Figure 3**). The 'Silver Star' has a gross tonnage of 300 t and a fuel capacity of 48 m^3 (approx. 48,000 L), with fuel spread between numerous tanks.

Depending on inspection and maintenance activities required, vessels are at sea for 1 to 4 weeks. Given their greater fuel capacity, large vessels can remain at sea for these time periods, however, smaller vessels such as the 'Silver Star' may require port visit to refuel or for maintenance. No vessel refuelling is undertaken at sea.

Vessels use global positioning system (GPS) coordinates to remain within the pipeline route. These GPS coordinates are provided by OSDAS and its contractors. Routes to and from the pipeline remain within designated Bass Strait shipping lanes.

Figure 3 The 'Silver Star', typical of the vessels used for pipeline surveys

3.3.2 Pipeline Inspection Activities

Periodic inspections are required to provide assurance of the pipeline integrity. Specialised geophysical surveys are used to inspect the condition of the offshore component of the pipeline. Pipeline anomalies or span inconsistencies from as-laid data are identified in these operations, along with pipeline orientation and the condition of coatings, field joints and anodes.

Each survey uses offshore support vessels and associated inspection equipment, such as ROV / AUV mounted cameras, single and multi-beam echo sounders and SSS. Vessels are also equipped with deck handling facilities and survey positioning equipment.

Offshore vessels involved with pipeline inspections have their own communications system for use between the vessel, land base and emergency services should they be required. The communication system is made available to visiting OSDAS personnel, visitors, representatives, consultants, etc. at all times during the surveys and in emergency situations.

Inspection of the offshore TGP is normally scheduled once every 2 years (unless a risk assessment or unplanned event triggers a survey). OSDAS is working towards a risk-based inspection (RBI) approach to future surveys, with a view to extending the inspection intervals out to possibly every 7 years. The last full length pipeline inspection was completed in March / April 2013, and the next full pipeline inspection is targeted in the 2018/19 period. The duration of each survey ranges between 1 to 4 weeks. Surveys are not expected to exceed 4 weeks.

Pipeline inspection surveys may involve the use of SSS, ROV / AUV, divers or pipeline pigs.

SSS Surveys:

SSS is a hydro-acoustic technique that involves towing a torpedo shaped 'towfish' behind the survey vessel. The tows are typically conducted at 3 to 5 knots with a maximum swath width of 150 m per side depending on resolution and water depth. The towfish is normally located about 10-15 m above the seabed and at a distance of about 150-200 m behind the vessel. There are no fluids contained within the towfish.

SSS surveys do not use air-guns and are considered less intrusive than surveys for oil exploration where air gun penetration is expected to be in the range of 3 to 4 km. Systems used in the geophysical surveys of the pipeline typically penetrate the seabed only to 10 m

and the source noise level of sub bottom profile equipment is approximately 60-70 dB re 1µPa@1m.

The SSS survey is conducted over the majority of the pipeline length (excluding inshore portions) and is used to:

- determine if the pipeline has moved;
- identify any objects that may have impacted the pipeline; and
- identify any spans that exceed the maximum allowable length.

Information gathered during the survey is used to plan and determine the visual inspection requirements of the subsequent ROV / AUV survey.

ROV / AUV Surveys:

Visual inspections of portions of the pipeline identified during the SSS surveys are undertaken using a ROV or AUV. This allows confirmation of the pipe stability and weight coating integrity, confirmation of any locations where the approved free span lengths are exceeded, and checks for external damage, debris and marine growth.

ROVs / AUVs are also used to inspect the CP system and may use probes to determine electrical potential differences at fixed points. Sacrificial anodes (zinc bars), placed about every 180 m along the pipeline, are also inspected as are field joint coatings applied in the gaps of concrete between individual pipe joints.

ROV surveys are undertaken in line with industry standards and codes of practice (e.g. *IMCA R004*). ROVs are generally mounted with a camera in pressure proof housing and may have robotic arms to allow completion of small tasks. Small amounts of hydraulic oil may therefore be present. A cable connects the ROV / AUV to the surface and the image of the seabed can be viewed and recorded on the vessel. Coordinates are recorded via GPS in order to have an automated permanent record of the location of the camera drop or tow. Where spans are confirmed to be beyond the maximum allowable limit, maintenance works will be undertaken on the same voyage to correct the deficiency (refer to Section 3.3.3 below).

Diver Inspections:

The tie-in flanges at the HDD sections of the pipeline lie in relatively shallow water and it was anticipated that the flanges would be inspected manually using divers. However, during the 2013 ROV survey, the ROV unit was able to inspect the tie-in flanges to such an extent that the need for diving operations is no longer required for this inspection work.

Diver inspections are not normally carried out during the major surveys. However, in the event of extreme damage, if metrology is required, or for repair/maintenance work, divers may be employed to both inspect and accurately map the pipeline in the relevant area.

Internal Inspection (Pigging):

Pigs are devices inserted into the pipeline using ‘pig traps’ (launchers) that are fitted with doors (closures). Pigs enter the pipeline via a launcher and exit via a receiver, both of which are onshore devices. When inserted, pigs travel throughout the length of a pipeline driven by the gas flow.

There are two types of pigs which perform different inspection and maintenance functions:

- *Utility pigs* - are used to perform functions such as cleaning or sealing a pipeline; and

- *Intelligent ('smart') pigs* - provide information on the internal condition of the pipeline, as well as locating problem areas.

The frequency of pipeline pigging using utility pigs is determined based on operational history and the annual integrity risk assessment and review. Cleaning pig runs are scheduled in accordance with the TGP 'Offshore Operations and Maintenance Management Plan' (NM2-014PA-OMP). The timing of subsequent cleaning pig runs will be determined subject to pig retrieval and inspection of the nature and amount of debris collected.

Intelligent pigging is also included as part of the regular inspection and maintenance programme and is planned every 10 years, following a successful run performed in 2010. The frequency is reviewed every year in the annual integrity risk assessment and review, however, the next routine intelligent pigging run is currently scheduled for 2020.

3.3.3 Pipeline Maintenance Activities

Maintenance work to repair potential or existing damage consists of specific tasks required to rectify deficiencies found during inspections, and their frequency will therefore depend on the results of the inspection surveys. It is anticipated that maintenance activities could consist of the following:

- Rectification of unsupported pipeline spans that are greater than the maximum allowable span, in order to ensure compliance with the allowable design length and reduce the likelihood of vortex induced vibrations (VIV). Span correction generally involves the installation of supports, in the form of grout-filled bags, underneath the centre of the span (jetting to remove high points is considered unlikely once the pipeline has been laid). Each bag (about 1800 mm × 1200 mm) is placed under the pipeline using a ROV and inflated with grout (concrete) via a hose connection to the support vessel. Each operation is monitored by the ROV to ensure smooth operation.
- Removal of dropped objects (such as containers) from passing vessels (including survey vessels) that may settle on or near the pipeline is a conceivable requirement and, depending on the object, is likely to be achieved with the assistance of a ROV (objects of up to 300 kg in weight can be removed by ROV).
- Repair of concrete coating which, depending on the severity, may simply involve placing a concrete mattress over the damaged area to prevent possible damage to the steel pipe from further impacts. Concrete itself is considered environmentally benign and the mattress installation is undertaken in accordance with industry standards and codes of practice (e.g. *IMCA D042, R016*). Concrete mattresses will be lowered onto the pipe via a specialised crane on-board support vessels (maximum on-board weight of 3.5 t). Final placement is assisted by the use of ROVs and/or divers.
- Occasional replacement of sacrificial anodes (expected life of an anode is at least 15 years). This will be undertaken using a ROV, which will remove and replace the anode (attached via a bracket).

Removal of marine growth is not expected to be required at this stage. Similarly, while it is expected that the pipeline will self-bury over time as sediment shifts, removal of excessive sedimentation is not an expected requirement. This is monitored as part of pipeline inspections.

4. DESCRIPTION OF THE ENVIRONMENT

4.1 Physical Environment

Bass Strait was formed approximately 12,000 to 15,000 years ago by the inundation of a land bridge that had once connected Tasmania and Victoria. It is a comparatively shallow sea (depths of up to 80 m) with the western and eastern entrances defined by the continental shelf that extends between King Island and Cape Otway in the west and between Flinders Island and Wilsons Promontory in the east. Beyond the continental shelf the seabed declines sharply to depths over 3,000 m.

The seabed along the direct route between Seaspray and Five Mile Bluff is reasonably featureless. In the vicinity of the pipeline the seabed consists primarily of fine and medium grained quartzose sands with a mean grain size of 0.12 to 0.25 mm. Coarse sands and gravels are present to a lesser extent in the proximity of the Victorian shore crossing. Seabed current manipulations have formed some sand waves.

Circulation, or mixing of water, in Bass Strait is mainly dependent on tidal currents, but wind-driven currents, coastal trapped waves, barometric pressure-induced currents, density-driven flows and ocean-scale circulation patterns also contribute. The current speeds ultimately depend on the proximity to the eastern entrance of Bass Strait, with lower current speeds expected to the west. Current speeds between 0.30 and 0.79 m/s occur during 5 year return period storms, while current speeds of 0.41 to 1.03 m/s occur during 100 year return period storms.

The average annual rainfall is 718.8 mm (recorded at Deal Island in the Kent Group), with the highest rainfall and most rainy days occurring from May through to August. Winds are typically strongest during spring and weakest during the winter: 50-60% of winds are under 10 knots, with 30-37% of winds occurring between 10 and 20 knots. Strongest winds (greater than 20 knots) mainly originate from the west. Average temperatures range from 8.5^{o}C in winter to 20.5^{o}C in summer.

Protection of the region from westerly and south-westerly swells is provided by Wilsons Promontory, Tasmania and King Island. However, during 5 and 100 year storm events, wave heights may range from 4.5 to 5.5 m and 6.8 to 7.5 m, respectively. Although the pipeline was originally laid on the surface of the seabed, strong current and wave activity may result in shifting sands and periodical burial of pipeline sections.

Seismic activity along the pipeline route was considered during the design phase of the pipeline and was confirmed to be of minimal risk.

The pipeline route does not lie within any significant terrestrial features, with the closest landform 9 km away, but does pass within the vicinity of a number of small islands or island groups (as shown in **Figure 2**). These include (in order from north to south):

- ***The Hogan Island Group*** - straddles the border between Victoria and Tasmania and is located about 10 km to the west of the pipeline and about 45 km east of Wilsons Promontory, Victoria. It is made up of one main island; Hogan Island and several islets including Boundary Islet, East Islet, Long Islet, Twin Islet, Round Islet and Seal Rock. Boundary Islet is the land boundary between Victoria and Tasmania.
- ***The Curtis Island Group*** - lying about 25 km west of the pipeline and made up of Curtis Island, Cone Island, Sugarloaf Rock and Devils Tower.

- ***The Kent Group*** - an archipelago of six islands and offshore rocks situated approximately half way between Wilsons Promontory and the northern end of Flinders Island. The main groups of islands (incorporating Deal, Dover and Erith Islands) lie about 23 km east of the pipeline. Two minor islets, North East and South West are within the vicinity of this group, however, Judgement Rocks, a small granite island with an area of 0.39 hectares (ha) lies to the south-west of the main islands of the Kent Group and about 10 km east of the pipeline.
- ***The Bass Pyramid Group*** - made up of Craggy Island, Wright Rock and Bass Pyramid and lying between Flinders Island and the Kent Group. Bass Pyramid is a small, steep-sided granite island with an area of <1 ha and lies about 20 km east of the pipeline.
- ***Tenth Island*** - part of the Waterhouse Island Group off the northern coast of Tasmania, lies approximately 9 km east of the pipeline.

All islands, apart from Boundary Islet within the Hogan Island Group, are under the jurisdiction of Tasmania and are located at least 8 km from the pipeline.

4.2 Biological Environment

Bass Strait is an area of relatively high faunal diversity and supports a number of species of high conservation and commercial value. This is partly due to its unique biogeographical location at the convergence of three marine biogeographical regions: the Peronian (New South Wales), Maugean (Tasmania) and Flindersian (southern Australia).

There are many different temperate ocean habitat types represented in Bass Strait, from open beaches and rocky reefs (both exposed and sheltered) to offshore islands, soft bottom habitats (sand, mud and seagrass) and open sea. The main marine species and communities present within, and immediately surrounding, the pipeline route primarily comprise the following:

- ***Plankton*** - There have been few studies of plankton populations in the Bass Strait region, however a key study recorded over 170 species of zooplankton during sampling of eastern Bass Strait waters, half of which were marine copepods. These are a key biomass component of the ocean food chain.
- ***Macroalgae*** - A detailed survey of the north-eastern Bass Strait Islands identified up to 40 species of macroalgae surrounding the Kent and Hogan Groups, an indicator of the nutrient rich waters and diversity of habitats available.
- ***Benthic infauna and epifauna*** (fauna living within and on the seabed) - Include brittlestars, urchins, sponges, lamp shells, crabs, sea squirts, polychaete worms, bivalves and molluscs. Bass Strait, as a whole, has a relatively heterogeneous benthic habitat and has one of the highest biodiversities of benthic fauna in the world. The substrate along the pipeline route itself, however, represents a largely homogenous habitat type and is not significantly diverse from other regions within Bass Strait. While a number of species that occur in south-east Australian waters are endemic to the area, most of these species are widely distributed throughout the region. Any impacts will be localised and unique faunal elements are unlikely to be disturbed.
- ***Pelagic and demersal species*** (ocean dwelling species and those species that live close to the seafloor) - A number of important commercial fish and invertebrate species, with a relatively high diversity in fish species, have been recorded around the Kent Group. It is estimated that over 500 species of fish, including approximately 50 species of elasmobranches (sharks and rays), are found in Bass Strait. There are no endemic species to the area, with the majority of species being widely dispersed throughout the region.

Two migratory species found in Bass Strait are listed as vulnerable under the *EPBC Act*, the Great White Shark (*Carcharodon carcharias*) and occasionally the Whale Shark (*Rhincodon typus*). Ninety Mile Beach provides important feeding grounds for juvenile great white sharks, effectively representing nursery habitat. Sharks are known to congregate around seal colonies within the Kent and Hogan Group looking for food.

- ***Pinnipeds*** - Pinnipeds, principally the Australian Fur Seal (*Arctocephalus pusillus*), frequent Bass Strait. Many of the islands in Bass Strait are important breeding or haul-out sites for the Australian Fur Seal, including large breeding colonies at Judgement Rocks and Tenth Island. Australian Fur Seals generally breed around November to December with the majority of pups suckled for about 8 months.
- ***Cetaceans*** - About 12 species of whales and dolphins have been observed in Bass Strait, although only a minority are resident or have been observed frequently. The most freely seen are the Common (*Delphinus delphis*) and Bottle-nosed (*Tursiops truncatus*) dolphins, but a number of whales also visit the region during annual migrations to and from their breeding grounds (mostly during the winter months). These include the Blue Whale (*Balaenoptera musculus*) and Southern-right Whale (*Eubalaena australis*), which are listed as Endangered under the *EPBC Act*, and the Humpback Whale (*Megaptera novaeangliae*) which is listed as Vulnerable. All cetaceans are susceptible to direct disturbance from shipping operations, including seismic or acoustic surveys, collision with large vessels, and pollution from plastics, oil spills, and dumping of industrial wastes which can lead to bio-accumulation of toxins in cetacean body tissues.
- ***Birds*** - Include resident seabirds and migratory species crossing Bass Strait. Large breeding seabird colonies exist around the Kent Group, particularly on Deal and Erith Islands and two small islets known as North East and South West Islands. Species include common diving petrels, short-tailed shearwaters, little penguins, pacific gulls, sooty oystercatchers and cormorants. Species listed under the *EPBC Act* also breed within islands of the Kent Group, including the Vulnerable Fairy Prion (*Pachyptila turtur subantarctica*) and Cape Barren Goose (*Cereopsis novaehollandiae grisea*). Up to 24 species listed under the *EPBC Act* may occur, or are likely to occur, within the Bass Strait region throughout the year. Many of these species are protected under international agreements (e.g. CAMBA, JAMBA and ROKAMBA) and may be observed passing through Bass Strait on their way to or from mainland Victoria and Tasmania. This includes land based species such as the endangered Swift Parrot (*Lathamus discolour*), which migrates from Southern Tasmania to Victoria every winter.
- ***Reptiles*** - There are a couple of reptile species that are occasional vagrants to the eastern part of Bass Strait, including two species of marine turtle: the Loggerhead (*Caretta caretta*) and the Leatherback (*Dermochelys coriacea*), both of which are listed as Endangered under the *EPBC Act*.
- ***Introduced Pests*** - At least 130 introduced and cryptogenic (species of unknown origin) marine pest species are found in and around Tasmanian coastal waters and more than 100 species in Victorian waters. It is likely that many of these species have been introduced by ballast water discharged from international shipping or attached to the many private and commercial vessels traversing Bass Strait. Key marine pests observed in northern Tasmania, Bass Strait and southern Victorian waters include the northern Pacific Seastar (*Asterias amurensi*), European Green Crab (*Carcinus maenas*), Asian Date Mussel (*Musculista senhousia*), European Clam (*Corbula gibba*), European Fan Worm (*Sabella spallanzanii*), New Zealand Screw Shell (*Maoricolpus roseus*), Japanese Kelp (*Undaria pinnatifida*) and Long-spined Sea Urchin (*Centrostephanus rodgersii*). All marine pests are considered a threat to the marine environment as they compete directly with native species for habitat and food.

Threatened species and communities listed under the *EPBC Act* are protected by legislation and include species listed as endangered or vulnerable, migratory species (including birds and mammals), and cetaceans including whales and dolphins. In addition, State legislation protects threatened species, communities and whales in coastal waters. Under State and Commonwealth legislation it is an offence to kill, injure, take or interfere with threatened species, migratory species and cetaceans.

A list of threatened species, as classified under the *EPBC Act*, likely to occur near the offshore pipeline is provided in **Table 3** below

Table 3: Threatened species that may occur near the TGP

Species	Scientific Name	Common Name	EPBC Listing
Birds	*Pachyptila turtur subantarctica*	Fairy Prion	Vulnerable
	Cereopsis novaehollandiae grisea	Cape Barren Goose	Vulnerable
Fish	*Carcharodon carcharias*	Great White Shark	Vulnerable
	Rhincodon typus	Whale Shark	Vulnerable
Reptiles	*Dermochelys coriacea*	Leatherback turtle	Endangered
	Caretta caretta	Loggerhead turtle	Endangered
Mammals	*Balaenoptera musculus*	Blue whale	Endangered
	Eubalaena australis	Southern-right Whale	Endangered
	Megaptera novaeangliae	Humpback whale	Vulnerable

It should be noted that some species occurring in the region may not be classified as threatened under the *EPBC Act*, but are classified under the relevant State legislation, e.g. *Sterna albifrons sinensis* (Little Tern (western Pacific)) is classified as Endangered under the *Tasmanian Threatened Species Protection Act 1995*.

Although frequented by transient species, there are no recognised aggregation areas (nesting, resting, breeding and feeding areas) for protected whales or turtles within the area. Fur seals are known to use some of the islands within Bass Strait as breeding or haul-out sites, but these are generally to the east of the pipeline route.

Numerous resident and migratory birds are common in Bass Strait, with large breeding seabird colonies existing around the Kent Group.

Species listed under State and Commonwealth legislation may migrate or move through the pipeline route at any given time, however none of the species are dependent upon the area for food or reproduction. Furthermore, as the pipeline is operational and lies on the seabed 80 m below sea level, operation, inspection and maintenance activities are expected to have a minimal impact on the biological environment.

4.3 Cultural Environment

A number of studies and surveys were undertaken prior to construction of the TGP to identify the potential for presence of cultural heritage sites along the pipeline route, including:

- Submerged terrestrial sites dating from the period prior to the creation of Bass Strait (prehistoric); and
- Sites of Aboriginal or non-Aboriginal heritage significance, including potential and actual submerged archaeological remains, and known and potential shipwrecks within 5 nautical miles (nm) of the pipeline route.

4.3.1 Submerged Terrestrial Sites

The potential for impact of the pipeline on submerged terrestrial sites is considered low, partly due to the effect of physical factors on surface deposits as sea levels rose, but also due to the subsequent sedimentation and burial of submerged terrestrial sites that would have occurred following inundation. No submerged terrestrial sites were identified during construction of the pipeline.

4.3.2 Aboriginal or Non-Aboriginal Heritage Sites

The coastal zone of both Tasmania and Victoria potentially contains numerous heritage sites, predominantly of recent formation (last 1,000 years). However, archaeological surveys conducted prior to TGP construction found little evidence within the pipeline route of sites of either Aboriginal or non-Aboriginal origin. All potential sites within the foreshore landform of the alignment were nonetheless avoided via use of directional drilling under the coastal zone.

Data on shipwrecks in the region indicates a significant number are present throughout Bass Strait and coastal Victoria and Tasmania. However, exact resting places for most of these wrecks are unknown. The estimated locations of shipwrecks in the Bass Strait and State coastal regions in relation to the pipeline are shown in the TGP Offshore EP and include the following:

- The wreck *Glenelg* - reported to be situated in close proximity to the pipeline, although estimates of its location vary from close to Lakes Entrance to being 40 nm west of Lakes Entrance.
- The *Norfolk*, which also has conflicting locations (one report has it situated 30 nm from Lakes Entrance, while another records a location between Seaspray and Woodside). Several wrecks have been listed as ‘lost Ninety Mile Beach.’
- The wrecks *Fear Not* and *Oberlin* situated close to the shore at Hogan Island.
- The wreck of *Bulli* lies almost intact in West Cove, Erith Island within the Kent Group.
- A number of wreck locations in the Five Mile Bluff region, including an unidentified coaster (1843) and the *Royal Oak*.

While it is important to be aware of the possibility of cultural artefacts within the vicinity of the pipeline, no sites of Aboriginal or non-Aboriginal significance (including shipwrecks) were evident along the pipeline route during pre-construction surveys conducted in September 2000. The pipeline and its operation is therefore considered unlikely to have any impact upon values of heritage significance.

Locations of known sites of heritage significance and Aboriginal lands near to the offshore TGP have nevertheless been noted on the TGP geographic information system (GIS). This provides further detail regarding the significance, location and management measures of each site, so that impacts may be avoided.

It is acknowledged that the Kunai and Gunai people have a native land title claim over sections of the Gippsland region (VCD 2010/001, VIC 6007/98). Areas within and adjacent to the Ninety Mile Beach Marine National Park (refer to Section 4.5) are considered culturally and spiritually significant to the relevant indigenous communities. Although the TGP Offshore EP applies to the offshore component of the TGP pipeline, the application for native title is relevant given that the application boundary extends to 40 km offshore in Commonwealth waters.

4.4 Socio-Economic Environment

A wide range of human activities occur in the waters of Bass Strait, including commercial oil and gas fields, shipping, commercial and recreational fishing, and other recreational activities.

- ***Commercial Fisheries*** - Several commercial fisheries operate in the general vicinity of the pipeline depending on the season, including the: Southern Bluefin Tuna Fishery; Eastern Tuna and Billfish Fishery; Eastern Skipjack Tuna Fishery; Small Pelagic Fishery, the Bass Strait Scallop Fishery (Central Zone) and the Southern Squid Jig Fishery. School whiting (*Sillago bassensis* and *S. flindersi*) and flathead (*Platycephalus* and *Neoplatycephalus spp.*) are the most significant commercial species. Other commercially significant species include Pilchards (*Sardinops neopilchardus*), Anchovies (*Engraulis australis*), Australian Salmon (*Arripis trutta*), Blue Sprat (*Spratelloides robustas*), and Southern Calamari (*Sepioteuthis australis*). Of less commercial value are the Gummy Shark (*Mustelus antarcticus*), School Shark (*Galeorhinus galeus*), Jackass Morwong (*Nemadactylus macropterus*), Jack Mackerel (*Trachurus declivis*) and Snapper (*Chrysophrys auratus*).
- ***Commercial shipping*** - Bass Strait is one of Australia's busiest shipping areas, with passengers and freight being transported between the mainland and Tasmania as well as New Zealand. The highest volumes of shipping traffic travel in an east-west direction, with connections to Melbourne and Geelong. Substantial volumes of shipping traffic also occur between Melbourne/Geelong and Tasmania moving in a north-south direction.
- ***Recreational activities*** - Most recreational activities occur in nearshore environments, including fishing, boating and diving, and are often controlled by conditions within the open waters of the Strait. Several of the islands in the region are also available for visiting, although access may be controlled by permit systems managed by the Tasmanian Parks and Wildlife Service. Popular recreational activities offered by the Bass Strait islands include bird-watching, fishing and diving around reefs and shipwrecks.
- ***Oil and Gas Infrastructure*** - The Gippsland Basin has been producing significant oil and gas resources since the 1960s and includes a number of operating fields. Petroleum permits have been issued for exploration and production within the central Bass Strait region, with the closest operating field located at least 3 km to the east of the pipeline.
- ***Other infrastructure***: The Victorian shore crossing of the pipeline is adjacent to existing pipeline easements or infrastructure, including EAPL/BHP pipeline and BASSLINK Interconnector. These have been outlined in Section 2 above.

Due to the depth and location of the TGP, and periodic nature of inspection and maintenance activities, pipeline activities should pose minimal hindrance to socio-economic activities in Bass Strait. Nevertheless, a permanent 500 m safety zone has been imposed around the operating gas pipeline, which is managed by the AMSA in line with their responsibilities under the *Australian Maritime Safety Act 1990*. Prior to undertaking any inspection and maintenance activities offshore, OSDAS and its contractors will notify relevant stakeholders of their intentions and maintain communications in line with the TGP Consultation Plan (refer to Section 8 below).

4.5 Environmentally Significant Areas

4.5.1 Matters of National Environmental Significance (MNES)

Heritage Sites

There are no World Heritage sites, properties or areas in, or adjacent to, the TGP activity locations.

Wetlands of International Importance (Ramsar Convention)

The following sites within the vicinity of TGP activities are classified as wetlands of international importance under the Ramsar Convention:

- Corner Inlet in south-eastern Victoria (Australian Ramsar site 13) is located approximately 70 km to the west of the northern section pipeline route, and is the most southerly marine embayment and tidal mudflat system of mainland Australia;
- Gippsland Lakes in south-eastern Victoria (Australian Ramsar site 21), which is located approximately 2 km east of Seaspray; and
- East Coast Cape Barren Island Lagoons, on the east side of the Flinders-Cape Barren Islands in Tasmania (Australian Ramsar site 8), is located over 150 km east of the TGP route.

Listed Threatened Species and Ecological Communities

Threatened species and communities listed under the *EPBC Act* are protected by legislation and include species listed as endangered or vulnerable, migratory species including birds and mammals, and cetaceans including whales and dolphins. Details of threatened species, as classified under the *EPBC Act*, that are likely to occur near the TGP offshore pipeline are provided in Section 4.2 and **Table 3**.

As of August 2012, the Giant Kelp Marine Forests of South East Australia have been protected under the *EPBC Act* as a threatened ecological community. Giant kelp (*Macrocystis pyrifera*) is the foundation species of the community, with other components including a large range of algae, reef associated fish and numerous invertebrates that shelter, feed and reproduce within the kelp. Remaining populations occur along coastal Tasmania and Victoria and in small patches around the Kent Group. Giant kelp marine forests favour temperate south east waters on rocky reefs, where conditions are cool and relatively nutrient rich. The pipeline route passes through deeper waters and does not impact directly on the any known populations.

4.5.2 National Parks and Marine Reserves

A number of areas adjacent to or within Victorian and Tasmanian State waters have been declared as National Parks or Marine Protected Areas. These are shown in **Figure 4** and include the following reserves within the vicinity of the pipeline:

- ***Gippsland Lakes Coastal Park*** - Managed by Parks Victoria and lies less than 2 km to the east of Seaspray. The Gippsland Lakes are classified as 'wetlands of international importance' under the Ramsar Convention (refer to Section 4.5.1 above) and includes Lake Reeve, a site of international zoological significance, which attracts up to 20,000 migratory waders and is one of five important wetlands in Victoria for wading birds. Breeding colonies of fairy terns (*Sternula nereis*) and little terns (*Sterna albifrons sinensis*) are known to occur within the area, as are populations of dolphins including the Bottlenose (*Tursiops truncates*) and Burrunan (*Tursiops australis*)

species. The far south-western boundary of the Park is located approximately 100 m north-east of the pipeline offshore commencement point.

- ***Ninety Mile Beach Marine National Park*** – Located 550 m south west of Seaspray, Victoria and is also managed by Parks Victoria. The Park covers 2750 ha and stretches south-west along 5 km of coastline and 3 nm offshore to the boundary of Victorian waters. Marine habitat consists of sandy beach, sub tidal soft sediment and 8 ha of low profile calcarenite reef. The Park is frequented by a number of threatened shorebird species including the Hooded Plover (*Thinornis rubricollis*), Little Egret (*Egretta garzetta*), Little Tern (*Sterna albifrons sinensis*), Royal Spoonbill (*Platalea regia*) and Whiskered Tern (*Chlidonias hybridus*). The area contains diverse fish species, with schools of pelagic fish including pike, school whiting and snapper common to the area. The area is also a nursery and feeding ground for Great White Sharks (*Carcharodon carcharias*). The Park is located approximately 2 km west of the pipeline.
- ***The Kent Group National Park*** – A terrestrial park managed by the Parks and Wildlife Service of Tasmania. There are three major islands (Deal, Dover and Erith), two minor islands (North East and South West) and Judgement Rocks incorporated into the national park. The pipeline is oriented in close proximity to South West Island and Judgement Rocks, with KP 130.7 positioned approximately 10 km west of the park boundary. Breeding seabird colonies are large, particularly on the two small islets known as North East and South West islands. Common diving petrels, short-tailed shearwaters, little penguins, pacific gulls, sooty oystercatchers and cormorants are the primary inhabitants, as are the Little Tern (*Sterna albifrons sinensis*), endangered under Tasmanian legislation, and the Fairy Prion (*Pachyptila turtur subantarctica*) listed as vulnerable under the *EPBC Act*. Judgement Rocks is also an important Australian Fur Seal (*Arctocephalus pusillus*) breeding colony, being the largest within Tasmanian waters. However, the distance of approximately 10 km is expected to buffer nesting sites from pipeline activities.
- ***The Kent Group Marine Reserve*** – Also managed by the Parks and Wildlife Service of Tasmania, extends 3 nm (about 5.6 km) offshore from the main islands of the Kent Group, and includes a Habitat Protection Zone (restricted take) and Sanctuary Zone (no take). The submarine topography surrounding these islands is dominated by massive granite blocks interspersed with clefts, ledges and caverns. The diversity in fish species is considered unusually high given the proximity to more homogenous substrates across the Bass Strait. It is considered unique in faunal assemblage and of high scientific value, partly due to its unique biogeographical location at the convergence of the three marine biogeographical regions. The Sanctuary Zone covers the western part of the Kent Group, including Dover and Erith Islands and Murray Passage, as well as part of the western coast of Deal Island. The Marine Reserve lies 23 km east of the pipeline.
- ***The Beagle Commonwealth Marine Reserve*** - Declared in June 2007, covers 2,928 square kilometres of Commonwealth ocean territory, and incorporates the Kent Island Group, Hogan Island Group and Curtis Island Group. It is situated within shallow topography, mostly at depths of 50 to 70 m, with the north-western edge abutting Victorian waters to the south-east of Wilson's Promontory. The pipeline is oriented between the Hogan and Kent Island Groups, traversing the entire marine reserve in a north-south direction. As shown in **Figure 4**, the Marine Reserve is traversed by the pipeline between KP 110 and KP 170. Its ecosystems are similar to those documented for the deeper sections of the Kent Group Marine Reserve.

The deep rocky reefs support a rich array of life, and the area provides homes and feeding grounds for seabirds, little penguins and Australian fur seals. The Reserve is zoned for 'Multiple Use' (category VI under the classification system established by the International Union for Conservation of Nature (IUCN) and adopted by the Commonwealth government). The Reserve is effectively a managed resource protected area that is administered to ensure long-term protection and maintenance of biological diversity, but with a sustainable flow of natural products and services to meet community needs. The general zoning allows for a number of activities including mining exploration and development activities, select commercial fishing methods, recreational and charter fishing, shipping and general transit, scientific research and commercial tourism. Demersal trawl, scallop dredging, mesh netting and Danish seine commercial fishing methods, however, are not permitted.

- A number of other islands lying about 10 to 25 km from the pipeline are listed as nature reserves under the *National Parks and Wildlife Act 1970* (Tasmania). They include: Bass Pyramid, Devils Tower, Tenth Island and Wright Rock. The islands not only provide resting sites from foraging, but also serve as breeding sites for some species of birds and, in some cases, for seals.

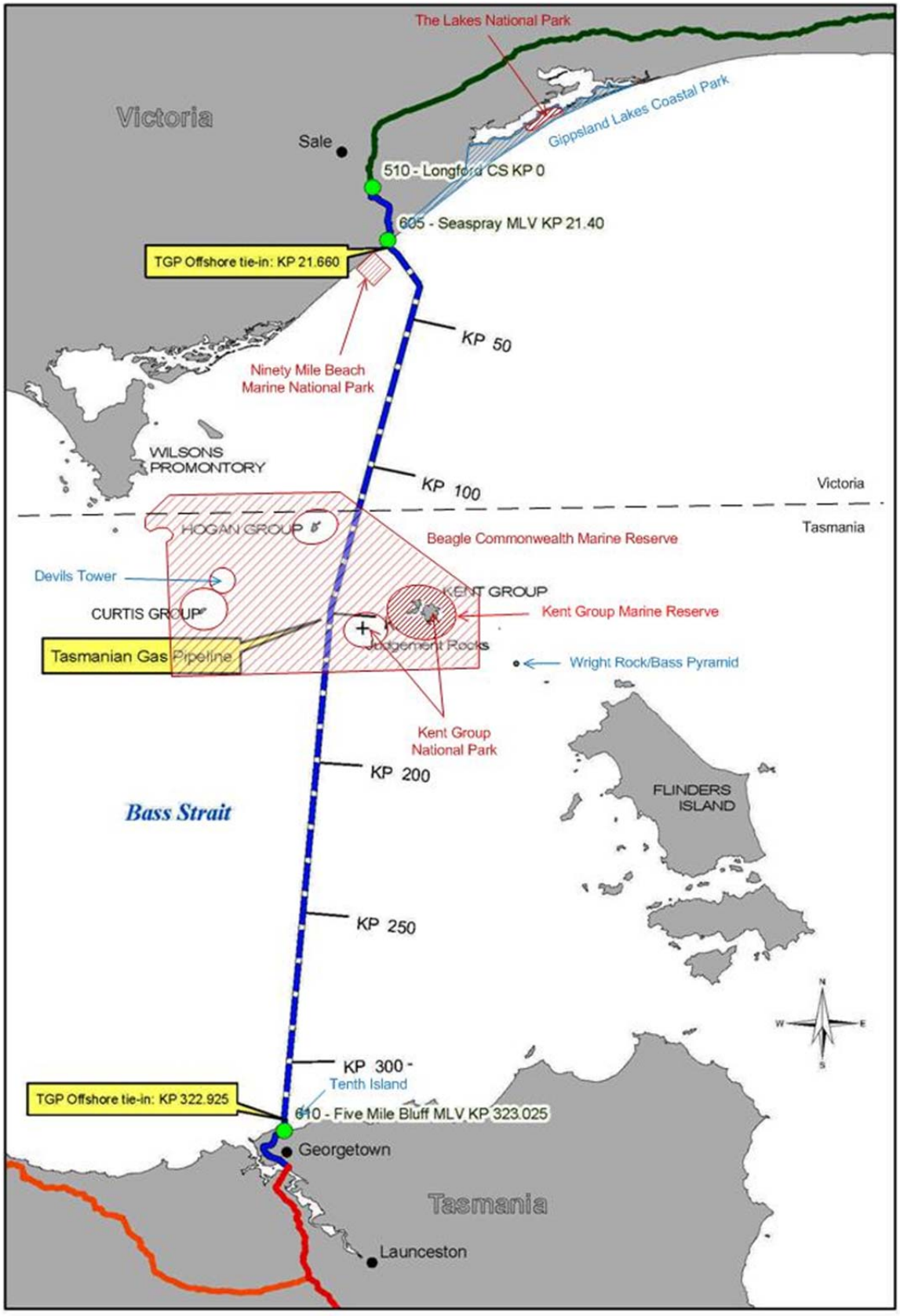

Figure 4 Environmentally Significant Areas along the TGP route

5. ENVIRONMENTAL RISKS AND CONTROLS

As a key component of the TGP Offshore EP, OSDAS has undertaken an environmental risk assessment (ERA) to identify potential environmental risks associated with operation, inspection and maintenance of the TGP and to ensure that identified risks are reduced to 'as low as reasonably practicable' (ALARP) and will be of an acceptable level consistent with OSDAS and industry standards. The environmental risk assessment and management process used is outlined in Section 5.1 below.

5.1 Environmental Risk Management Process

5.1.1 Environmental Risk Management Model

Environmental risk assessment and management for the TGP Offshore EP has been undertaken using a methodology that is consistent with the approach outlined in the following standards and guidelines:

- AS/NZS ISO 14001: 2004 - Environmental Management Systems- Requirements with Guidance for Use;
- AS 2885.1: 2012 - Pipelines - Gas and Liquid Petroleum, Part 1 – Design and Construction;
- AS/NZS 31000:2009 - Risk Management – Principles and Guidelines; and
- HB 203:2012 – Managing environment-related risk.

The model used to evaluate and manage environmental risks potentially resulting from TGP operation and associated inspection and maintenance activities comprises the following main components:

- ***Risk identification*** - Identification of the environmental aspects of operations (i.e. elements of those activities carried out on the TGP that can interact with the environment) and potential impacts or changes to the environment resulting from these environmental aspects.
- ***Risk analysis*** – Developing and understanding of the risks and controls in place, i.e. analysing risks in terms of controls, consequences and likelihood to determine an estimated level of risk of the impact from each aspect.
- ***Risk evaluation*** - Assessment of the environmental risk according to the allocated likelihood and consequence to rate or rank the risk, and identify those aspects with risks considered to be significant. An Environmental Risk Matrix was used to determine risk ratings and identify significant risks that require further treatment.
- ***Risk treatment*** - Reviewing the proposed management controls for each of the significant risks identified and proposing additional controls or recommending further actions or treatments to mitigate the risk to a level that is deemed to be ALARP.

Although the TGP Offshore EP focusses on the environmental risk management process, the overall TGP Risk Management process is a whole of life process conducted during the three project phases of design, pre-commissioning, post-commissioning and continuing through ongoing operations and eventually de-commissioning. The process incorporates a range of activities to ensure that all risks to people, the facilities, environment and continuity of supply are identified and managed to be ALARP.

5.1.2 Environmental Risk Assessment (ERA) Process

The Environmental Risk Assessment (ERA) process applied during development of the TGP Offshore EP involved a detailed and systematic assessment of the risk associated with each identified hazard, including an assessment of the consequences and likelihood of each potential incident. The ERA process is summarised as follows:

- Risk assessments are undertaken as structured workshops facilitated by an independent facilitator, with involvement from members of the workforce (where appropriate) and other external personnel with experience and knowledge appropriate to issues being considered.
- Identified hazards or potential incidents are reviewed and the associated risks (without controls) are analysed in terms of the likelihood of their occurrence and the consequences that would result if they did occur. Based on the combination of likelihood and consequences, a resultant risk ranking (inherent risk) is attributed using an Environmental Risk Matrix.
- Controls and mitigation measures in place to prevent, mitigate or recover from the potential risk are then analysed and the likelihood and consequences of the risk, following the application of these controls and consideration of any assumptions and uncertainties, is re-evaluated. This results in a residual risk ranking, which is also assigned using an Environmental Risk Matrix. Where the risk assessment is a review of previous risk assessments, only the existing residual risk ranking is reviewed in consideration of any new information relevant to the hazard being considered.
- Based on HB 203:2012, residual risks that are rated as “Low” are considered “Acceptable”, whereas residual risks classified as “Critical” are considered “Intolerable” risks that must be managed immediately to reduce the risk.
- Based on HB 203:2012, “High” and “Medium” level risks are considered to be “Tolerable”, however, they must be subject to an ALARP assessment to determine whether the risks can be further reduced by implementing additional controls and mitigation measures.
- ALARP assessments are reviewed for relevance and consistency as part of the ERA review process.
- Matters requiring action are recorded in an Action Plan. It is a requirement that these action plan items are followed up and closed out in a timely manner.
- The TGP ‘Environmental Aspects and Impacts Register’ is updated as part of the ERA process.

The ‘Environmental Aspects and Impacts Register’ provided in the TGP Offshore EP is a “live” document that is used and continually updated, as required, during operation, inspection and maintenance of the offshore TGP to facilitate the appropriate management of all identified environmental risks. The environmental risk associated with TGP activities are continually assessed as part of the “continual improvement” component of the environmental management process. The ERA will be reviewed, and the ‘Environmental Aspects and Impacts Register’ updated accordingly, whenever a review and amendment of the Offshore EP is required (refer to Section 6.3 below).

5.2 Sources of Environmental Risk

5.2.1 Planned Activities

The main potential sources of environmental risk associated with the offshore TGP relate to activities which are planned and undertaken on a periodic basis only (approximately every 2 to 5 years). Examples of these sources of environmental risk include:

- Routine inspection surveys, including the timing, location, use and presence of vessels and inspection equipment;
- Pipeline maintenance activities, such as span correction and anode replacement; and
- Storage, handling and disposal of waste and chemicals on board vessels during inspection and maintenance activities.

Generally, the potential environmental impacts associated with planned activities are less significant than those potentially resulting from unplanned activities or incidents. However, as these sources of risk relate to planned activities occurring on a routine basis, the TGP Offshore EP and associated 'Environmental Aspects and Impacts Register' contain a number of controls and mitigation measures to ensure environmental impacts and risks are reduced to ALARP and are of an acceptable level.

Potential environmental impacts from offshore TGP activities and the proposed controls and mitigation measures to minimise these impacts are summarised in **Appendix A** of this EP Summary.

5.2.2 Unplanned Events

Unplanned events or emergencies identified for the TGP are:

- Leaks from the pipeline due to loss of pipeline integrity;
- Hydrocarbon spills from offshore inspection and maintenance vessels.

Loss of Pipeline Integrity

Unplanned activities or events that could potentially result in a loss of containment from the offshore pipeline are largely related to management of pipeline integrity and measures to manage such issues are addressed in the TGP 'Offshore Pipeline Integrity Management Plan' (QR4-012PA-OPI).

The TGP is licensed to carry natural gas only, i.e. it contains no liquid hydrocarbons or contaminating compounds. Therefore, in the event of loss of pipeline integrity, the TGP is not considered a credible source of liquid hydrocarbon spills. Also, as detailed in the TGP Offshore EP, subsea gas leak due to loss of pipeline integrity is not expected to have any adverse environmental impacts.

Hydrocarbon Spills

As detailed in the TGP Offshore EP and associated 'Oil Spill Contingency Plan' (OSCP), no operational chemicals are required on vessels used for inspection / maintenance activities and no refuelling will occur at sea. Therefore the most credible sources of hydrocarbon spills were identified as:

- Fuel tank breach on inspection or maintenance vessel (due to accidents during extreme weather events or vessel collisions) resulting in a fuel spill;
- Minor hydraulic/oil spills (maximum 100 L) from an ROV /AUV.

Response requirements in the event of a vessel hydrocarbon spill are summarised in Section 7.2 of this EP Summary and are detailed in the TGP OSCP.

Potential environmental impacts from unplanned events associated with the offshore TGP, and the proposed controls and mitigation measures to minimise these impacts, are summarised in **Appendix A** of this EP Summary.

5.2.3 Assessment of Identified Environmental Risks

As discussed in Section 5.1.2 above, the rating of environmental risks identified for the offshore component of the TGP were assessed at two levels:

- Inherent (untreated) risk (before any controls are put in place);
- Residual (treated) risk (after controls and treatments have been put in place).

The 'Environmental Aspects and Impacts Risk Register' contained within the TGP Offshore EP identifies the risk rating for each environmental aspect both pre and post application of controls and/or treatments.

Within Section 6 of the TGP Offshore EP, for each of the identified environmental issues, the following information is provided:

- Identification of aspects or activities and potential incidents that could result in environmental impacts;
- Description of the key environmental risks or impacts associated with each identified activity or incident and their significance;
- Details of the controls and mitigation measures that are implemented to ensure the identified environmental risk is reduced to ALARP;
- A summary of the environmental risk assessment related to each environmental issue; and
- A summary of the ALARP evaluation.

As shown in the 'Summary of Environmental Impacts and Controls' Table in **Appendix A** of this EP Summary, all environmental risks identified for pipeline operational, inspection and maintenance activities have been assessed as 'Low' following the application of controls and mitigation measures. Given the control measures in place and the infrequent nature, relatively small scale and short duration of pipeline inspection and maintenance activities, all identified environmental risks were considered to be ALARP.

6. ENVIRONMENTAL MANAGEMENT APPROACH

OSDAS has implemented a company-wide Environmental Management System (EMS), which has been developed in accordance with the principles of AS/NZS ISO 14001-2004. In line with AS/NZS ISO 14001 requirements, OSDAS's environmental management framework has a tiered structure, with all plans and procedures consistent with the corporate environmental policy and objectives. The guiding document with respect to the EMS is the 'Environment Management System Manual' (MS-MN-101), which provides hyperlinks to the relevant corporate environmental and quality procedures. The TGP Offshore EP is part of the tiered EMS structure and has been developed in accordance with the guiding principles of AS/NZS ISO 14001.

OSDAS, as the operator of the TGP on behalf of TGPPL, has engaged experienced contractors to undertake operation, inspection and maintenance activities along the offshore component of the TGP. OSDAS and its contractors are committed to responsible environmental management during TGP operations.

All employees and contractors working for the TGP are required to work in line with the TGP environmental policies, their EMS and EP requirements. All TGP activities will be conducted in accordance with the approved EP as well as relevant international, Commonwealth and State legislation, regulations, conventions and guidelines.

6.1 Environmental Responsibilities

The General Manager TGP, OSDAS is responsible for implementation of the TGP Offshore EP and conducting operation, inspection and maintenance activities in line with EP requirements; including coordination of contractors offshore.

External contractors are engaged for all offshore operations, inspection and maintenance activities. Contractor supervisors manage on the ground activities with the OSDAS Asset Engineer providing direct environmental management support regarding offshore inspection, maintenance and operations.

Responsibility for operation of the Control Room lies with Jemena who is engaged to perform these services under a sub-contract with Zinfra. The Control Room Manager, Jemena reports to OSDAS for all environmental matters.

Environmental support is provided by the corporate Health, Safety and Environment (HSE) and Technical Compliance groups in OSDAS, as well specialised environmental consultants engaged by OSDAS. All personnel are responsible for ensuring their work complies with the TGP Offshore EP.

All personnel associated with activities on the offshore pipeline are required to be aware of the environmental responsibilities described in the TGP Offshore EP and all other requirements related to working on and around the pipeline. The TGP Offshore EP is included as part of all contractual documents for works on the offshore TGP, and all contractors are required to comply.

6.2 Environmental Performance Monitoring

6.2.1 Environmental Objectives, Performance Standards and Measurement Criteria

Section 7 of the TGP Offshore EP details specific environmental performance objectives, performance standards and measurement criteria for offshore TGP operation, inspection and maintenance activities. OSDAS, as the operator of the TGP, accepts and is committed to

implementation of these environmental requirements. The environmental performance standards, performance criteria and documentation listed in the TGP Offshore EP are used to assess OSDAS's overall environmental performance against stated environmental objectives.

The environmental performance objectives listed in Section 7 of the TGP Offshore EP are directly linked to the identified risks and impacts from the ERA and the controls and mitigation measures implemented to reduce risks and impacts to ALARP. OSDAS's representative will conduct audits of the defined environmental performance standards and measurement criteria, both prior to and during inspection and maintenance activities, to verify the responsibilities and commitments of the TGP Offshore EP are carried out.

It must be noted that a breach of an environmental objective or performance standard constitutes a recordable incident, which must be reported to NOPSEMA in accordance with Section 7.6.4 of the TGP Offshore EP.

6.2.2 Monitoring of Legislation

OSDAS is responsible for identifying changes to codes and standards, reviewing applicable procedures and ensuring the knowledge is transferred to the relevant areas. OSDAS is also responsible for maintaining legislative compliance knowledge in the business and for updating a 'Legislative Compliance Register'.

Up-to-date compliance requirements are listed in the TGP 'Compliance Plan' (QR4-004PA-CP). Upon the receipt of a notification of a change in legislation relevant to the business, the change management procedure is followed in accordance with the 'Change Management Plan' (QR4-010PA-CMP). This includes a risk assessment process which may result in the addition of compliance measures to this plan. Changes to legislation are communicated to all relevant personnel.

6.2.3 Audits

Regulatory audits will be conducted as required by regulatory authorities. Generally, this is anticipated to be annually by NOPSEMA. All regulatory audit schedules are subject to change based on the requirement of the authority and the occurrence of environmental incidents.

As stated in Section 6.2.1 above, OSDAS's representative will conduct audits of TGP environmental performance standards and measurement criteria, both prior to and during inspection and maintenance activities (and as scheduled for all other activities) to verify the responsibilities and commitments of the TGP Offshore EP are complied with.

The General Manager TGP, OSDAS maintains a schedule of compliance audits for the TGP in accordance with the TGP 'Offshore Audit Management Plan' (QR4-009PA-AMP). Compliance audits of the TGP Offshore EP are to be completed annually to ensure that the EP continues to conform to relevant legislative requirements. The 'Audit Management Plan' outlines the requirements for compliance audits.

Copies of the results of the audits will be made available to the appropriate regulatory authorities upon request.

The work that contractors perform to maintain the TGP will be audited in line with the TGP 'Offshore Audit Management Plan' to ensure that appropriate standards are met on routine and project works. This is anticipated to be on an annual basis. In addition, each major inspection and maintenance contractor will be visited at least annually for an end-to-end

audit of their management systems and processes. Where shortfalls exist, corrective action requests will be raised and the close out of these items will be monitored through contractor management meetings.

6.3 EP Review and Amendment

The TGP Offshore EP (QR4-007PA-EP) will be reviewed and resubmitted for approval by the Regulatory Authority (NOPSEMA) in the following circumstances:

- Every five (5) years from the date of last acceptance, as required under Section 19 of the OPGGS Regs;
- In the event that a new or increased environmental risk is identified;
- In the event that there is any change or proposed change in circumstances or operations that results in a significant additional or modified risk not provided for in the existing EP;
- When requested by NOPSEMA.

Other examples of changes that may require the TGP Offshore EP to be revised and resubmitted include:

- Change in permit titleholder or operator in relation to an activity;
- Significant change in timing or location;
- Introduction of a new stage of an existing activity, new facilities or activities or modification of existing facilities or activities that fall outside the accepted EP;
- Following an event which highlights that environmental impacts or risks of an activity are greater than those predicted and agreed to in the accepted EP (e.g. major chemical spill).

Revision of the TGP Offshore EP will include a re-evaluation of the ERA, environmental performance objectives and implementation strategy, as well as a review of the TGP OSCP.

7. OIL SPILL CONTINGENCY PLANNING

7.1 TGP OSCP

In the event of a hydrocarbon spill, the response, notification and reporting will be in accordance with the TGP 'Offshore Oil Spill Contingency Plan' (OSCP) (QR4-016PA-OSC), which has been prepared in line with regulatory requirements. The OSCP outlines special requirements for oil spill management, including loss of oil, fuel and other hydrocarbons. All contractors are to adhere to the measures outlined in the OSCP.

The TGP OSCP includes detailed information on the following aspects of oil spill contingency planning and response:

- Objectives and scope of the OSCP;
- Regulatory requirements, and relevant legislation and international conventions;
- Integration with government and other agencies, including details of the National Plan, VicPlan, TasPlan and AMOSPlan;
- OSCP document interfaces and review;
- Criteria for selection of contractors and vessels;
- Overview of TGP operations and inspection / maintenance activities;
- Description of the Project area and existing environment;
- Properties of the hydrocarbons that could potentially be spilled;
- Identified spill scenarios, mitigation measures and oil spill modelling;
- Response management, including response priorities, response team structure and responsibilities, and statutory responsibilities (e.g. identification of Statutory Authorities and Combat Agencies);
- Initial spill response actions and notifications, including spill response tier levels;
- Detailed spill response strategies for Tier 1 spills ('monitor and evaluate' response) and Tier 2 escalation (including escalation requirements and notification requirements);
- Spill reporting requirements (including POLREP and SITREP);
- Termination and recovery procedures, including incident termination and debrief, environmental monitoring and evaluation, and waste management;
- Response readiness, including training and spill response exercises;
- Occupational health and safety (OH&S) considerations, e.g. fire and health risks; and
- Appendices, including Oil Spill Emergency Contact List; NOPSEMA Notification and Reporting Guide; POLREP Form; SITREP Form; AMSA Oil Spill Modelling Request form; Material Safety Data Sheet (MSDS) for Marine Fuel.

7.2 TGP Oil Spill Response Strategies

In the first instance, the vessel Emergency Response Team (ERT) will respond to an oil spill under their Shipboard Oil Pollution Emergency Plan (SOPEP) or OSDAS approved Vessel OSCP (or equivalent) which is aligned with the TGP Offshore OSCP. The vessel ERT will usually consist of contractor personnel and vessel crew.

All spills will be immediately reported to the General Manager TGP, OSDAS who is responsible for organising relevant external notifications (e.g. NOPSEMA, EPA and DTPLI).

Hydrocarbon spills less than 80 L will be dealt with under the vessel SOPEP/OSCP (or equivalent) and are not considered a reportable incident under the OPGGS Regs.

Any uncontained hydrocarbon spills over 80 L will be reported immediately to OSDAS Management and the relevant regulatory authority and deemed a Tier 1 event. OSDAS is the Combat Agency for all Tier 1 incidents.

When a Tier 1 spill incident occurs with the potential to escalate beyond the control of the vessel ERT, the OSDAS Emergency Management Team (EMT) is activated. As detailed in the TGP OSCP, in the highly unlikely event Tier 1 fuel spill, the OSDAS spill response is to 'Monitor and Evaluate'. Factors taken into consideration in determining this response strategy include:

- limited hydrocarbon volumes;
- the light, highly evaporative nature of vessel fuel;
- the high energy marine environment of the Bass Strait;
- dispersant application and other intervention measures may cause greater harm to sensitive environments than the hydrocarbons themselves; and
- the increase in health and safety risk from deploying containment and recovery equipment in high seas and remote locations, for hydrocarbons that are difficult to capture due to their composition.

OSDAS will closely monitor the behaviour and movement of any fuel spill should one occur and, in the highly unlikely event that its trajectory indicates that it may encroach on sensitive environments, then an escalation in response above 'monitor and evaluate' may be required.

OSDAS EMT is not equipped to deal with an escalated offshore spill beyond a 'monitor and evaluate' response. Any response beyond the capability of the vessel and OSDAS will be escalated to a Tier 2 event and require the assistance of external parties. This will be fully coordinated through the OSDAS EMT.

- For escalation scenarios in Commonwealth waters, AMSA will become the Combat Agency.
- For escalation scenarios in Victorian State waters, the Department of Transport, Planning and Local Infrastructure (DTPLI) will become the Combat Agency.
- For escalation scenarios in Tasmanian State waters, the Environment Protection Authority (EPA) will become the Combat Agency.

Although it is not anticipated that outside emergency response will be required, OSDAS recognises that working systems need to be in place and, hence the TGP OSCP outlines potential escalation scenarios.

It should be noted that, due to the size of vessels used during TGP inspection and maintenance activities, as well as the nature of the fuels used, a Tier 3 oil spill incident is not considered to be a credible scenario. Therefore, response actions in the event of a Tier 3 incident are not addressed in the TGP OSCP.

In an emergency, contractors are also to adhere to the TGP 'Emergency Response Management Plan' (NM2-002PA-ERMP).

8. CONSULTATION

As per Regulation 11A of the OPGGS Regs, in the course of preparing an EP or a revision of an EP, the titleholder must consult each of the following (a "relevant person"):

- each Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant;
- each Department or agency of a State or Territory to which the activities to be carried out under the EP may be relevant;
- the Department of the responsible State or Territory Minister;
- a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP;
- any other person or organisation that the titleholder considers relevant.

Consultation with the community and key stakeholders has been a feature of the TGP from its inception and will continue for the duration of the life of the TGP. Initial consultation prior to construction and during pipeline operations from 1999 to 2012 were undertaken by the previous TGP operator, Tas Gas Networks. During this period most stakeholders indicated they did not have major concerns during construction or operation of the TGP and no issues were recorded.

The current operator, OSDAS, is continuing environmental consultation on an as-needs basis. OSDAS has developed a TGP 'Consultation Plan' (TGP-698-PA-GEN-001) to regularly assess stakeholder expectations and answer enquiries as they arise.

The purpose of the TGP Consultation Plan is to:

- Keep key stakeholders up to date with TGP activities;
- Ensure timely response to stakeholder issues; and
- Maintain dialogue with regulatory authorities.

A diverse range of stakeholders has been identified as having potential interest in the management of operations along the pipeline. **Table 4** below identifies the key offshore TGP stakeholders and groups them into broad categories reflecting their differing interests.

Table 4 Key Stakeholders

Stakeholder	Group Description
Regulatory authorities	• DEPI • EPA Tasmania • EPA Victoria • MRT, DIER • NOPSEMA • NOPTA
Government organisations	• AMSA • Department of Defence • Department of Transport, Planning & Local Infrastructure (DTPLI)

Stakeholder	Group Description
Government organisations *(cont'd)*	• Energy Safe Victoria • Heritage Victoria • Marine and Safety Tasmania (MAST) • Office of the Economic Regulator (OTTER), Tasmania • Transport Safety Victoria (TSV) • Tasmanian Heritage Council • Victorian Work Cover Authority • Workplace Standards Tasmania
Government (local council, members of parliament)	• Shire of Wellington (Victoria) • George Town council
Interest groups	• Aboriginal organisations • Australian Pipelines Industry Association (APIA) • Basslink • Commercial fisheries (e.g. SETFIA) • Esso Australia Resources Ltd • Gippsland Lakes & Coast Regional Coastal Board • Gippsland Ports – Port Welshpool, Victoria • Landcare • Launceston Ports Authority • Parks Victoria • Parks & Wildlife Service Tasmania • Seafood Industry • Shipping Operators • Tourist groups • Tas Coastal Patrol • Tasmanian Ports Corporation, Bell Bay • West Gippsland Catchment Management Authority
TGP Service providers	• AMOG, Melbourne, Victoria • Oil States Industries, Houston, US • Tamboritha Consultants, WA • Wood Group Kenny, Melbourne, Victoria
General public (via the media)	The Age, The Herald Sun, The Weekly Times, The Mercury, ABC Radio and local papers

The General Manager TGP, OSDAS is the primary contact for government environmental agency officers with regard to environmental issues encountered offshore during operations and for enquires from relevant stakeholders. All communications with stakeholders pertaining to environmental matters to date has been recorded in an 'Environmental Correspondence Log' (as required under Section 11A of the OPGGS Regs; Section 19(b) of the Victorian Offshore Petroleum and Greenhouse Gas Storage Regulations 2011; and Section 22(b) of the Tasmanian Petroleum (Submerged Lands) (Management of the Environment) Regulations 2012).

To date, no stakeholders have lodged any objections to TGP activities or enquired about current TGP operations or inspection and maintenance activities. The low level of comments received is generally attributed to the location of the TGP on the seabed and unobtrusive/infrequent nature of TGP operations and maintenance activities.

If any enquiries or issues are to arise, OSDAS will provide stakeholders with a response in line with the TGP Consultation Plan.

9. CONTACT DETAILS

For the purposes of the TGP Offshore EP, the titleholder and nominated liaison person is:

Lindsay Ward
Chief Executive Officer
Tasmanian Gas Pipeline Pty Ltd
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60 Margaret Street
Sydney,
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10. ACRONYMS & ABBREVIATIONS

The following abbreviations, acronyms and terms have been used in this EP Summary.

ALARP	As Low As Reasonably Practicable
AMOSPlan	Australian Marine Oil Spill Plan
AMSA	Australian Maritime Safety Authority
AS	Australian Standard
ASME	American Society for Mechanical Engineers
AUV	Autonomous Underwater Vehicle
BHP	Broken Hill Proprietary Company Limited (now BHP Billiton)
CAMBA	China-Australia Migratory Bird Agreement 1986
CP	Cathodic Protection
dB	Decibels
DC	Direct Current
DEPI	Department of Environment and Primary Industries, Victoria (formerly DPI and DSE)
DoE	Department of Environment
DIER	Department of Infrastructure, Energy and Resources (Tasmania)
DSE	Department of Sustainability and Environment (now DEPI)
DTPLI	Department of Transport Planning and Local Infrastructure (Victoria)
EAPL	East Australian Pipeline Limited
EP	Environment Plan
EMP	Environmental Management Plan
EMS	Environmental Management System
EMT	Environmental Management Team
EPA	Environment Protection Authority
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ERA	Environmental Risk Assessment
ERT	Emergency Response Team
FY	Financial Year

GIS	Geographical Information System
GPS	Global Positioning System
ha	hectare
HDD	Horizontal directional drill
HSE	Health, Safety and Environment
IMCA	International Marine Contractors Association
IMDG Code	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
IP	Intersection Point
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement 1974
kg	kilogram
km	kilometre
KP	Kilometre Point
kV	kilovolts
L	litres
LAT	Lowest Astronomical Tide
m	metres
m^3	cubic metres
mm	millimetres
m/s	metres per second
MAOP	Maximum Allowable Operating Pressure
MARPOL	International Convention for the Prevention of Pollution from Ships
MAST	Marine and Safety Tasmania
MFO	Marine Fauna Observer
MLV	Main Line Valve
MNES	Matters of National Environmental Significance

MPa(g)	Mega Pascals (gauge)
MRT	Mineral Resources Tasmania (a division of DIER)
MSDS	Materials Safety Data Sheet
nm	nautical mile
NB	Nominal Bore
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOx	Oxides of Nitrogen
NOPTA	National Offshore Petroleum Titles Administrator
NZS	New Zealand Standard
OH&S	Occupational Health and Safety
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act* 2006
OPGGS Regs	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSCP	Oil Spill Contingency Plan
OSDAS	OSD Asset Services
OTTER	Office of the Economic Regulator, Tasmania
PJ	Petajoule
POLREP	Pollution Report
PPE	Personal Protective Equipment
RBI	Risk-Based Inspection
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement 2002
ROV	Remotely Operated Vehicle
SCADA	Supervisory Control and Data Acquisition system
SETFIA	South East Trawl Fishing Industry Association
SITREP	Situation Report
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Sulphur Oxides
SSS	Side Scan Sonar
t	tonnes

TAS	Tasmania
TasPlan	Tasmanian Marine Oil Pollution Contingency Plan
TGP	Tasmanian Gas Pipeline
TGPPL	Tasmanian Gas Pipeline Pty Ltd
TJ	Terajoule
TP	Tangent Points
TSV	Transport Safety Victoria
VIC	Victoria
VicPlan	Victorian Marine Pollution Contingency Plan
VIV	Vortex Induced Vibrations
^{o}C	degrees Celsius
%	percent

11. APPENDICES

Appendix A - Summary of Environmental Impacts and Controls

Appendix A: Summary of Environmental Impacts and Controls

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
ACTIVITY – OFFSHORE PIPELINE OPERATION					
Presence of operating subsea pipeline	Loss of pipeline integrity as a result of: • Physical damage (e.g. dropped objects, dropped / dragged anchors, sinking ships); • Fatigue damage (free spans) due VIV or subsea currents; • Internal corrosion of the pipeline.	Subsea gas release.	Injury to, or death of, marine fauna in the immediate vicinity of the release (particularly in the event of ignition resulting in a flash fire). Scouring / physical damage to benthic communities; and generation of a sediment plume in the water column, potentially leading to smothering of, or reduced light penetration to, benthic communities. Emission of greenhouse gases to the atmosphere.	• Basis of design (pipe material selection, wall thickness and concrete coating) to minimise potential damage to the subsea pipeline from external sources. • Continuous monitoring of pipeline integrity via the SCADA system. • In the event of detection in pressure drop through the SCADA system, the pipeline will be immediately isolated by closure of the onshore MLVs. This will automatically limit the volume of gas released (maximum 20TJ). • Periodic inspection of the internal condition of the pipeline using internal pigging devices. • Periodic inspection of the external physical condition of the subsea pipeline. • Any maintenance requirements identified during pipeline inspections (e.g. span correction, removal of dropped objects, repair of concrete pipeline coating and replacement of sacrificial anodes). • All pipeline inspection and maintenance activities are performed in accordance with the 'Offshore Operations and Maintenance Management Plan' (NM2-014PA-OMP) and 'Offshore Pipeline Operations and Maintenance Schedule' (NM2-015SH-OMP). • Maintenance of pipeline integrity is specifically addressed in the 'Pipeline Integrity Management Plan' (QR4-012PA-OPI). • Gas is filtered and is transported as "sweet dry" gas containing no liquid hydrocarbons or contaminating compounds. Maintenance of dry gas seals at Longford CS will prevent entry of liquid hydrocarbons (seal oil) into the pipeline. • Compliance with standard operating and maintenance procedures. • Pipeline route selection to avoid areas of significant benthic habitat. • No recognised aggregation areas (nesting, resting, breeding and feeding areas) for protected whales or dolphins within the area. • TGP included on AMSA Marine Navigation Charts to minimise the potential for anchoring in the vicinity of the offshore pipeline. • Training and induction for all relevant TGP personnel on relevant environmental issues. • Activation of Emergency Response Management Plan in event of loss of pipeline integrity.	**LOW**
	Pipeline spans (unsupported) causing vortex induced vibrations (VIV) along the pipeline.	Underwater noise.	Low level, localised underwater noise in the vicinity of the VIV. Marine fauna within the demersal zone expected to use avoidance behaviour and move away from the immediate area.	• Ongoing pipeline inspection surveys. In the event that a span with potential to lead to VIV is located, it will be scheduled for correction during the next maintenance activity. • Unsupported lengths of pipeline ("spans") are to be maintained to a maximum allowable length to reduce the likelihood of VIV. Rectification of span intervals to a maximum of 20 to 30 m (using grout bags in known free span locations to provide pipeline support). • Compliance with standard industry operating procedures. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Basis of design (pipe material selection and wall thickness). • Regular maintenance surveys to detect lengths of unsupported pipeline with increased inspection in vulnerable locations.	**LOW**
ACTIVITY - USE OF VESSELS DURING PIPELINE INSPECTION / MAINTENANCE					
Presence of vessel	Vessel movements	Vessel strike.	Injury or death to listed marine fauna (as protected under State or Commonwealth legislation or International conventions).	• Appropriately qualified / trained and experienced vessel personnel. Vessel Masters trained in appropriate vessel stand-off distances and other vessel-marine megafauna interaction management requirements. OSDAS to ensure appropriate training has been provided during vessel audits. • Peak migration and breeding seasons avoided where possible. • Marine Fauna Observer (MFO) present during inspection and maintenance activities to visually monitor for marine megafauna (e.g. cetaceans, seals and turtles). • Training and induction for all relevant TGP personnel on relevant environmental issues. • Works conducted in compliance with standard industry operating procedures and in adherence with all relevant international, national and state legislation, guidelines and conventions. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • The Director of National Parks will be notified prior to conducting any inspection and maintenance works within declared Commonwealth marine reserves.	**LOW**
	Vessel movements / timing and location of activities	Interaction of vessel and marine fauna.	Disturbance to marine fauna (including altered feeding, nesting, nursing, mating or migrating behaviour).		**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
Presence of vessel	Vessel movements / timing and location of activities.	Interaction of vessel and other marine users.	Disruption to other marine users (e.g. recreational vessels, fishing vessels and commercial shipping traffic).	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Appropriate consultation and effective liaison maintained with relevant stakeholders, which will be recorded in the consultation log. This will include providing a daily schedule of location of activities to affected parties (e.g. commercial fishing operators) and Notice to Mariners issued prior to departure. • Vessels equipped with full complement of navigation equipment, including GPS, navigation lights and continuous radio and radar watch. • Vessels will maintain a 500 m safety zone.	**LOW**
			Collision with other marine users (e.g. recreational vessels, fishing vessels and commercial shipping traffic), potentially leading to fuel spills (refer below).		**LOW**
	Vessel lighting.	Artificial light.	Disturbance to marine fauna (including altered feeding, nesting, nursing, mating or migrating behaviour).	• Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Lighting on survey vessels is not above that of normal commercial shipping traffic in Bass Strait. • Vessels used generally smaller than most commercial shipping traffic and will be undertaking inspection and maintenance activities during daylight hours. • While vessels may be lit at night, no additional lighting above that of normal safe vessel operation will be required. • Although some of the islands in the vicinity of the TGP offshore route are known breeding colonies for seals and seabirds, there are no recognised aggregation areas (nesting, resting, breeding and feeding areas) for protected whales, dolphins or turtles within the area. • Peak migration and breeding seasons avoided where possible.	**LOW**
	Vessel movements / operation.	Noise (underwater and airborne).	Disturbance to marine fauna (including altered feeding, nesting, nursing, mating or migrating behaviour).	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Level of noise generated by inspection and maintenance vessels similar to that of, or less than, commercial vessels expected in the area. Vessels used are generally smaller than most commercial shipping traffic. • No vertebrate fauna populations known to inhabit the immediate area of the pipeline outside the coastal zone, with inspection and maintenance activities confined to areas located at least 8 km from the nearest onshore breeding or home habitat. • All contracted vessels and equipment used in operations associated with the offshore pipeline shall be fit for purpose and operated in accordance with regulations and manufacturer specifications. Vessels and equipment will also be compliant with all relevant international, Commonwealth and State legislation, guidelines and conventions. • All equipment inspected and operational prior to commencing work and serviced in accordance with manufacturer specifications. OSDAS will audit contractor vessels and marine equipment to ensure that it is fit for purpose and satisfies relevant regulatory, statutory and Contract requirements. • Vessels adhere to a planned maintenance system that ensures engines and thrusters are maintained for optimum performance during survey activities. • Appropriately qualified / trained and experienced vessel personnel. Vessel Masters trained in appropriate vessel stand-off distances and other vessel-marine megafauna interaction management requirements. • Works conducted in compliance with standard industry operating procedures • Peak migration and breeding seasons avoided where possible. • MFO present during inspection and maintenance activities to visually monitor for marine megafauna. • Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location.	**LOW**
	Vessel anchoring.	Anchor dragging along the seabed.	Disturbance / damage to sensitive benthic marine fauna and ecosystems.	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Inspection and maintenance vessels will avoid anchoring (unless in an emergency). Use of anchors will be avoided in marine protected areas unless sufficient steps are taken to avoid dragging. • Pipeline route selection to avoid areas of significant benthic habitat. • The Director of National Parks will be notified prior to conducting any inspection and maintenance works within declared Commonwealth marine reserves. • Vessels equipped with full complement of navigation equipment, including GPS. Navigation charts will be referred to ensure avoidance of reefs and habitats in marine protected areas.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
Presence of vessel	Vessel anchoring.	Anchor dragging along the seabed.	Interference to commercial fishing activities (including damage to fishing equipment).	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Inspection and maintenance vessels will avoid anchoring (unless in an emergency). • Appropriate consultation and effective liaison maintained with relevant stakeholders, which will be recorded in the consultation log. This will include providing a daily schedule of location of activities to affected parties (e.g. commercial fishing operators) and Notice to Mariners issued prior to departure. • Vessels equipped with full complement of navigation equipment, including GPS, navigation lights and continuous radio and radar watch. • Vessels maintain a 500 m safety zone.	**LOW**
			Damage or disturbance to known, or previously unidentified, cultural heritage sites.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Inspection and maintenance vessels will avoid anchoring (unless in an emergency). • TGP pipeline route was selected to avoid known heritage sites, and no sites of Aboriginal or non-Aboriginal significance (including shipwrecks) were evident along the pipeline route during pre-construction surveys. • Known sites of cultural heritage significance have been recorded in the GIS for reference by contractors prior to any work in the vicinity of such sites. The GIS maintains details of known cultural heritage sites and, where possible, includes not only information to identify the location, but also details regarding the significance and management measures specific to each identified site. • Vessels equipped with full complement of navigation equipment, including GPS, to assist in identifying the location of known cultural heritage sites.	**LOW**
	Vessel biofouling.	Inappropriate biofouling management.	Introduction of exotic marine pests, potentially displacing native species, altering ecosystem function and affecting biodiversity.	• Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Appropriately qualified / trained and experienced vessel personnel. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Adherence to guidelines for biofouling management e.g. “National biofouling management guidance for the petroleum production and exploration industry”. • Biofouling management documentation on board, available to all relevant personnel. • Where required, vessel hull cleaned prior to exiting port. Record of hull cleaning certificate. • Where required, visual inspections for fauna attached to vessels. Records kept.	**LOW**
	Vessel ballast water.	Inappropriate ballast water management.	Introduction of exotic marine pests, potentially displacing native species, altering ecosystem function and affecting biodiversity.	• Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Appropriately qualified / trained and experienced vessel personnel. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Compliance with the Australian Ballast Water Management Requirements (Department of Agriculture, 2013). • Maintenance of ballast water log and submission of ballast water report in accordance with Department of Agriculture requirements. • Ballast water management documentation on board, available to all relevant personnel.	**LOW**
	Vessel deck drainage / bilge water.	Uncontrolled or inappropriate disposal of oily wastewater to the marine environment.	• Very minor, localised, short-term contamination of the marine environment, no impact on marine ecosystems or marine fauna expected. • Very minor, localised, short-term visible pollution / reduction of visual amenity.	• Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Appropriately qualified / trained and experienced vessel personnel. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Drainage from vessel decks with potential for oil, grease or hydrocarbon contamination either be collected and processed through an appropriately maintained oil/water separator prior to discharge, or stored onboard for onshore disposal by a licensed waste subcontractor. • Bilge water directed to an oil/water separator prior to discharge, or stored onboard for onshore disposal by a licensed waste subcontractor. • Where provided on-board, oil / water separation equipment will be regularly maintained and records kept. • Oil in water instrumentation certified (IMO) and calibration records maintained. • Spill kits provided on board vessels for clean-up of any spills to deck and vessel personnel trained in their use. • Waste chemicals and oils from the inspection and maintenance vessels taken directly from the vessel by licensed waste contractors.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
Presence of vessel	Vessel sewage / grey water.	Inappropriate disposal of sewage / grey water (i.e. nutrient rich wastewater, potentially containing pathogens and some domestic chemicals) to the marine environment.	• Very minor, localised, short-term contamination of the marine environment, no impact on marine ecosystems or marine fauna expected. • Very minor, localised, short-term visible pollution / reduction of visual amenity.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Appropriately qualified / trained and experienced vessel personnel. • All contracted vessels and equipment used in operations associated with the offshore pipeline fit for purpose and operated in accordance with regulations and manufacturer specifications. Vessels and equipment compliant with all relevant international, Commonwealth and State legislation, guidelines and conventions (including MARPOL). • OSDAS audit contractor vessels and marine equipment to ensure that it is fit for purpose and satisfies relevant regulatory, statutory and Contract requirements, including requirements related to waste management. • Works conducted in compliance with standard industry operating procedures. • All sewage and grey water treated and discharged in accordance with MARPOL requirements, i.e. sewage will not be discharged within 3 nm of land, unless the vessel has an IMO approved sewage treatment system certified to meet the operational requirements in Regulation 9.1.1 of MARPOL Annex IV; only treated sewage (macerated to fragment diameters less than 25 mm) will be discharged between 3 and 12 nm of land; untreated sewage may be discharged beyond 12 nm from land. • GPS records to confirm discharges are greater than 3 nm or 12 nm from land, as applicable. • Documented waste management procedures and disposal records (including for sewage).	**LOW**
	Solid wastes from vessel.	Uncontrolled or inappropriate disposal of solid wastes (e.g. plastic) from vessel to the marine environment.	• Injury to, or death of, marine fauna through entanglement in, or ingestion of, plastic and other solid wastes. • Very minor, localised visible pollution / reduction of visual amenity.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Appropriately qualified / trained and experienced vessel personnel. • All contracted vessels and equipment used in operations associated with the offshore pipeline fit for purpose and operated in accordance with regulations and manufacturer specifications. Vessels and equipment compliant with all relevant international, Commonwealth and State legislation, guidelines and conventions (including MARPOL). • OSDAS audit contractor vessels and marine equipment to ensure that it is fit for purpose and satisfies relevant regulatory, statutory and Contract requirements, including requirements related to waste management. • Works conducted in compliance with standard industry operating procedures. • Wastes managed in accordance with an approved Vessel Waste (Garbage) Management Plan prepared in accordance with the requirements of MARPOL Annex V. The Waste Management Plan includes written procedures for minimising, collecting, storing, processing and disposing of waste, including the use of the equipment on board. • No disposal of wastes overboard, except for macerated food waste, which may be disposed of at sea at least 12 nm from the nearest land in line with MARPOL requirements. • Appropriate, clearly labelled waste receptacles of sufficient capacity provided on board vessels to enable effective segregation and storage of wastes. Waste receptacles provided with lids / covers to prevent loss of containment of wastes. • All solid wastes (including non-macerated food wastes) contained on board in appropriate containers for onshore disposal in accordance with the relevant State regulations. • Volumes of all wastes generated recorded and the disposal path tracked in a Vessel Waste (Garbage) Record Book. • Temporary and localised activity along pipeline with no activity of long-term duration at any one location.	**LOW**
	Vessel operations - engine exhaust emissions.	Increased levels of atmospheric pollution (NOx, SOx and particulates) and greenhouse gases.	• Localised reduction in air quality. • Reduced visual amenity (e.g. black smoke and particulates). • Disturbance to shore based fauna (e.g. colonies of seals and seabirds).	• Training and induction for all relevant TGP personnel on relevant environmental issues. • All contracted vessels and equipment used in operations associated with the offshore pipeline fit for purpose and operated in accordance with regulations and manufacturer specifications. • Vessels and equipment compliant with all relevant international, Commonwealth and State legislation, guidelines and conventions (including MARPOL Annex VI). OSDAS will audit contractor vessels and marine equipment to ensure that it is fit for purpose and satisfies relevant regulatory, statutory and Contract requirements. • Vessels adhere to a planned maintenance system that ensures engines and thrusters are maintained for optimum performance during inspection and maintenance activities. Regular maintenance of vessels ensures fuel efficiency and minimises exhaust emissions, thereby reducing greenhouse gas emissions and air pollution. • Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Sulphur content of fuel oil used not to exceed 4.5% m/m • Fuel consumption monitored to ensure fuel efficiency. Records kept by vessel contractor.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
Presence of vessel	Storage and use of chemicals onboard vessel.	Loss of containment of chemicals onboard the vessel (maximum total storage 75 L), potentially leading to chemical spill to the marine environment.	• Very minor, localised, short-term contamination of the marine environment, no impact on marine ecosystems or marine fauna expected. • Very minor, localised, short-term visible pollution / reduction of visual amenity.	• Spills contained and recovered, where practical, in accordance with the approved vessel SOPEP/OSCP. • Appropriate spill response equipment, including containment and recovery equipment, available on-board and personnel trained in their use. • Regular spill response exercises will be conducted to test the effectiveness of the approved vessel SOPEP / OSCP. • The maximum volume of liquid chemicals stored on-board vessels will be no greater than 75 L. • Where practicable, contractors will select chemicals with low environmental impact (i.e. lowest toxicity, lowest bioaccumulation potential and highest biodegradability). OSDAS will review contractor's chemical selection process during vessel audits. • Hydraulic oils, lubricants and chemicals stored and, where practicable, handled within containment facilities, designed in accordance with relevant Australian / international codes and standards, to prevent the release of spilt substances to the marine environment. • Chemicals stored with appropriate segregation, in accordance with the IMDG code, to minimise the potential for reaction of incompatible chemicals. • Training and induction for all relevant TGP personnel (including contractors) on chemical handling, use and storage. • Where possible, vessel activity will avoid peak migratory and breeding seasons which will minimise impacts to marine megafauna in the event that a spill occurs. • Material Safety Data Sheets (MSDS) obtained when purchasing chemicals and are available on-board vessels for all chemicals stored and handled. MSDS provide important information regarding hazardous properties of the chemical, first aid treatment, spill clean-up instructions and PPE requirements. • All containers compatible with the chemical stored and clearly labelled. Chemical containers securely closed after use. • Waste chemicals are collected and stored in closed containers for onshore disposal. • Securing and restraining of loads on-board the vessel. • Temporary and localised activity along pipeline with no activity of long-term duration at any one location.	**LOW**
	Vessel movements.	Vessel collision / accident (e.g. grounding during extreme weather event) leading to vessel fuel tank rupture and spill (maximum volume of 40,000 L).	• Contamination of the local marine environment leading to degradation of marine ecosystems and potential toxicity impacts on marine biota (e.g. death, injury). • Disturbance to marine fauna including mammals, birds, reptiles and other organisms (i.e. altered feeding, nursing, mating or migrating behaviour). • Oiling of marine animals and coastlines / Visible pollution / reduction of visual amenity. • Disruption to other marine users such as commercial fishing and recreational users.	• Vessels contracted compliant with all relevant international, Commonwealth and State legislation, guidelines and conventions, including IMO / MARPOL requirements. OSDAS audits contractor vessels and equipment to ensure it is fit for purpose and satisfies relevant regulatory/statutory/ Contract requirements. • All Vessels have a SOPEP (or equivalent OSCP appropriate to size and class) in accordance with MARPOL 73/78 Annex I (Regulation 37). TGP OSCP also implemented in the event of a vessel fuel spill. • Appropriately qualified / trained and experienced vessel personnel. • Regular spill response exercises conducted to test the effectiveness of the approved SOPEP / Vessel OSCP and TGP OSCP. • Where possible, vessel activity to avoid peak migratory and breeding seasons which will minimise impacts to marine megafauna in the event of spills. • MFO present to visually monitor for marine megafauna (e.g. cetaceans, seals and turtles). In the event of a hydrocarbon spill, the MFO assesses any potential impacts on marine megafauna and, where possible, take appropriate action to minimise potential for fauna to come into contact with the spill. • Appropriate consultation and effective liaison maintained with relevant stakeholders to minimise the risk of accidental collisions and other incidents that may lead to a breach of fuel storage tanks. Daily schedule of location of activities to affected stakeholders and Notice to Mariners issued prior to departure. • Operations to occur only in appropriate weather windows. Maximum distance a vessel working near the pipeline could be from a safe mainland harbour is only 160 km. If weather conditions are predicted to deteriorate, vessels will terminate activities and seek refuge. • Vessels equipped with full complement of navigation equipment, including GPS, navigation lights and continuous radio and radar watch. • Vessels will maintain a 500 m safety zone. Vessels remain along the pipeline route (and within designated route to and from pipeline location). • MSDS available on-board for all fuels used. • Vessels & equipment operated and regularly maintained in accordance with regulations and manufacturer's instructions. Records kept & audited by OSDAS. • Temporary and localised activity along pipeline with no activity of long-term duration at any one location.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
Presence of vessel	Dropped objects from vessel (including inspection / maintenance equipment).	Physical damage to the seabed.	Disturbance / damage to sensitive benthic marine fauna and ecosystems.	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Pipeline route selection to avoid areas of significant benthic habitat. • Vessels equipped with full complement of navigation equipment, including GPS. Navigation charts will be referred to ensure avoidance of reefs and habitats in marine protected areas. • Securing and restraining of loads on-board the vessel to minimise potential for dropped objects.	**LOW**
ACTIVITY - PIPELINE INSPECTION					
Internal inspection of pipeline	Pigging.	Underwater noise.	Transitory, temporary underwater noise as the pig moves through the pipeline. Marine fauna within the demersal zone expected to use avoidance behaviour / move away	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Adherence to standard operational and maintenance procedures. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Pig runs are on a 10 year cycle and noise emissions within each run are transitory and temporary (next scheduled 2020). • Concrete coating provides buffer from internal noise. • Underwater noise emissions transitory and temporary as the pig moves through the pipeline. • Operations internal to pipe with no external effects expected.	**LOW**
ROV / AUV inspection	Use of ROV / AUV equipment / timing and location of activities.	Interaction of ROV / AUV equipment and marine fauna. *NOTE – Any underwater noise associated with ROV / AUV operation is considered insignificant when compared to vessel noise (refer above) and, hence, it was not addressed separately.*	Disturbance to marine fauna (including altered feeding, nesting, nursing, mating or migrating behaviour).	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Where possible, pipeline inspections to avoid peak migratory and breeding seasons which will minimise impacts to marine megafauna in the event of spills. • MFO present to visually monitor for marine megafauna (e.g. cetaceans, seals and turtles). • Works conducted in compliance with standard industry operating procedures (including IMCA R 004). • All ROV / AUV personnel hold valid and appropriate qualifications for their nominated roles and are assessed for competence. The ROV contractor ensures full details of personnel (qualifications, experience, medicals, training, etc.) are available to OSDAS. • Inspections on 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed.	**LOW**
ROV / AUV inspection	Use of ROV / AUV equipment / timing and location of activities.	ROV / AUV equipment dragging along the seabed.	Disturbance / damage to sensitive benthic marine fauna and ecosystems.	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Works conducted in compliance with standard industry operating procedures (including IMCA R 004). • All ROV / AUV personnel hold valid and appropriate qualifications for their nominated roles and are assessed for competence. The ROV contractor ensures full details of personnel (qualifications, experience, medicals, training, etc.) are available to OSDAS. • Pipeline route selection to avoid areas of significant benthic habitat. • Vessels equipped with full complement of navigation equipment, including GPS. Navigation charts will be referred to ensure avoidance of reefs and habitats in marine protected areas. • Position of ROV / AUV above pipeline ensures no disruption to seabed or epibenthos. • Inspections on 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed.	**LOW**
			Damage or disturbance to known, or previously unidentified, cultural heritage sites.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • TGP pipeline route was selected to avoid known heritage sites, and no sites of Aboriginal or non-Aboriginal significance (including shipwrecks) were evident along the pipeline route during pre-construction surveys. • Known sites of cultural heritage significance have been recorded in the GIS for reference by contractors prior to any work in the vicinity of such sites. The GIS maintains details of known cultural heritage sites and, where possible, includes not only information to identify the location, but also details regarding the significance and management measures specific to each identified site. • Vessels equipped with full complement of navigation equipment, including GPS, to assist in identifying the location of known cultural heritage sites. • Position of ROV / AUV above pipeline would ensure no disruption to cultural heritage sites on the seabed. • Inspections on 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
ROV / AUV inspection	Use of ROV / AUV equipment / timing and location of activities.	ROV / AUV equipment dragging behind the vessel.	Disruption to other marine users such as commercial fisheries (including damage to fishing equipment) and recreational users.	• Appropriately qualified / trained and experienced vessel personnel. • Vessels remain along the pipeline route (and within designated route to and from pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Appropriate consultation and effective liaison maintained with relevant stakeholders, which will be recorded in the consultation log. This will include providing a daily schedule of location of activities to affected parties (e.g. commercial fishing operators) and Notice to Mariners issued prior to departure. • Vessels equipped with full complement of navigation equipment, including GPS, navigation lights and continuous radio and radar watch. • Vessels maintain a 500 m safety zone. • Towed surface inspection equipment visible by flagging. • Inspections on 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed.	**LOW**
		Rupture of, or leak from, hydraulic hose on a ROV / AUV (maximum spill volume 100 L).	• Very minor, localised, short-term contamination of the local marine environment, no impact on marine ecosystems or marine fauna expected. • Very minor, localised, short-term visible pollution / reduction of visual amenity.	• Due to the size of the ROV / AUV equipment used, the maximum volume of any potential spill of hydraulic oil will be 100 L. • Hydraulic oils used in ROVs / AUVs are environmentally friendly oils with low toxicity, which will break down rapidly posing minimal threat to the environment. • Any hydraulic oil spills will be contained and recovered, where practical, in accordance with the approved vessel SOPEP/OSCP. • Appropriate spill response equipment, including containment and recovery equipment, available on-board and personnel trained in their use. • Regular spill response exercises will be conducted to test the effectiveness of the approved vessel SOPEP / OSCP. • Works conducted in compliance with standard industry operating procedures (including IMCA R 004). • Inspections on 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed. • All ROV / AUV personnel hold valid and appropriate qualifications for their nominated roles and are assessed for competence. The ROV contractor ensures full details of personnel (qualifications, experience, medicals, training, etc.) are available to OSDAS • Where possible, pipeline inspections will avoid peak migratory and breeding seasons which will minimise impacts to marine megafauna in the event that a spill occurs. • MSDS available on-board vessels for all chemicals stored and handled. MSDS provide important information regarding hazardous properties of the chemical, spill clean-up instructions and PPE requirements. • Equipment will be operated and regularly maintained in accordance with regulations and manufacturer's instructions. Records are kept and audited by OSDAS.	
Use of SSS for subsea pipeline surveys	Operation of SSS equipment.	Underwater noise.	• Potential injury to marine megafauna. • Disturbance to marine fauna (including altered feeding, nesting, nursing, mating or migrating behaviour).	• All contracted vessels & equipment used to be fit for purpose and operated in accordance with regulations and manufacturer specifications. Vessels & equipment also compliant with all relevant international, Commonwealth / State legislation, guidelines & conventions. • All equipment will be inspected and operational prior to commencing work and serviced in accordance with manufacturer specifications. OSDAS will audit contractor vessels and marine equipment to ensure that it is fit for purpose and satisfies relevant regulatory, statutory and Contract requirements • Appropriately qualified / trained and experienced vessel personnel. Vessel Masters shall be trained in appropriate vessel stand-off distances and other vessel-marine megafauna interaction management requirements. OSDAS to ensure appropriate training has been provided during vessel audits. • Peak migration and breeding seasons will be avoided where possible. • MFO present during inspection and maintenance activities to visually monitor for marine megafauna (e.g. cetaceans, seals and turtles). Any unintended marine megafauna encounters will be managed in accordance with EPBC Policy Statement 2.1 and Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000. • Vessels to remain along the pipeline route (and within designated route to and from the pipeline location). • Temporary and localised activity along pipeline with no activity of long-term duration at any one location. • Where required (although unlikely for the SSS equipment used), soft-start procedures will be implemented. • Inspections on a 2 to 5 year cycle (FY2018) unless other events occur or annual risk assessment requires remedial work to be performed. • No acoustic surveys undertaken where whales are observed breeding, calving, resting or feeding (as identified by MFO). • Discharge of acoustic services exceeding 140dB are not to commence unless no whales are found within a minimum distance of 3 km of the survey vessel.	**LOW**

Environmental Aspect	Source of risk	Environmental risk	Potential environmental impacts	Controls & Mitigation Measures	Residual risk
				• Start-up procedures will be delayed if whales are encountered within the 3km radius until they are observed to be travelling beyond this zone • Vessels will not travel within 100m of a seal colony if pupping season or within 50m of a seal colony at other times of year. • Avoidance of acoustic activity in close range of seals as a precautionary measure.	
ACTIVITY - PIPELINE MAINTENANCE					
Correction of spans outside specification	Jetting to remove high points.	• Physical damage to the seabed. • Increased turbidity from jetting process.	Disturbance / damage to benthic marine communities.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Compliance with standard industry operating procedures. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Pipeline route selection has minimised potential for span correction. • Pipeline route selection to avoid areas of significant benthic habitat. • Temporary and localised activity along pipeline with no activity of long-term duration at any one location (span correction only required in the event inspection identifies a problem).	**LOW**
		Underwater noise.	Any underwater noise associated with the jetting operation is considered insignificant when compared to vessel noise (*refer above*) and, hence, it was not addressed separately.		
	Placement and filling of grout bags.	Physical damage to the seabed.	Disturbance / damage to benthic marine communities.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Compliance with standard industry operating procedures. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Pipeline route selection has minimised potential for span correction. • Pipeline route selection to avoid areas of significant benthic habitat. • Disturbance highly localised and temporary. • Continuous monitoring of grouting operation by ROV, any loss of grout during filling of bags will be easily identified and rectified. • Shut off valves within grout pump system. • Due to its chemical properties, infrequent use and small volumes used, grout used in pipeline maintenance is not expected to have any adverse impacts on the marine environment.	**LOW**
		Underwater noise.	Any underwater noise associated with placement and filling of grout bags is considered insignificant when compared to vessel noise (*refer above*) and, hence, it was not addressed separately.		
Repair of concrete coating	Placement of concrete mattress over damaged area.	Physical damage to the seabed.	Disturbance / damage to benthic marine communities.	• Training and induction for all relevant TGP personnel on relevant environmental issues. • Compliance with standard industry operating procedures. • Installation in accordance with IMCA Concrete Mattress guidelines. • Adherence to all relevant international, national and state legislation, guidelines and conventions. • Concrete considered environmentally benign. • Final placement is assisted by the use of ROVs and/or divers to minimise damage and ensure correct positioning. • Disturbance highly localised and temporary. • Continuous monitoring of operation by ROV.	**LOW**
Removal of dropped objects	Environmental impacts and risks associated with removal of dropped objects are no different from those related to use of vessels and ROV / AUV equipment assessed above. In the ROV and SSS surveys conducted to date, the objects observed on or near the pipeline has not warranted any removal activity as they were considered small and harmless to the integrity of the pipeline. Dropped objects are prioritised along with spanning issues in any inspection surveys.				
Replacement of anodes	Environmental impacts and risks associated with replacement of anodes are no different from those related to use of vessels and ROV / AUV equipment assessed above. Existing CP anodes are currently depleting in line with the original design established for TGP. Eventual anode replacement will need to be considered in the 2030s.				