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# Subsea 7 Australia Contracting Pty Ltd

# LEARMONTH PIPELINE FABRICATION FACILITY: SITE SELECTION PROCESS

# APFAC017-HSE-00003

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# ABBREVIATIONS AND ACRONYMNS

| | |
| --- | --- |
| DJTSI | Department of Jobs, Tourism, Science and Innovation |
| DLPH | Department of Lands, Planning and Heritage |
| DoD | Department of Defence |
| DWER | Department of Water and Environmental Regulation |
| EPA | Environmental Protection Authority |
| EPBC | Environment Protection and Biodiversity Conservation Act |
| ESD | Environmental Scoping Document |
| FIFO | Fly in Fly out |
| Hs | Significant Wave Height |
| ILUA | Indigenous Land Use Agreement |
| km | Kilometre |
| LEP | Level of Ecological Protection |
| m | Metre |
| nm | Nautical mile |
| NWS | Northwest Shelf |
| PPA | Pilbara Ports Authority |
| PER | Public Environmental Review |
| SIA | Strategic Industrial Area |
| TEC | Threatened Ecological Community |
| UKC | Under Keel Clearance |
| WTO | World Trade Organisation |

# 1. INTRODUCTION

## 1.1 SCOPE

Subsea 7 Australia Contracting (Subsea 7) is the proponent for the Learmonth Pipeline Fabrication Facility, a proposal to develop and operate a pipeline bundle fabrication facility in northwest Western Australia. The proposal was initially referred to the Environmental Protection Authority (EPA) in late-2017 (Assessment Number: 2136), and a Public Environmental Review (PER) level of assessment was set (Figure 1.1).

This report has been prepared as a supporting document to the Learmonth Pipeline Fabrication Facility PER, and specifically addresses the following requirements from the EPA's Environmental Scoping Document (ESD) (EPA 2018a):

- Provide information on the site and tow route selection process, including alternatives considered;
- Provide a consideration of environmental values at risk for each site.

The site selection for the Learmonth Pipeline Fabrication Facility was undertaken during H2 2016, before the initial environmental referral to the EPA (Figure 1.1). This report therefore focusses on that process and the information available in 2016. Any environmental (or other) data from additional studies undertaken since this time has been included in the PER, and is not within scope of this report.

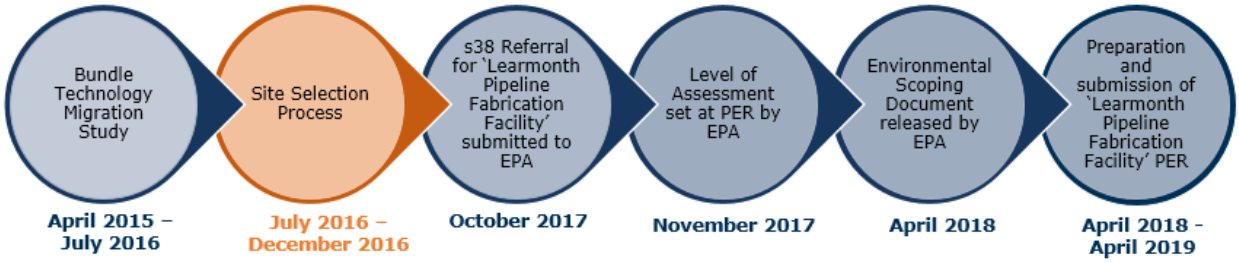



**Figure 1.1: Learmonth Pipeline Fabrication Facility project timeline**

To supplement the response to items within the ESD (EPA 2018a), a high-level qualitative assessment of the EPA environmental factors is presented in Appendix A (note: this qualitative assessment was not completed as part of the site selection process during 2016).

## 1.2 BACKGROUND

### 1.2.1 Bundle fabrication facilities

Subsea 7 is the only organisation globally that specialises in the build and launch of pipeline bundles.

A pipeline bundle ('Bundle') incorporates all structures, valve work, pipelines and control systems necessary to operate an offshore field development in one single product. Before launching, a towhead structure is attached to each end of the Bundle. The towhead structures can incorporate many functions from simple valve arrangements to complex processing and control systems. The system is fully tested onshore, and then launched offshore and towed to the offshore field for deployment.

The onshore component of a Bundle fabrication facility typically comprises of a pipe storage area, offices, fabrication shop, track and a launchway (Figure 1.2). The launchway allows the Bundle to be transferred into the water, and after this shore-crossing, no construction occurs within offshore waters. The Bundles are designed to have a specific in-water weight that allows the tow vessels to control their position and orientation during the launch and tow.

The Bundle is towed from the launchway by anchor handling tug vessels to the 'parking area' for submerged weight verifications and final system checks prior to open water tow. During this initial period of the tow, the Bundle is transported using an off-bottom tow method, whereby some contact with the seabed is made by the Bundle ballast chains. These ballast chains are typically Ø76mm chain, and 4-5 links of each length of chain may be in contact with the seabed. However, once the submerged weight is verified (at the parking area), and sufficient water depth is available, surface and/or controlled-depth tow methods can be used to transport the Bundle to the deployment site, and the Bundle and ballast chains will be clear of the seabed.

A 'permanent' Bundle fabrication facility is one that remains operational in a given area and is therefore capable of providing services to multiple offshore developments. A 'temporary' Bundle fabrication facility refers to one that is built to service a particular (i.e. one-off) project, and then deconstructed and removed. The infrastructure and construction activities associated with a temporary facility or permanent facility are similar as both require a pipe storage area, offices, fabrication shop, track, and a launchway. A temporary facility will have light duty infrastructure to simplify setup and decommissioning at the end of the Bundle construction project.

The deployment of Bundle technology focuses on developing local opportunities for onshore and offshore construction activities, while delivering a cost competitive technology to offshore oil and gas field operators. A key benefit of a permanent facility for Bundle technology is the development of a local knowledge base; a permanent facility promotes the establishment of a local site construction team which supports the continuity of projects and site maintenance activities. This site team would be supported by a regional engineering team that leverages the global capability of the Subsea 7 Bundle Technology Development Group.

The setup and operation of a temporary facility for the execution of a single project does not support the local benefits of a Bundle facility, as the project delivery team would be mobilised and demobilised with the site. The site setup and decommissioning cost is also challenging to qualify on the basis of one project, and a long-term investment strategy is required to maintain the market competitiveness of the Bundle technology.

**Figure 1.2: Concept drawing of onshore components of a Bundle fabrication facility**

### 1.2.2 History

Subsea 7 have a well-established permanent Bundle fabrication facility in Wick (Scotland), which has been operating sustainably since 1978 and services the offshore oil and gas industry within the North Sea. To date, this facility has fabricated and deployed 83 Bundles.

In addition to this permanent facility, Subsea 7 have also previously fabricated and deployed Bundles in Africa (eight) and Australia (two in Western Australia, one in Victoria) from temporary facilities.

### 1.2.3 Corporate strategy

A key objective of Subsea 7's strategic plan (the 'Vision 2020') (Subsea 7 2014) was to prioritise innovation as a way to improve the sustainability and efficiency within the offshore oil and gas industry. As such, Subsea 7 adopted an increased focus on both developing new technology, and also expanding the reach of their existing technology. With respect to the latter, this included extending the use of Bundle technology at permanent facilities beyond its original North Sea site.

A global Bundle Technology Migration Study (Subsea 7 2016) was undertaken by Subsea 7 to consider regions of the offshore oil and gas industry (outside of the North Sea) that may benefit from the use of Bundle technology and be viable for the development of a fabrication facility. The regions included in the study were:

- Africa;
- Asia Pacific & Middle East (including Australia);
- Brazil;
- Gulf of Mexico; and
- Canada.

The study included considerations of the following elements for each of the regions identified above:

- Local legislative frameworks, including World Trade Organisation (WTO) provisions and regulations;
- Health, safety, security and environmental considerations of operating a domestic site; and
- Domestic supply chain and logistics, including market research into client and project potential to ensure market demand could support a sustainable development.

The Bundle Technology Migration Study was completed by July 2016, and it concluded that Australia was the most suitable region for the deployment of Bundle technology. A selection of the high level reasoning behind this includes:

- The NWS and Bass Strait oil and gas industries are extremely remote in comparison to most other established offshore infrastructure hotspots. In turn, the mobilisation costs and challenges associated with bringing highly specialised pipelaying assets to this part of the world are high. Removing the need for these assets to mobilise to Australia is a significant advantage in executing future projects.
- Australia's oil and gas industry involves significantly more gas production in comparison to oil. Although bundles are appropriate for either production type, there are particular technical challenges with gas production that are well suited to solutions offered by bundle technology.
- The Northern and North-West region of Australia has seven (7) operational LNG facilities. The large assets have a long life service life, and require regular additional wells to be brought on line in order to maintain production levels as the existing reservoirs are depleted. This provides a level of certainty of the potential future market on which the business case for a long term bundle site could be based.
- Three bundles had previously been built, launched and installed in Australia. This track record provided confidence that Client uptake could be achieved.

In the assessment of Australia within the Migration Study, two regions were investigated, the Northwest Shelf (NWS) (Western Australia) region and the Bass Strait (Victoria) region. Subsea 7 has previously deployed Bundle technology from both of these regions (see Sections 1.2.2, 1.2.4). Following an assessment of the available, forecast and prospective subsea infrastructure market, the NWS region was deemed the most viable region to support the development of a new permanent Bundle fabrication facility.

### 1.2.4 Bundle technology in Australia

During the last 5-10 years the oil and gas industry in Western Australia has seen significant capital invested in the construction and development of offshore facilities, each with estimated field life ranging from 25 to 50 years. In order to maintain the oil or gas production in these fields, incremental subsea infrastructure developments will be required. As the initial reservoirs are depleted, new wells are required to be connected and brought online to continue the operation of the gas processing facilities. Bundle technology provides an innovative solution to this ongoing need for subsea infrastructure, and a single Bundle fabrication facility in the NWS region would be capable of servicing the majority of the NWS gas fields.

Bundle technology has been used in Australia previously, with previous Bundle fabrication and deployments occurring from two temporary facilities:

- Gnoorea Point, approximately 60 km west of Karratha (Western Australia), was used as a temporary facility to build and deploy Bundles for two projects during the 1990's.

- McGauran's Beach, approximately 21 km from Woodside (Victoria) and within the McLoughlin's Beach - Seaspray Coastal Reserve, was used for a single Bundle deployment in 1996.

Bundle technology and design has developed and progressed significantly since these deployments, and these improvements have changed the site requirements to support the technology.

# 2. SITE SELECTION PROCESS

## 2.1 OVERVIEW

The major challenge in developing a Bundle fabrication facility in a new region is to identify a site that is technically feasible, environmentally acceptable and has sufficient land available.

The selection of a site for the proposed Bundle fabrication facility within the NWS region of Western Australia followed a series of stages (Figure 2.1). The stages were designed such that a smaller number of sites were included in each subsequent stage of the assessment to filter out the unsuitable sites; i.e. all sites were considered in the Desktop Assessment, with only a sub-selection passing through to the Site Inspection and then again to the Site Investigations stages.


**Figure 2.1: Schematic of site selection process**

The process overview and outcomes for each of these stages is summarised separately in Sections 3–6. However, the factors, considerations, and decision-tracking tool common across all assessment stages are described below in Sections 2.3 and 2.4.

## 2.2 SPECIALIST ADVICE AND STAKEHOLDER ENGAGEMENT

Specialist advice and stakeholder engagement during 2016 was specifically focussed on supporting the site selection process only, and not the detailed engagement that has since been conducted as part of the PER process[1].

Subsea 7 is the only organisation globally that specialises in the build and launch of Bundles. To appropriately assess potential sites, key experts from the existing Bundle facility in Scotland, and the Bundle design team in Aberdeen (Scotland), were consulted with and were also mobilised to Australia during the site inspection stage (Table 2.1).

During the site selection process, project confidentially needed to be maintained. Experienced consultancies (under non-disclosure agreements) were also engaged during the site selection process to provide specialist advice on legal, tenure and environmental aspects (Table 2.1).

The initial external stakeholder engagement was focussed on obtaining advice from relevant government departments and agencies (Table 2.1). Additional stakeholder engagement was

[1] Subsea 7 considered it inappropriate to engage with local stakeholders (e.g. businesses, community and indigenous groups) for each potential site during this phase so as to avoid false intent or miscommunication.

also undertaken during the Site Inspection stage, with local shire and land owners consulted (Table 2.1, Section 5).

**Table 2.1: Involvement of internal and external specialists and key stakeholders**

| Stakeholder/Specialist | Purpose | Site Selection Stage |
|---|---|---|
| **Subsea 7** | | |
| • Group Technology<br>• Bundle Design<br>• Wester Site Build<br>• Local Business Unit | Provide technical expertise on the specific requirements for development and operation of a Bundle fabrication site. | • Desktop Assessment<br>• Site Inspection Assessment<br>• Site Investigations Assessment |
| **State government departments and agencies** | | |
| • Department of State Development[1]<br>• Landcorp<br>• Pilbara Port Authority<br>• Kimberley Port Authority | Provide advice on existing/proposed land-use and long-term State planning and development strategies. | • Regional Site Identification |
| • Department of Lands[2]<br>• Exmouth Shire | Provide advice regarding land tenure, planning and associated approvals | • Site Inspection Assessment |
| **Consultants** | | |
| • Squire Patton Boggs<br>• Taylor Burrell Burnett | Provide specialist advice on legal, land tenure, heritage, planning and associated approvals | • Desktop Assessment<br>• Site Inspection Assessment<br>• Site Investigations Assessment |
| • 360 Environmental<br>• Preston Consulting | Provide specialist advice on environmental aspects and associated approvals | |
| **Service providers** | | |
| • Neptune Marine Services | Undertake bathymetric surveys | • Site Investigations Assessment |

Notes:
1. Now the Department of Jobs, Tourism, Science and Innovation (DJTSI).
2. Now the Department of Lands, Planning and Heritage (DLPH).

## 2.3 ASSESSMENT FACTORS

Across each of the assessment stages of the site selection process the following six factors were considered:

- Marine conditions;
- Terrestrial conditions;
- Land tenure;
- Local infrastructure;
- Heritage values; and
- Environmental values[2].

[2] As the site selection process was undertaken before the initial Section 38 referral, and the release of the ESD (EPA 2018a), the environmental values assessment was not specifically aligned to the EPA's Environmental Factors identified for this proposal. During the Site Investigations stage, those environmental factors that were considered likely to require assessment were identified by specialist consultants (noting that the assessments themselves are not within the scope of this Site Selection Process report).

For each factor, the assessment was focussed on (but not limited to) the key considerations as listed in Table 2.2. It is acknowledged that some compromise may be possible on the below listed considerations, but significant deviations can jeopardise the feasibility of the site location. Any variations to the preferred case were noted in the assessments.

The site selection process did not compare or rank the sites against each other; each site was individually assessed against the six factors described below.

**Table 2.2: Key considerations for assessment factors**

| Factor | Key Considerations |
|---|---|
| Marine conditions | The proposed site needs to have:<br>• suitable marine access in order to launch the Bundles<br>• a beach interface with a sloping sandy transition (a gradient of 1:100 is considered ideal)<br>• sufficient nearshore water depth to allow for the tug vessels to be as close as practicable to the launchway[1] (distance to shore was ranked as ideal (<1.5 km), manageable (1.5–2.5 km) and not preferable (>2.5 km))<br>• relatively flat nearshore bathymetry to facilitate the launchway[2]<br>• sufficiently sheltered such that launch operations can be conducted safely (prevailing significant wave height (Hs) of <1.5 m between the launchway and submerged parking area is considered ideal)<br>• sufficient navigable marine corridor to allow for safe towing operations (nominally ~1,500m) |
| Terrestrial conditions | The proposed site needs to have:<br>• a minimum of 10 km available for the Bundle track<br>• a relatively flat onshore area between the fabrication site and the launchway (the Bundles can accommodate long, shallow vertical bends however the bend radius should not be <4,500 m)<br>• a relatively straight access path for the Bundle track between the fabrication site and the launchway (the Bundles can accommodate long, shallow horizontal bends, however this bend radius should not be <4,500 m)<br>• a straight access path in the immediate vicinity of the launchway (i.e. the standard 4,500 m bends are not suitable within the final access path; further, no large chicanes within 2 km and no smaller chicanes within 500 m)<br>A preference was also given to sites with substrates capable of supporting the bearing capacity requirements (up to 25 t/m$^2$) of the Bundle track without significant engineering remediation/stabilisation works. |
| Land tenure | The proposed site needs to have:<br>• available lots of the size required<br>• no conflicting existing leases/proponents that would impede the required development<br>• long-term security of land tenure, i.e. land that has a low risk of existing or future development impacting the operational capacity of the site |
| Local infrastructure | The proposed site needs to be:<br>• within a suitable proximity (≤1,000 nm)[3] of the offshore field developments<br>• within a suitable proximity (≤60 km)[4] of an existing town, and the existing town needs to be able to accommodate the fabrication facility workforce (no accommodation or FIFO facilities are associated with the fabrication facility; reasonable driving time to/from worksite)<br>• accessible by existing road infrastructure<br>• within a suitable proximity to existing marine infrastructure capable of receiving goods/materials<br>• within a suitable proximity to existing airports with regular services and freight capacity |

| Factor | Key Considerations |
|---|---|
| | • accessible to an appropriate amount of local industrial support (heavy industrial support is not a strict requirement, but there will be the need for basic local support for ease of fabrication, trades assistance, and established suppliers) |
| Heritage values | The proposed site will be checked for:<br>• proximity to sites of known indigenous significance, including any restricted access<br>• proximity to Native Title claims and/or determinations |
| Environmental values | The proposed site will be checked for:<br>• presence of Matters of National Environmental Significant (MNES) (as per the Commonwealth *Environmental Protection and Biodiversity Act 1999*)<br>• presence of conservation significant species and communities (as listed under the Western Australian *Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016*)<br>• consideration of potential significant impacts to any EPA environmental factors.<br>• proximity to any terrestrial or marine protected areas and their associated values and management requirements |

Notes:

1. Water depth required is based on a sufficient under keel clearance (UKC) for the tug vessels. Typical drafts of the tug vessels are 6.0-6.5 m; and therefore a screening water depth of at least 7.0-7.5 m (based on publicly available bathymetry data) was used. Note, vessel masters will typically prefer at least 2.0 m UKC, however the absolute minimum has been used in the desktop assessments to account for any interpolation and/or lack of detail in available bathymetry data.
   Tidal variation in the water depth is typically not considered when assessing the minimum water depth required, for the following reasons:
   a) During spring tides, whilst the high springs provide additional water depth that may be utilised, the low spring has the reverse effect. As launch operations take longer than a tide cycle, this does not assist in achieving predictable launch operations.
   b) During neap tides, whilst the neap high and low tides are closer to the mean sea level, it is not feasible to introduce the restriction to the timing of launch operations on top of the other existing criteria (such as suitable wave height, weather conditions, operational readiness, required on site dates, etc). If this was implemented, the available windows to launch bundles would potentially be excessively small.
   Upon review of this potential for additional water depth during neap tides post site selection, Subsea 7 do not consider that any of the potential sites that were assessed as unsuitable due to nearshore water depths, would have their assessments changed by inclusion of a specific tidal window. The sites with unsuitable UKC were generally only meeting this requirement at large distances offshore, so an allowance of even an additional 1-2 m was not going to make them viable. For example, Anketell did not reach the necessary UKC until ~13 km from the land, and even with a 7 km launchway, it was a further 6 km to the necessary water depth. If this water depth constraint was able to be lowered by say 2 m, the distance from the extended launchway to the tug would still be ~5 km range, which remains in excess of the preferred distance for operability.
2. Seabed profiles with outcrops or sandbar features are likely to require dredging or other construction works to smooth the profile.
3. Suitable proximity is based off maximum towing distance to maintain commercial viability.
4. Suitable proximity included consideration of transit time to and from the fabrication facility site to enable a locally based workforce. The proposal for the fabrication facility is not considered socially or commercially viable with a FIFO workforce. Driving distances less than the proposed limit were considered preferable so as to not induce additional fatigue on personnel; for example, a nominal distance of ≤60 km is preferred so that travel time is ≤1 hour.

## 2.4 ASSESSMENT DECISIONS

At each of the assessment stages (i.e. desktop, site inspection and final investigations), the following 'traffic light' system was adopted to track Subsea 7's decision against each factor (Table 2.3). The decision to progress a site to the next assessment stage of the site selection process was based on an integrated review of the assessment factors.

**Table 2.3: Decision key used to assess each factor**

| Assessment Outcome | | Description |
|---|---|---|
| Symbol | Definition | |
| | Suitable | • Key considerations for site requirements met<br>• No significant impact or risk identified<br>• It is considered that an identified potential impact or risk can be appropriately managed in accordance with the mitigation hierarchy to minimise environmental impact and align with objectives of the EPA environmental factor/s |
| | More information required | • Key considerations for site requirements not met, but site may still be feasible with further investigation<br>• Insufficient information to inform decision |
| | Unsuitable | • Key considerations for site requirements not met<br>• Potential for significant impact or risk identified<br>• It is considered that an identified potential impact or risk cannot be appropriately managed in accordance with the mitigation hierarchy to minimise environmental impact and align with objectives of the EPA environmental factor/s |

## 2.5 DATA SOURCES

The site selection process was undertaken during H1 2016 (see Section 1.1), and primarily sourced information from publicly available databases, including those listed in Table 2.4.

**Table 2.4: Type and source of publicly available information used during site selection process**

| Data Source | Description |
|---|---|
| Geoscience Australia | Australian Bathymetry and Topography Grid |
| Navionics | Electronic navigation charts |
| Google Earth | Aerial imagery |
| Seamap Australia | A nationally synthesised product of marine and coastal habitat data collected from various stakeholders |
| Australian Heritage Database | Database includes places on the World Heritage, National Heritage and Commonwealth Heritage lists |
| Aboriginal Heritage Places | Registered Sites under the WA *Aboriginal Heritage Act 1972* |
| Protected Matters Search Tool | Database of matters of national environmental significance or other matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* |
| FloraBase and NaptureMap | Database including conservation significant flora and fauna under the Western Australian *Biodiversity Conservation Act 2016* |
| Department of Biodiversity, Conservation and Attractions | State marine protected areas |
| Parks Australia | Commonwealth marine protected areas |
| National Conservation Values Atlas | Database of national data on Australia's marine environment, including biologically important areas for protected species. |
| SPRAT database | The Species Profile and Threats database is designed to provide information about species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999.* |

# 3. REGIONAL SITE IDENTIFICATION

## 3.1 OVERVIEW

Having established the offshore oil and gas field developments within the NWS region of Western Australia as a viable target market for Bundle technology (see Section 1.2.3), Subsea 7 undertook an initial screening to identify potential sites within this region that may be suitable for a fabrication facility. This initial screening for sites within the NWS region was based on three elements:

- Maximum towing distance of a Bundle;
- Open water tow operations; and
- Proximity to existing towns and infrastructure.

## 3.2 TOWING DISTANCE

A key consideration for the site is being a technically feasible distance from the offshore oil and gas developments that the fabrication facility would service. A maximum approximate tow distance of 1,000 nm (~1,850 km) was determined through detailed engineering studies that assessed the external forces exhibited on the Bundle during tow (e.g. wave, wind, current conditions) against the Bundle's capability to withstand these forces. The limiting case from the engineering analysis was the Bundle's fatigue strength (i.e. the Bundle's ability to withstand the repeatedly applied environmental loads) over the duration of the tow. With additional material added to increase the structural integrity of the Bundle, a tow duration (at nominal speeds) could be achieved that would safely reach 1,000 nm from the launch site. Feasibility of distances in excess of that could not be confirmed at this time, as longer distances would require additional structural material to the bundle to account for fatigue loading, which then required additional buoyancy, which in turn requires additional material and weight. It was considered that further extension of the towing distance was exceeding the limit of the practical application of the technology, given the level of assessment and analysis available at the time. Therefore, the 1,000 nm distance became the limiting criteria.

An area of interest was established by measuring this distance from the most southern (i.e. southwest of Exmouth) and northern (i.e. offshore from northern Kimberly coast) field locations of the NWS. This area of interest extends along the Western Australian coast from approximately Coral Bay to Wyndham; and also includes some southern islands of Indonesia (e.g. Java, Bali, Nusa) and East Timor (see the red-dashed line in Figure 3.1). Sites within this area of interest, would therefore be able to service oil and gas developments within the Northern Carnarvon Basin, Roebuck Basin, Browse Basin and western Bonaparte Basin.

## 3.3 OPEN WATER OPERATIONS

If an emergency event (e.g. cyclones) occurs during open water tow operations, it will be necessary to lower the Bundle to the seabed from its surface or controlled depth tow position. Consequently, tow routes transiting over areas of deep water are not considered operationally feasible due to this safety requirement, as in very deep water the bundle was liable to collapse due to hydrostatic pressure. Therefore, any site along the Indonesian/Timor coast was not considered feasible due to the need to transit through areas of very deep open water (e.g. Sunda Trench which has a maximum depth of >7,000 m; or the Timor Trough which has a maximum depth of >3,000 m) between a launch site and the deployment site on the NWS (see shaded bathymetry in Figure 3.1). Sites and subsequent tow operations along the Western Australian coast would be able to satisfy the requirement for Bundle placement on the seabed during emergency conditions as operations occur within the continental shelf area (i.e. water depths typically <200 m, but up to 1,500 m in some outer shelf areas).

## 3.4 EXISTING INFRASTRUCTURE

For the Bundle facility to be viable, it is necessary to be within a suitable proximity to existing airport facilities (to accommodate for freight transport). Coral Bay and Derby, while both within the area of interest defined by the towing distance (i.e. the red-dashed line Figure 3.1), do not have local airports and were therefore not considered further.

For the coastal towns (with local airports) in the Pilbara/Kimberley region (i.e. Broome, Port Hedland, Karratha, Onslow and Exmouth), an approximately 60 km buffer around each was established (see red-shaded areas in Figure 3.1). The buffer is based on the consideration of transit time to and from the work site. Due to the potentially intermittent nature of the workload (i.e. up to three Bundles fabricated and deployed each year) and the associated cost of a transient workforce, a Bundle fabrication facility is not considered commercially viable with a FIFO workforce. Therefore, as accommodation and living facilities are not a part of the development, any potential site needs to occur within suitable proximity[3] of an existing town with the ability to support the facility workforce (over a typical Bundles project, it is anticipated that an average of approximately 70-80 on-site personnel would be required).

## 3.5 SITE IDENTIFICATION

Following delineation of the area of interest and identification of local towns with capacity to support a suitable work force, Subsea 7 consulted with the government departments and agencies as identified in Table 2.1. The Department of State Development (now DJTSI) and Landcorp have designated Strategic Industrial Areas (SIAs) throughout Western Australia (Landcorp 2016). These SIAs are designed for heavy or strategic industrial use and are already connected to key infrastructure such as roads, rails and ports (Landcorp 2016). While there is no regulatory requirement to develop within SIAs, the areas were strongly regarded by DJTSI and Landcorp as being appropriate for consideration as Bundle fabrication facility sites, and consequently all SIAs occurring within the area of interest were listed as potential sites for further investigation:

- Browse SIA;
- Boodarie SIA;
- Burrup SIA;
- Maitland SIA;
- Ashburton North SIA.

Subsea 7 also identified the following additional five sites occurring within the area of interest and suitable for further investigation:

- Anketell Point – This area has been approved for use as a deep-water port, and therefore given that the area is already considered appropriate for marine operations, it was considered appropriate for further investigation as a Bundle fabrication facility.

[3] Suitable proximity included consideration of transit time to and from the work site so as to not induce additional fatigue on personnel; for example, a nominal distance of ≤60 km is preferred so that travel time is ≤1 hour.

- Cape Preston East – This site is used as an export facility for local iron ore mines; and therefore, similar to Anketell Point, it was considered appropriate for further investigation as a Bundle fabrication facility.[4]
- Exmouth – Subsea 7 have carried out marine operations from this area previously and suspected it may be feasible for use as a Bundle facility. However, it was acknowledged that the proposed area of Exmouth was within the Ningaloo Coast World Heritage area and within immediate vicinity of State and Commonwealth Marine Parks.
- Learmonth – Similar facilities and marine operability to the Exmouth area, however this site would avoid construction activities within the World Heritage area and Bundle launch operations directly within the Marine Parks.
- Gnoorea Point – although Bundle design and technology has significantly changed, this site was used for previous temporary Bundle fabrications and deployments in the 1990's, and therefore this site was added for further investigation.

These 10 potential sites (Figure 3.1) were carried through into the Desktop Assessment stage of the site selection process (Section 4).

[4] Cape Preston East is approximately 90 km from the nearest town (Karratha) but has a large corridor of land (>10 km) that could potentially be used as a Bundle track, and so Subsea 7 chose to include this site for further investigation.

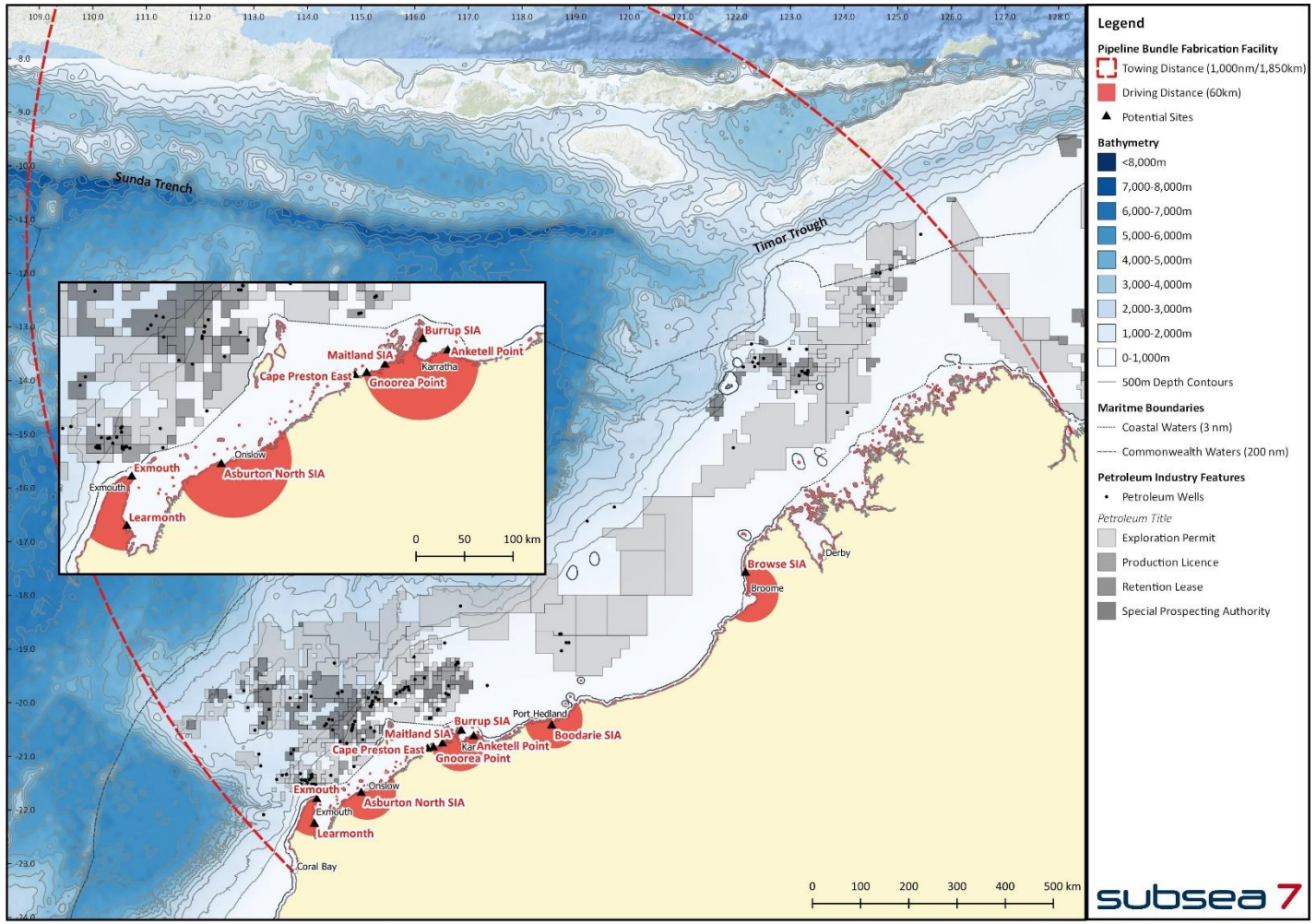



**Figure 3.1: Regional Site Identification for a Bundle Fabrication Facility within the NWS region of Western Australia**

# 4. DESKTOP ASSESSMENT

## 4.1 OVERVIEW

Following the Regional Site Identification process documented above, a Desktop Assessment was undertaken for the following ten potential sites for the proposed Bundle fabrication facility (in geographic order along the coast from north to south):

- Browse SIA;
- Boodarie SIA;
- Anketell Point;
- Burrup SIA;
- Maitland SIA;
- Gnoorea Point;
- Cape Preston East;
- Ashburton North SIA;
- Learmonth; and
- Exmouth.

The desktop assessments focussed primarily on the following four factors to determine if the development of a Bundle fabrication facility was technically feasible at a site:

- Marine conditions;
- Terrestrial conditions;
- Land tenure; and
- Local infrastructure.

If a site was considered unsuitable based on any of the above factors no additional assessment against the remaining factors (i.e. heritage or environmental values; Table 2.2) was undertaken.

The Desktop Assessment included reviews of a range of publicly available marine and terrestrial information, and environmental and heritage databases. Subsea 7 utilised both internal technical teams and external consultants (Table 2.1) during the Desktop Assessment process to provide specialist advice to support the decision-making process. Based on available data and specialist advice, an assessment for each factor at each site was completed. The decision to progress a site to the next Site Inspection Assessment stage was based on an integrated review of these assessment factors.

A summary of the key outcomes for each of the sites are included in the following subsections.

## 4.2 BROWSE SIA

The Browse SIA site was not progressed to the Site Inspection Assessment stage primarily due to unsuitable land tenure and marine conditions (Table 4.1, Figure 4.1).

**Table 4.1: Browse SIA – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • Beach interface may be appropriate in some areas; however, some beaches are backed by cliff features and perched beaches are common (and therefore the gently sloped beach transition would not be available).<br>• The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.1) due to the reduced safe operability and control of the Bundles from that distance.<br>• Oceanographic conditions potentially appropriate, although some concern regarding the exposed location to open ocean swells and large tides (and currents). | |
| Terrestrial conditions | • Availability of minimum track distance (10 km) is unknown due to other pending infrastructure developments. Additional crossings and/or bridges may be required to ensure a 10 km track length could be maintained.<br>• Gradually sloped site, average gradient over track length of 1:100 (Figure 4.1). | |
| Land tenure | • Government preference (at the time) was to retain the site for future development, specifically for servicing the Browse gas basin.<br>• SIA is predominantly Crown Land leased to LandCorp. However, the port area is vested with Kimberley Port Authority, and therefore a separate lease for this area would be required. | |
| Local infrastructure | • Distance to nearest town ~60 km.<br>• The SIA is a greenfield site and no services have been established within the area to date.<br>• Site development would therefore likely require funding to support road infrastructure or be reliant on the approvals and construction of road infrastructure from other developments. | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| | **Progress to the next stage of assessment:** | **No** |

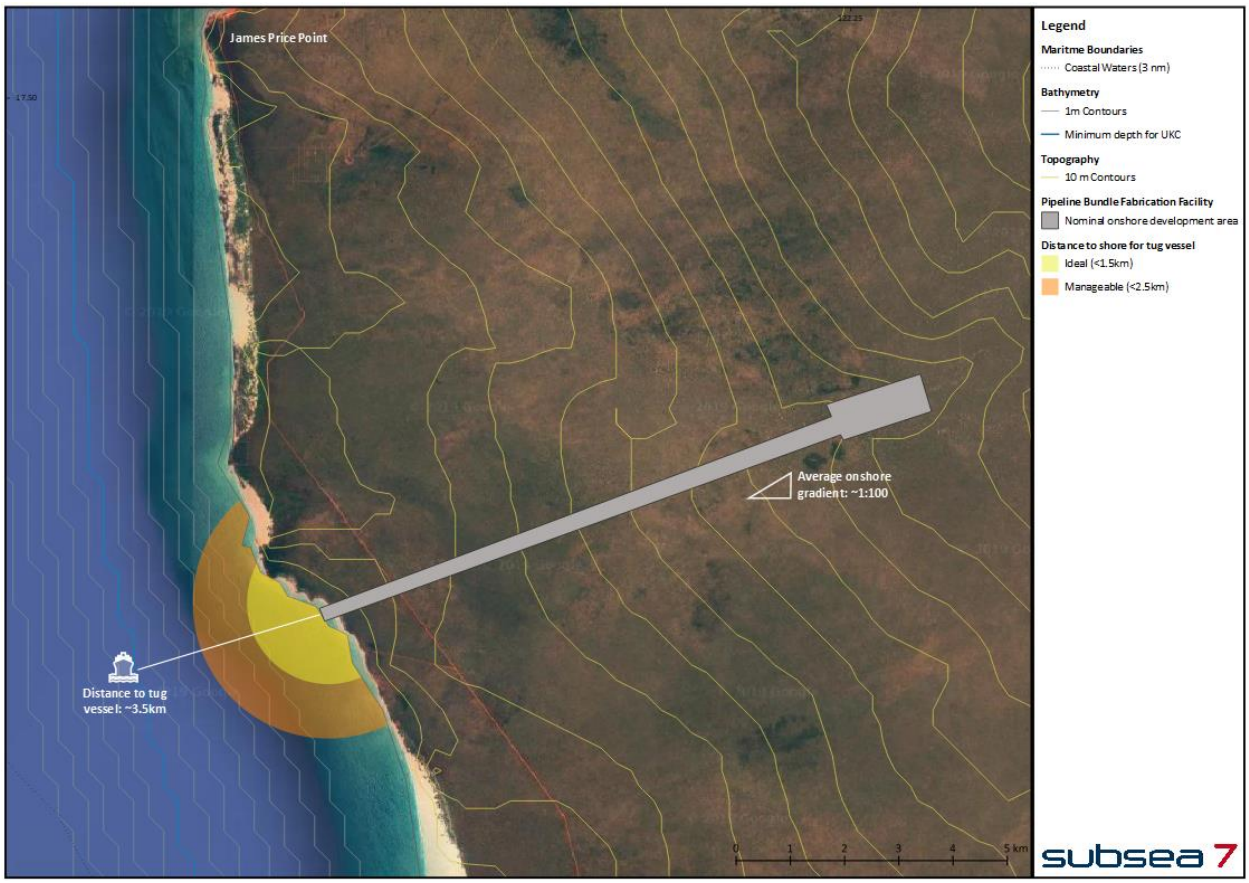



**Figure 4.1: Nearshore bathymetry and topography of the proposed Browse SIA site**

## 4.3 BOODARIE SIA

The Boodarie SIA site was not progressed to the Site Inspection Assessment stage due to there being no marine access within the boundary of the SIA (Table 4.2). As marine access is a critical element for a pipeline Bundle fabrication facility, no further assessments were completed for this site.

**Table 4.2: Boodarie SIA – Summary of Desktop Assessment outcomes**

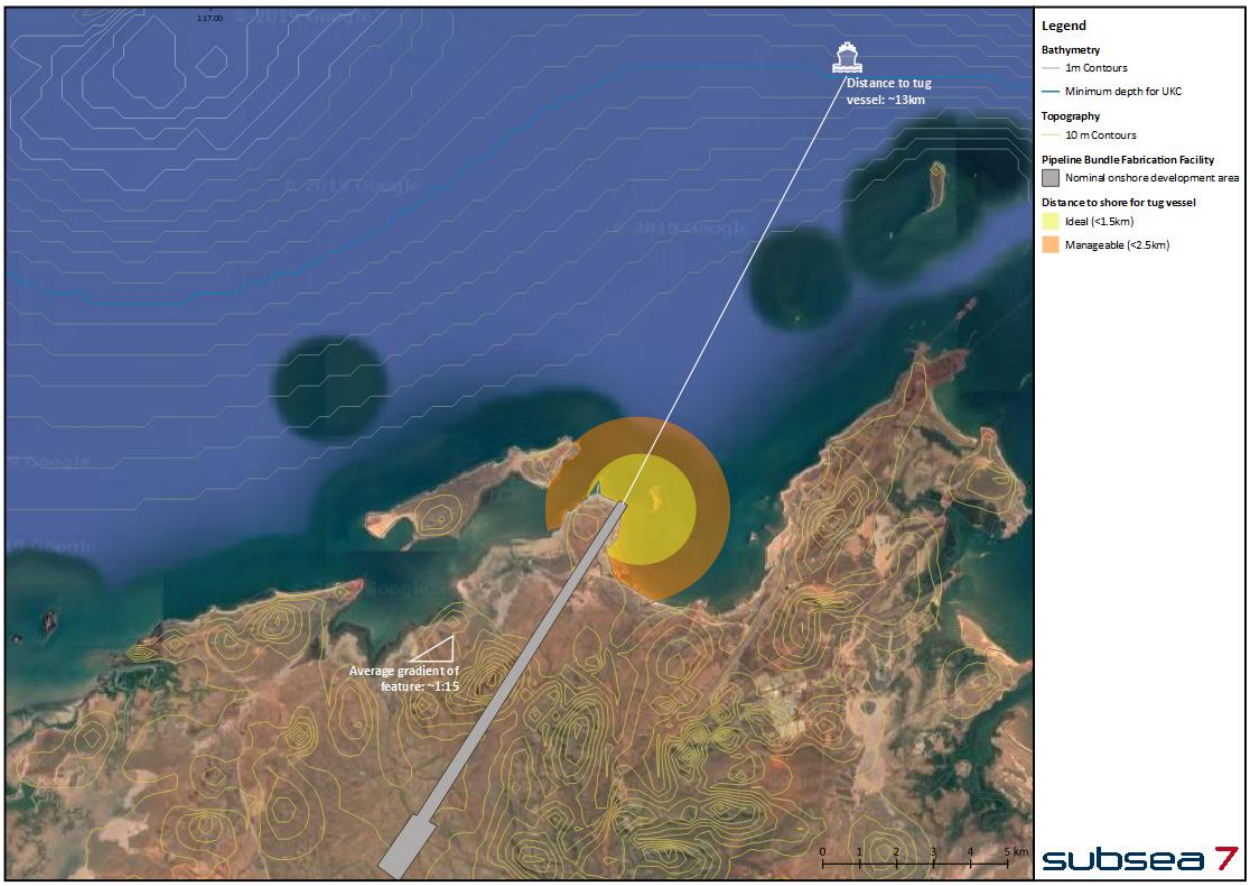
| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The Boodarie SIA is located approximately 12 km inland with no coastal interface or marine access. | |
| Terrestrial conditions | • No assessment completed for this factor. | |
| Land tenure | • The Boodarie SIA is located approximately 12 km inland with no coastal interface or marine access. | |
| Local infrastructure | • No assessment completed for this factor | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| **Progress to the next stage of assessment:** | | **No** |

## 4.4 ANKETELL POINT

The Anketell Point site was progressed to the Site Inspection Assessment stage, noting that further information was required regarding marine and terrestrial conditions and land tenure (Table 4.3, Figure 4.2).

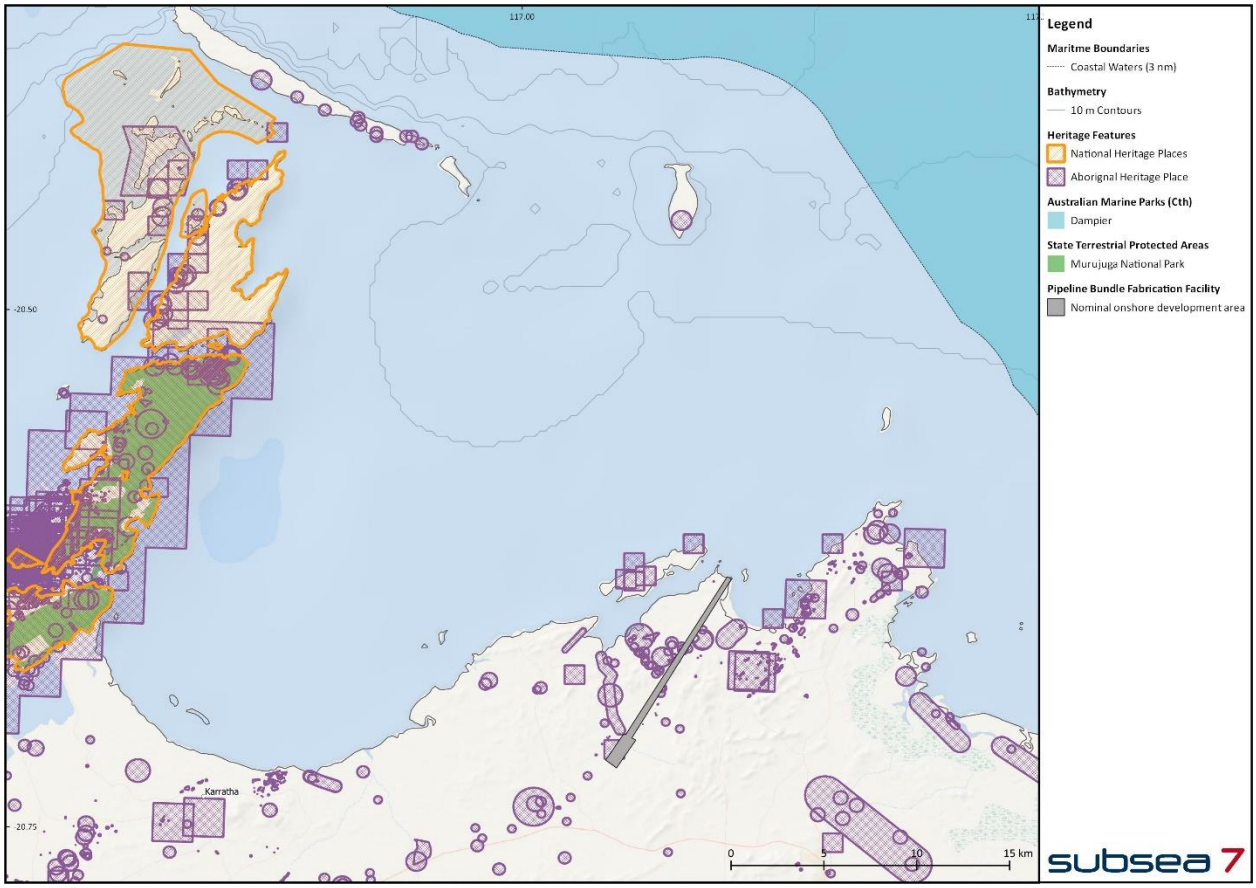
**Table 4.3: Anketell Point – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.2) due to the reduced safe operability and control of the Bundles from that distance.<br>• However, given the existing and/or proposed marine use of this area, construction of an extended launchway was considered as a potential way to reduce the distance to sufficient water depth and mitigate the above distance limitation. | |
| Terrestrial conditions | • Track length available is not within preferred limits; only ~8.8km would be available.<br>• Generally, relatively flat onshore topography; however, some features with higher gradients would not be suitable for track alignment (Figure 4.2).<br>• Inundation risk in coastal area.<br>• Ground remediation works (reclamation and/or stabilisation) are likely required. | |
| Land tenure | • Existing approval for Anketell Port development in same vicinity.<br>• Long-term access to port facilities uncertain. | |
| Local infrastructure | • Distance to nearest town ~50 km.<br>• Sufficient local industry and support base. | |
| Heritage values | • No known Native Title claims within the vicinity.<br>• Existing Indigenous Land Use Agreement in place for current Anketell Port development.<br>• Registered Aboriginal Heritage Places (e.g. artefacts/scatter, engravings) within immediate vicinity (Figure 4.3). | |
| Environmental values | • MNES were identified within the vicinity of the site, including threatened and/or migratory species such as flatback turtle, greater and lesser sand plover, and fossorial skink.<br>• Vegetation clearing permits are likely to be required.<br>• Nearshore benthic habitats and communities (e.g. corals, filter feeders) are known to occur within the vicinity.<br>• Coastal habitats (e.g. mangroves) are known to occur within the vicinity (Figure 4.4).<br>• Dampier Marine Park (Commonwealth) approximately 20 km offshore (Figure 4.4). | |
| | **Progress to the next stage of assessment:** | **Yes** |



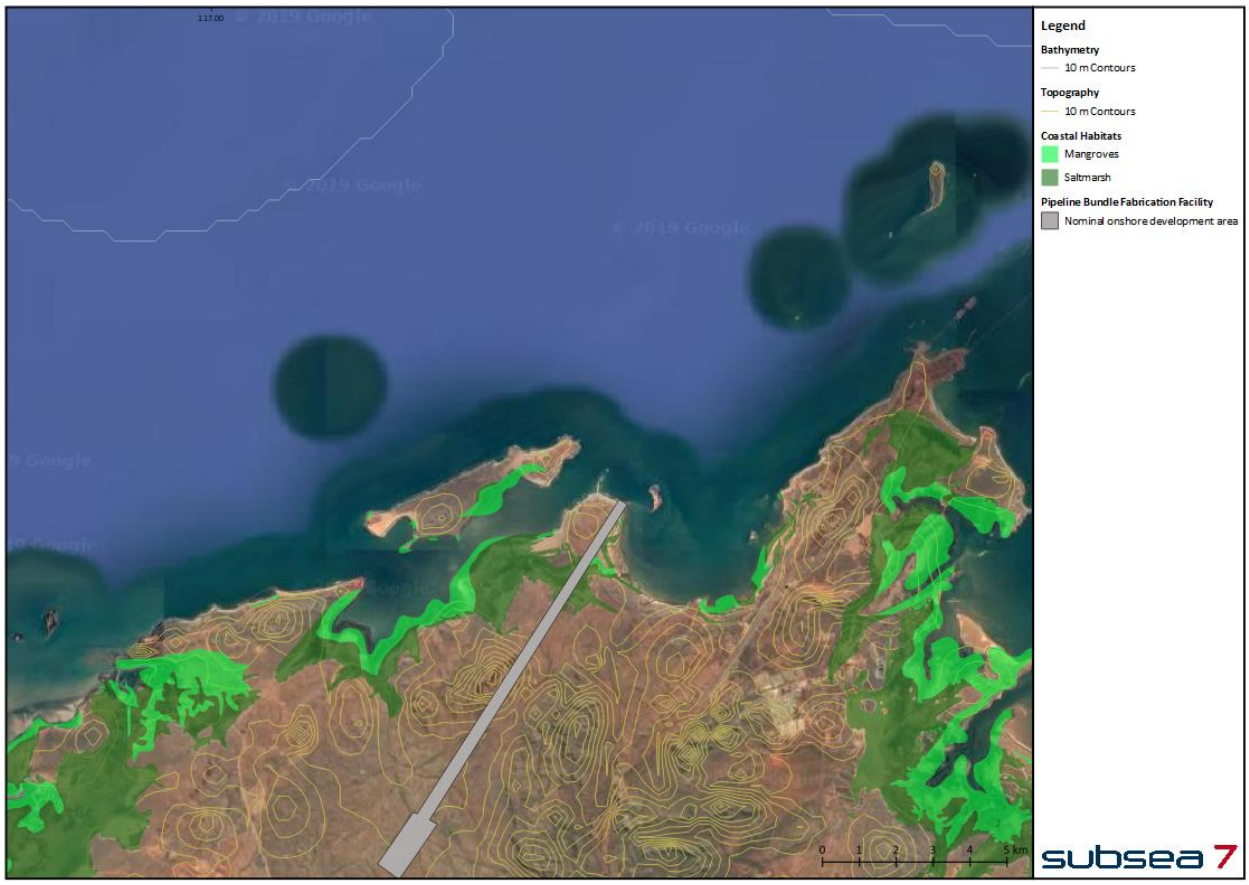

Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site. Track alignment was investigated further during the next assessment stages (Section 5.2).

**Figure 4.2: Nearshore bathymetry and topography of the proposed Anketell Point site**




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site. Track alignment was investigated further during the next assessment stages (Section 5.2).

**Figure 4.3: Heritage features and marine protected areas within the vicinity of the proposed Anketell Point site**




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site. Track alignment was investigated further during the next assessment stages (Section 5.2).

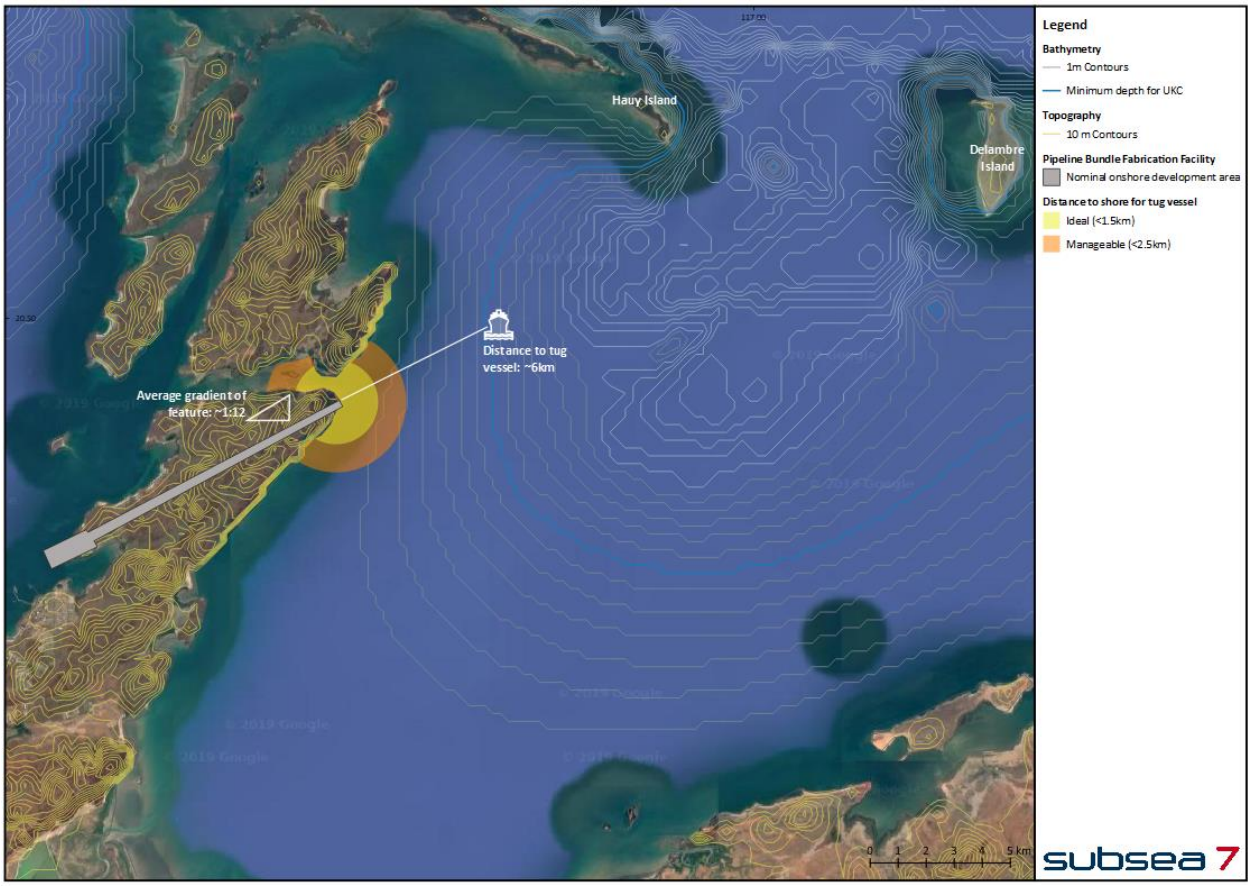
**Figure 4.4: Coastal habitats within the vicinity of the proposed Anketell Point site**

## 4.5 BURRUP SIA

The Burrup SIA site was not progressed to the Site Inspection Assessment stage due to unsuitable land tenure, marine and terrestrial conditions (Table 4.4, Figure 4.5).

**Table 4.4: Burrup SIA – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.5) due to the reduced safe operability and control of the Bundles from that distance.<br>• Hauy and Delambre Islands restrict potential tow route options (Figure 4.5).<br>• Unsuitable beach interface with a steep cliff shoreline. | |
| Terrestrial conditions | • Unsuitable onshore topography that would not allow for a suitable alignment for the Bundle track (there is multiple rises up to 100 m AHD over the length of the proposed track alignment) (Figure 4.5).<br>• Required track length extended outside of SIA (see Land Tenure). | |
| Land tenure | • The SIA is predominantly already allocated to existing proponents, therefore very limited land available for the onshore facilities.<br>• To achieve the required minimum track length, the proposed track alignment was required to be located to the north of the SIA, in an undeveloped area of the Burrup Peninsula. This would require extensive additional clearing, access road construction etc. | |
| Local infrastructure | • Distance to nearest substantial town ~30 km.<br>• Sufficient local industry and support base. | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| **Progress to the next stage of assessment:** | | **No** |




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site (this length is physically not available, and track alignment is outside the SIA boundary).

**Figure 4.5: Nearshore bathymetry and topography of the proposed Burrup SIA site**

## 4.6 MAITLAND SIA

The Maitland SIA site was not progressed to the Site Inspection Assessment stage due to unsuitable marine and terrestrial conditions (Table 4.5, Figure 4.6, Figure 4.7).

**Table 4.5: Maitland SIA – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.6) due to the reduced safe operability and control of the Bundles from that distance.<br>• Large number of shoals and islands within nearshore area; marine operations considered high risk. | |
| Terrestrial conditions | • Proposed track alignment is through mangrove habitat and intertidal creek systems (Figure 4.7), and therefore ground conditions are likely to be unsuitable given the bearing capacity requirements for the Bundle track; and therefore, ground improvement works would be required.<br>• Significant inundation risk in coastal area. | |
| Land tenure | • Initial assessment indicated that land was available and would likely be able to be secured for long term use. | |
| Local infrastructure | • Distance to nearest town ~60 km.<br>• Sufficient local industry and support base. | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| **Progress to the next stage of assessment:** | | **No** |

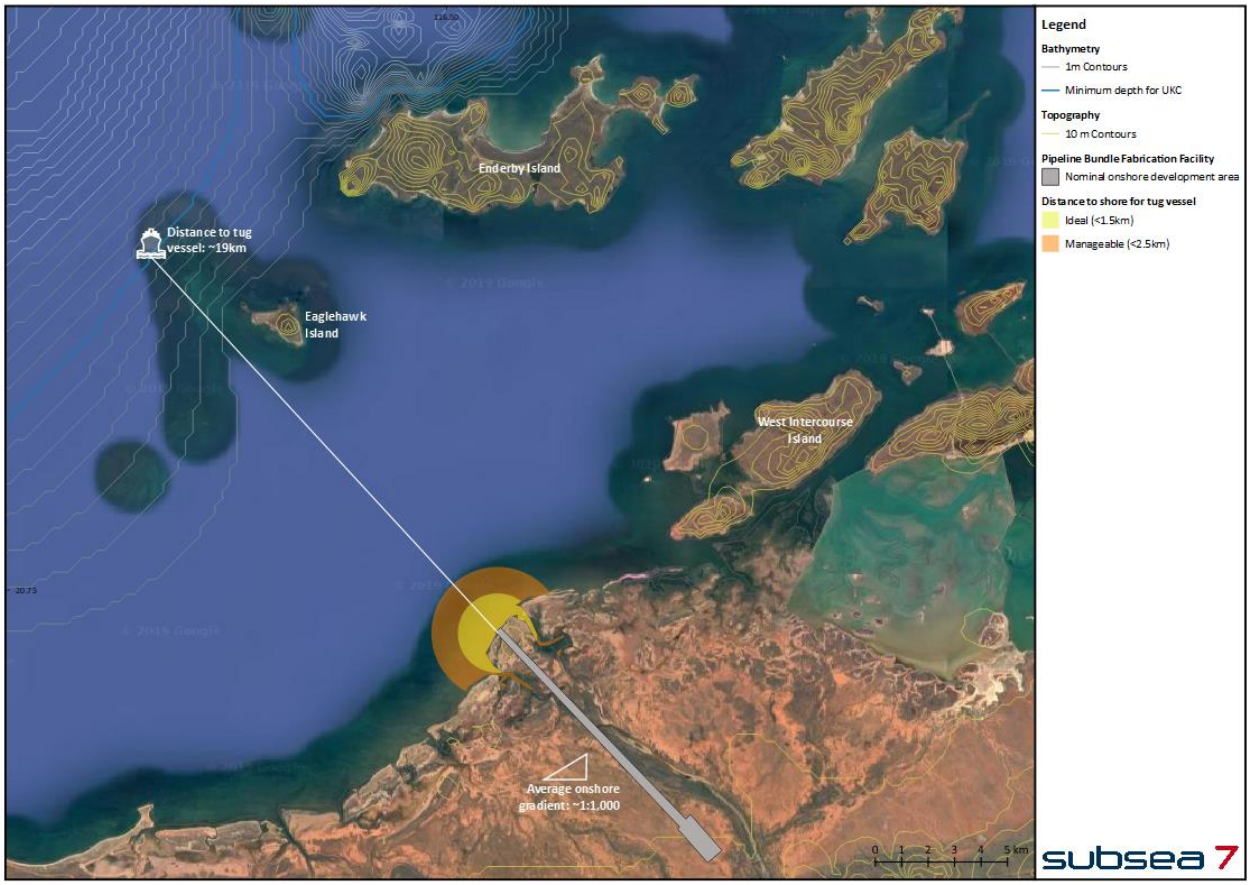



**Figure 4.6: Nearshore bathymetry and topography of the proposed Maitland SIA site**

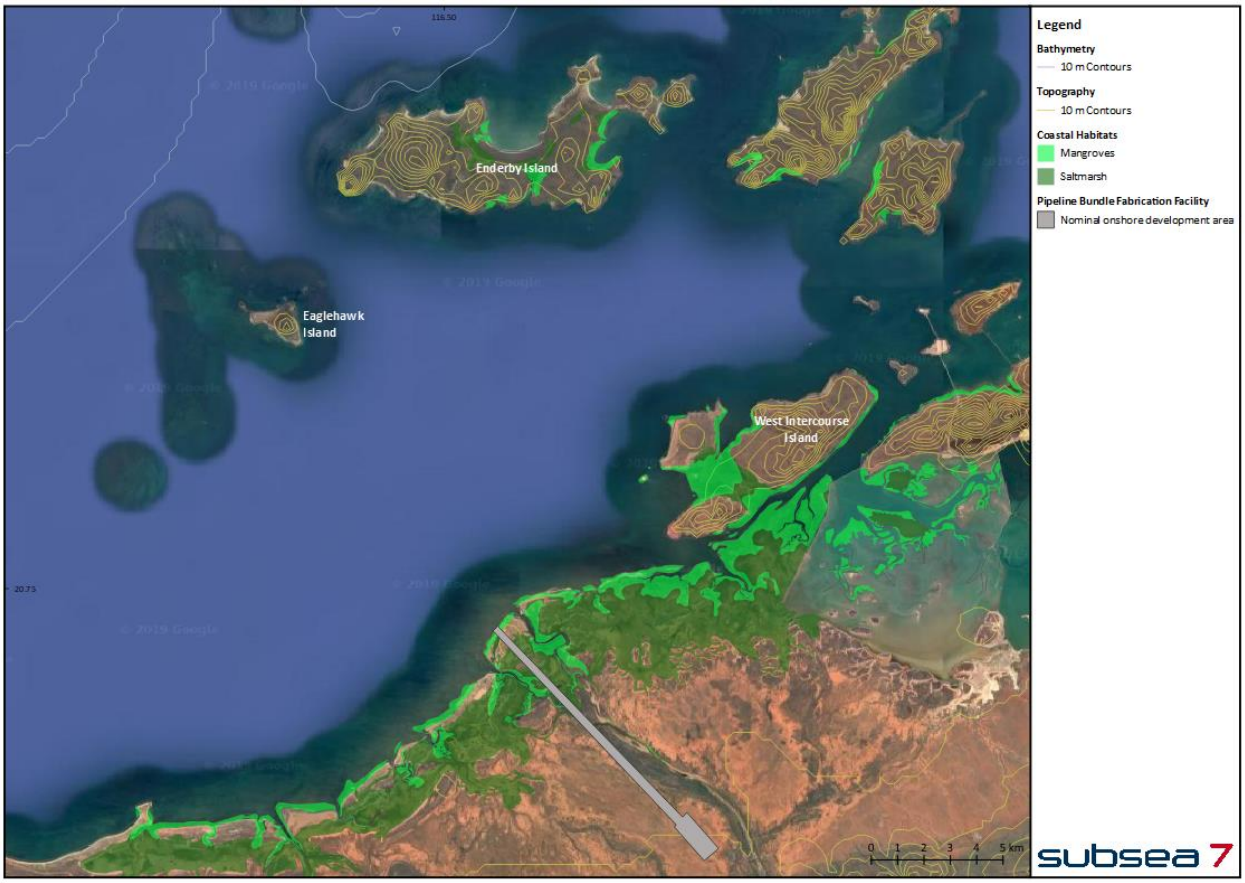



**Figure 4.7: Coastal habitats within the vicinity of the proposed Maitland SIA site**

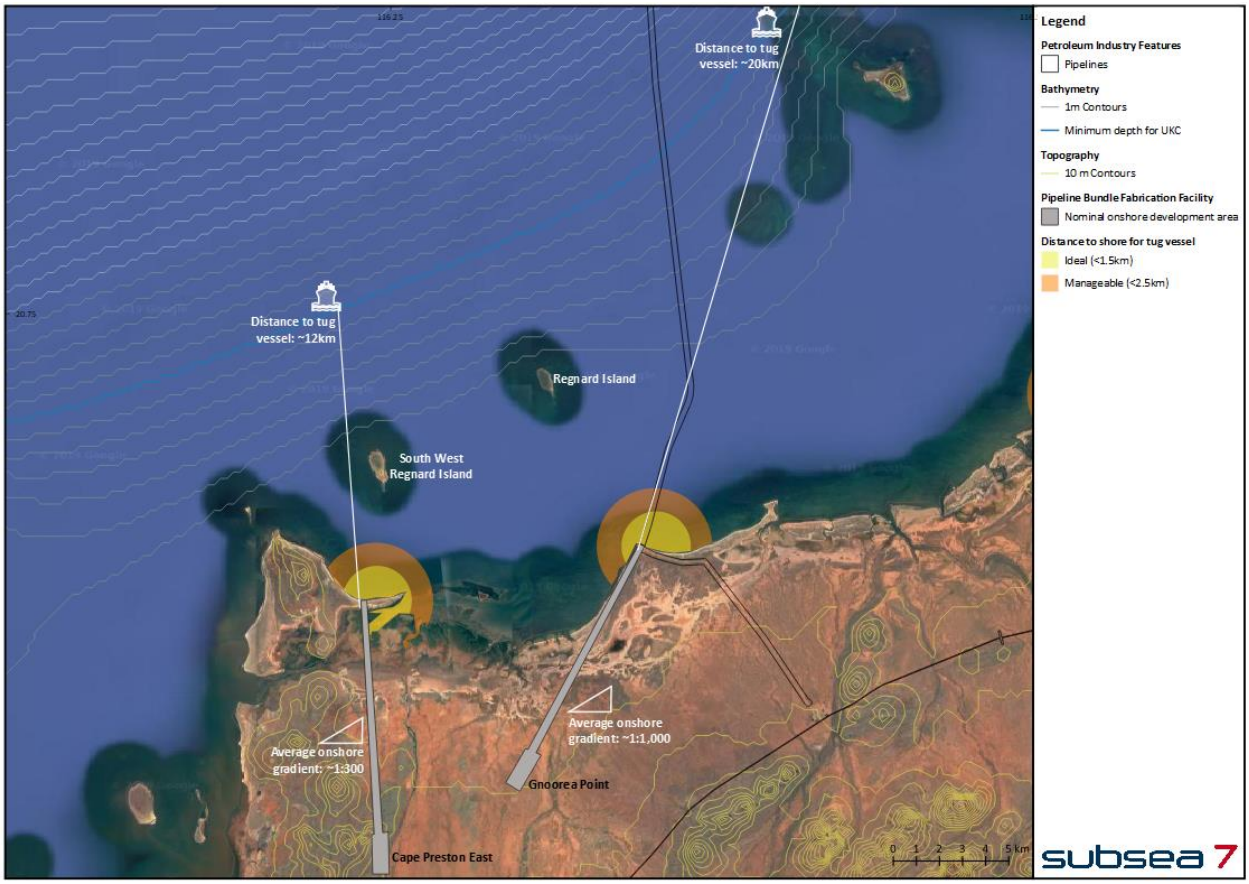
## 4.7 GNOOREA POINT

Gnoorea Point was progressed to the Site Inspection Assessment stage despite being assessed as having unsuitable marine and terrestrial conditions (Table 4.6, Figure 4.8). Given this site was previously used as a temporary Bundle fabrication and deployment site, Subsea 7 wanted to undertake a site inspection and further investigation to confirm the outcomes of the Desktop Assessment.

**Table 4.6: Gnoorea Point – Summary of Desktop Assessment outcomes**

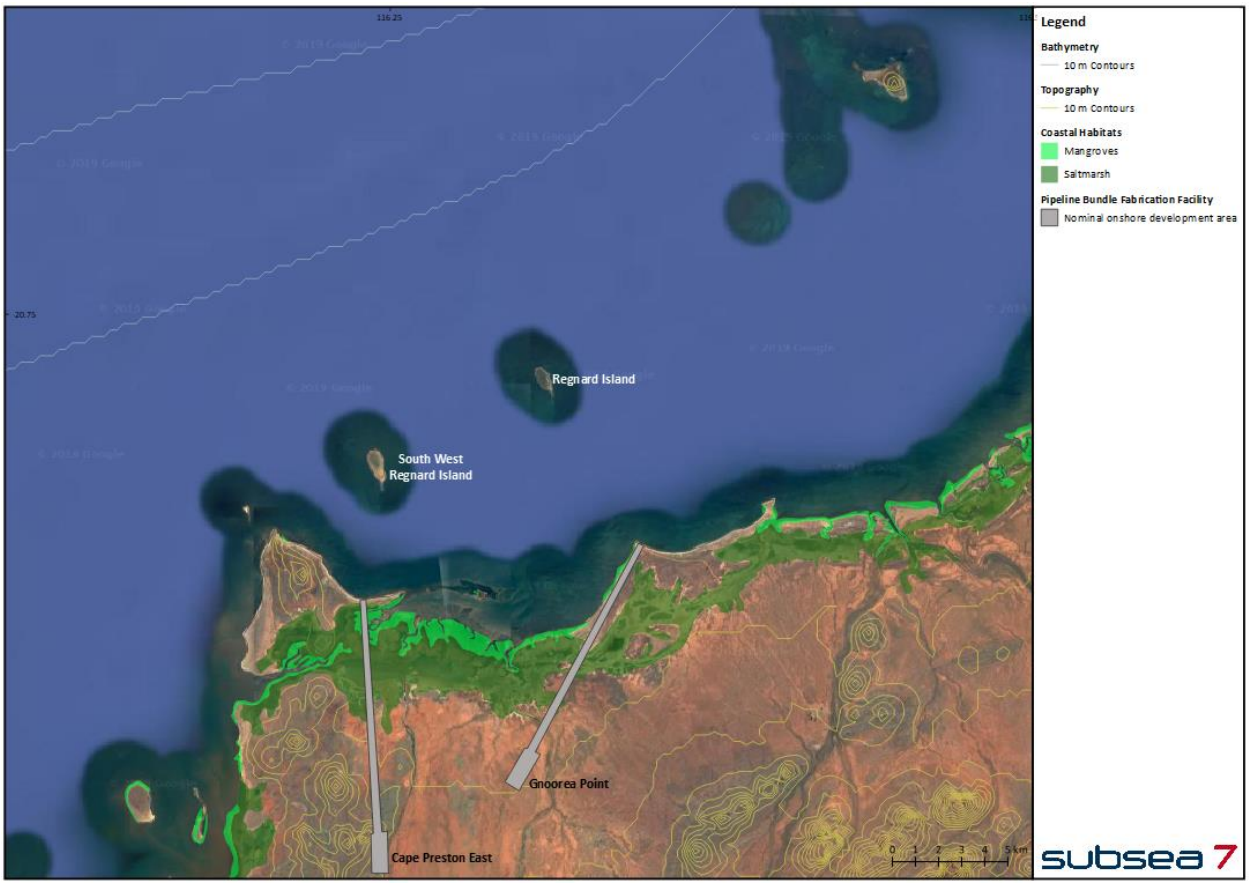
| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.8) due to the reduced safe operability and control of the Bundles from that distance.[1]<br>• Nearshore seabed not flat, and therefore dredging may be required.<br>• An operational subsea pipeline (associated with the Devil Creek Gas Plant) is within the immediate vicinity of the proposed site (Figure 4.8); it is considered unlikely that tow operations in the shallow waters within the vicinity of the pipeline would be approved.[2] | |
| Terrestrial conditions | • Track length available is not within preferred limits; ~2.6 km would be available.<br>• Alternate track routes would likely require ground remediation and/or stabilisation engineering works due to the presence of mangroves and intertidal mudflat habitats (which are unlikely to have suitable bearing capacity requirements) (Figure 4.9).<br>• Inundation risk in coastal area. | |
| Land tenure | • Coastal area is popular and used for recreational purposes.<br>• Gnoorea Point is a registered camp ground.<br>• Availability and security of land for fabrication site is unconfirmed. | |
| Local infrastructure | • Distance to nearest town ~60 km.<br>• Sufficient local industry and support base. | |
| Heritage values | • Registered Aboriginal Heritage Places (e.g. artefacts/scatter) within vicinity of launchway (Figure 4.10). | |
| Environmental values | • MNES were identified within the vicinity of the site.<br>• Proposed State Regnard Marine Management Area within the vicinity.<br>• Areas of coastal (e.g. mangrove) and subtidal (e.g. coral, macroalgae, seagrass) known to occur within the vicinity. | |
| | **Progress to the next stage of assessment:** | **Yes** |

Notes:
1. The Bundles launched from temporary facilities in the 1990's were much shorter and therefore vessels with different specifications were used (see Section 5.3.1).
2. Subsea 7 have a long track record of towing Bundles over 'live' pipelines in the North Sea, and confirming that no impact has occurred following each tow. However Australian pipeline licenses are more stringent, and approval of tow operations is considered a risk for this site.



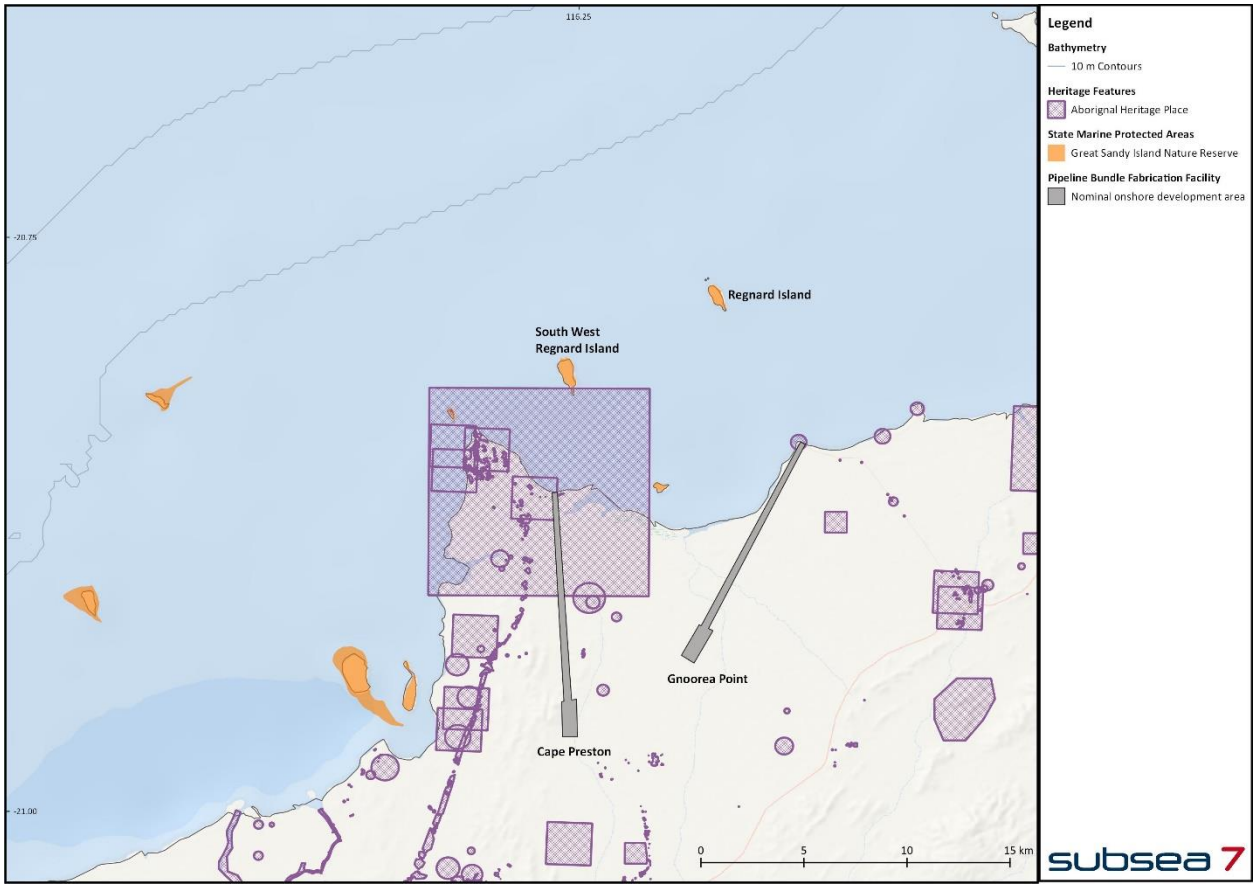

Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site.

**Figure 4.8: Nearshore bathymetry and topography of the proposed Gnoorea Point and Cape Preston East sites**




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site.

**Figure 4.9: Coastal habitats within the vicinity of the proposed Gnoorea Point and Cape Preston East sites**




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site.

**Figure 4.10: Heritage features and marine protected areas within the vicinity of the proposed Gnoorea Point and Cape Preston East sites**

## 4.8 CAPE PRESTON EAST

The Cape Preston East site was not progressed to the Site Inspection Assessment stage due to unsuitable marine conditions and land tenure (Table 4.7, Figure 4.8).

**Table 4.7: Cape Preston East – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.8) due to the reduced safe operability and control of the Bundles from that distance.<br>• Shallow reefs and offshore islands (e.g. South West Regnard Island) would restrict possible tow routes; and would also be on limits of marine corridor requirements. | |
| Terrestrial conditions | • Sufficient Bundle track length (>10 km) available; however, this intersects with existing development approvals in the area (see Land Tenure).<br>• Bundle track would intersect with mangroves (Figure 4.9) and intertidal mudflats, and therefore additional engineering works would be required to stabilise the ground conditions needed for the launchway.<br>• Inundation risk in coastal area. | |
| Land tenure | • Bundle track would intersect with areas already approved for port expansion.<br>• Bundle track also intersects areas approved for construction of an aerodrome, and therefore long-term access to the required land is unlikely[5].<br>• Risk of interference with existing Cape Preston port operations, and long-term access to port facilities uncertain given the planned further expansions of the port. | |
| Local infrastructure | • Distance to nearest town ~90 km.<br>• Limited local industry and support base. | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| | **Progress to the next stage of assessment:** | **No** |

[5] Since this site selection process was undertaken, the Cape Preston (Sino Iron) Aerodrome has been constructed and has been operational since July 2017.

## 4.9 ASHBURTON NORTH SIA

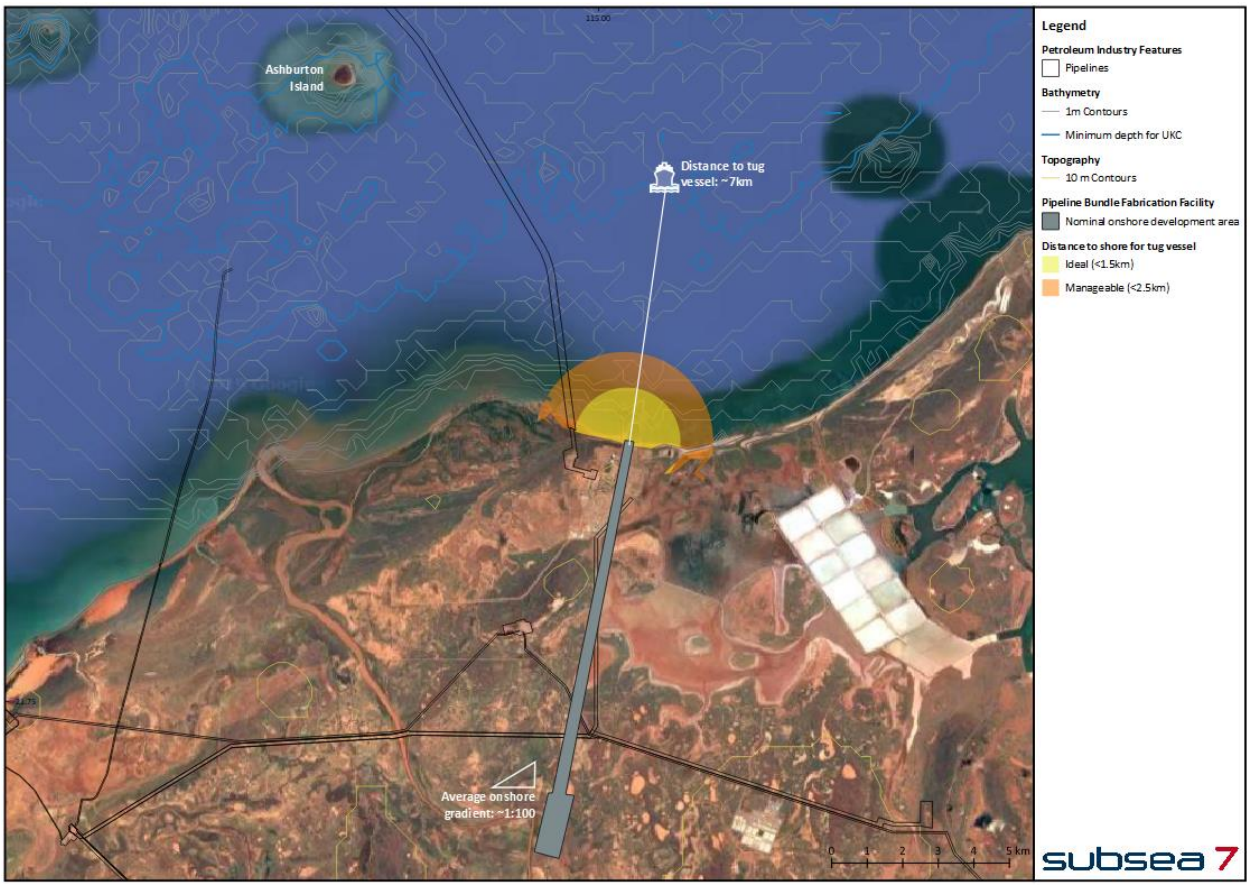
The Ashburton North SIA site was not progressed to the Site Inspection Assessment stage due to unsuitable land tenure, marine and terrestrial conditions (Table 4.8, Figure 4.11, Figure 4.12).

**Table 4.8: Ashburton North SIA – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • The distance offshore from the launchway to a water depth to allow for sufficient UKC for the tug vessels is classified as 'not preferred' (i.e. >2.5 km; Figure 4.11) due to the reduced safe operability and control of the Bundles from that distance.<br>• An operational subsea pipeline (associated with the Wheatstone Project) is within the immediate vicinity of the proposed site (Figure 4.11); it is considered unlikely that tow operations in the shallow waters within the vicinity of the pipeline would be approved.[1]<br>• Large number of shoals and islands within nearshore area; marine operations considered high risk. | |
| Terrestrial conditions | • Insufficient area within the SIA to allow for the fabrication of a 10 km Bundle.<br>• The potential track alignment to suit SIA proponents consists of a series of horizontal bends that could not be accommodated within the minimum required bend radius (4,500 m). | |
| Local infrastructure | • Distance to nearest town ~30 km.<br>• Limited local industry and support base. | |
| Land tenure | • While long-term access to the terrestrial site further from the port could be achieved, there was significant risk in securing exclusive access to the marine interface that is required to support operations. The port area is a common user area, and there would be no guarantee that competing operations from a major LNG plant, supply base, and other users would not severely impact the operation of the Bundle facility.<br>• The SIA site does contain a service corridor which could potentially have been used as an alternative alignment for the site. However, this service corridor was designed for the provision of services to the SIA as a whole, and a development such as a Bundle fabrication facility would prohibit this. The service corridor also does not extend for the desired minimum 10 km track length (Figure 4.12). | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| | **Progress to the next stage of assessment:** | **No** |

Notes:

1. Subsea 7 have a long track record of towing Bundles over 'live' pipelines in the North Sea, and confirming that no impact has occurred following each tow. However Australian pipeline licenses are more stringent, and approval of tow operations is considered a risk for this site.




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site (this length extends beyond the SIA boundary).

**Figure 4.11: Nearshore bathymetry and topography of the proposed Ashburton North SIA site**

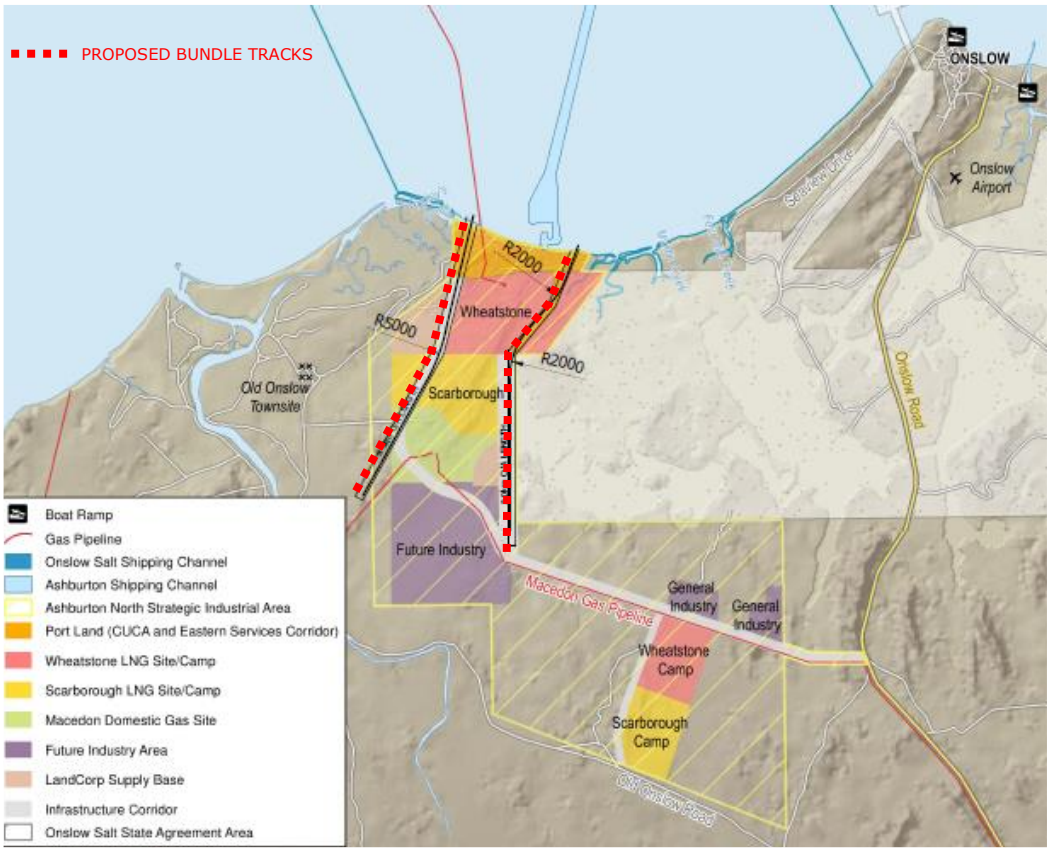



**Figure 4.12: Sketch of alternative Bundle track alignment along the corridor of existing proponent developments within the Ashburton North SIA**

## 4.10 LEARMONTH

The Learmonth site was progressed to the Site Inspection Assessment stage, noting that further information was required regarding tenure considered and local infrastructure (Table 4.9).

**Table 4.9: Learmonth – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • Suitable beach interface, steady sloping beach profile.<br>• Sufficient nearshore water depth to allow the tow vessels to be positioned close to the shore (<2.5km; Figure 4.13).<br>• Sheltered waters at the launch site. | |
| Terrestrial conditions | • Sufficient land available for the 10 km track.<br>• Relatively flat onshore area with no significant bends required in track path (Figure 4.13). | |
| Land tenure | • Sufficient land space available within a designated pastoral lease.<br>• Long-term access to land unknown. | |
| Local infrastructure | • Distance to nearest town ~30 km.<br>• Limited local industry and support base. | |
| Heritage values | • No registered Aboriginal Heritage Places within immediate vicinity (Figure 4.14).<br>• An undetermined Native Title claim does exist over the site. | |
| Environmental values | • MNES were identified within the vicinity of the site.<br>• Tow route passes through the Ningaloo Marine Park (Figure 4.15), however tow configurations at this water depth can be used to avoid seabed disturbance. This route is regularly used for general commercial and recreational vessel transit.<br>• The Ningaloo Marine Park is known to support highly diverse marine life including coral reefs, diverse and abundant fish species, as well as large marine fauna such as turtles, whale sharks, dugongs, whales and dolphins (MPRA & CALM 2005).<br>• While not within the immediate footprint of the site, the Ningaloo Coast World and National Heritage area occurs on the western side of Exmouth Peninsula. | |
| **Progress to the next stage of assessment:** | | **Yes** |

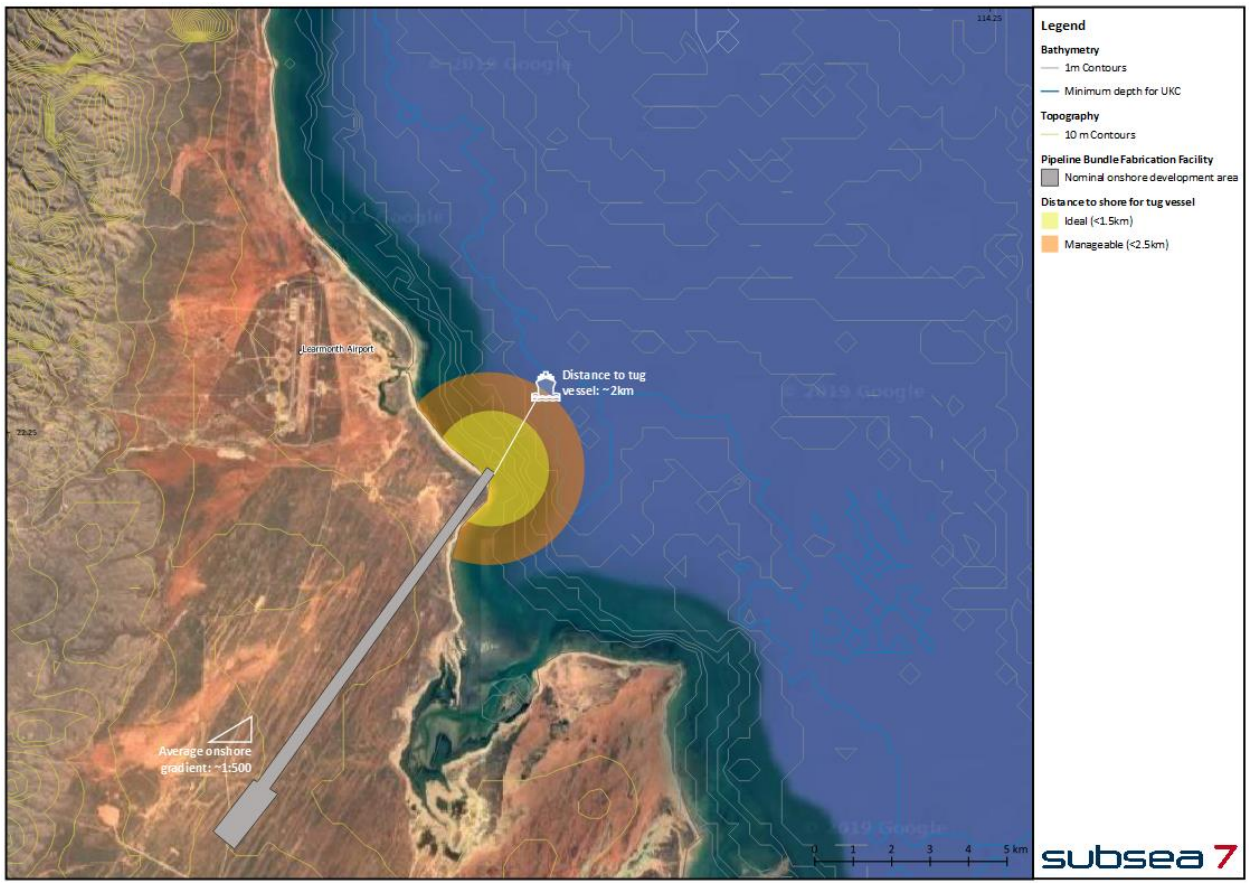



**Figure 4.13: Nearshore bathymetry and topography of proposed Learmonth site**

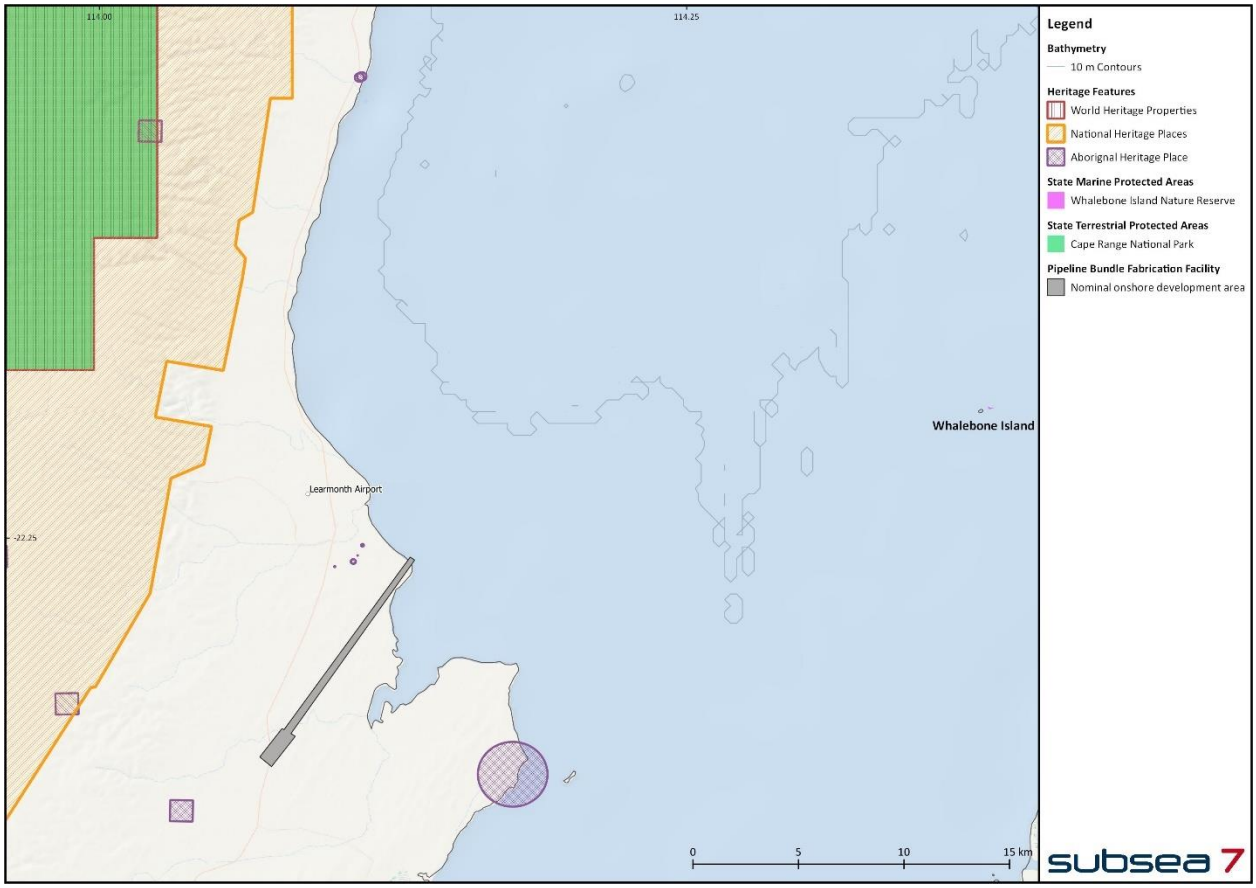



**Figure 4.14: Heritage features and marine/terrestrial protected areas within the vicinity of the proposed Learmonth site**

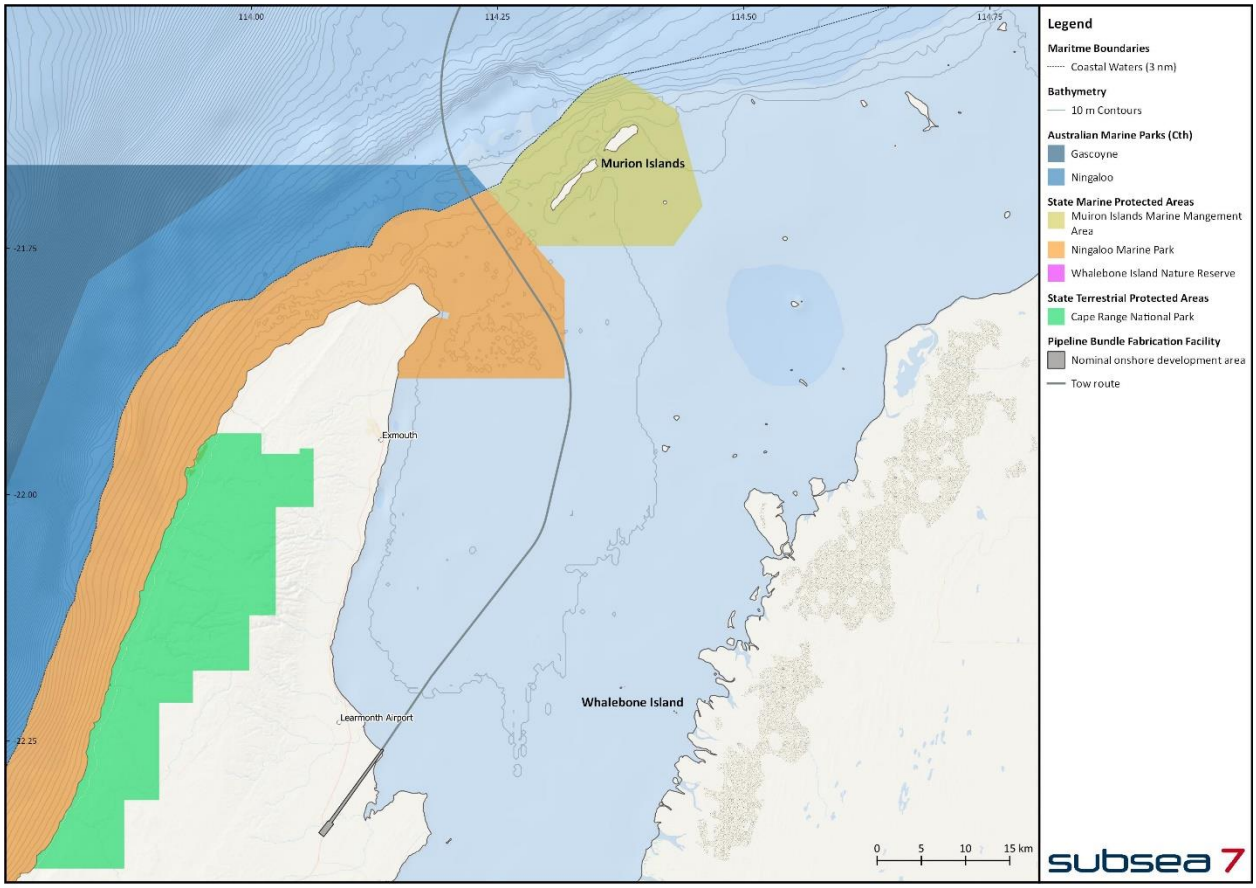



**Figure 4.15: Marine/terrestrial protected areas within the vicinity of the proposed Learmonth site and tow route**

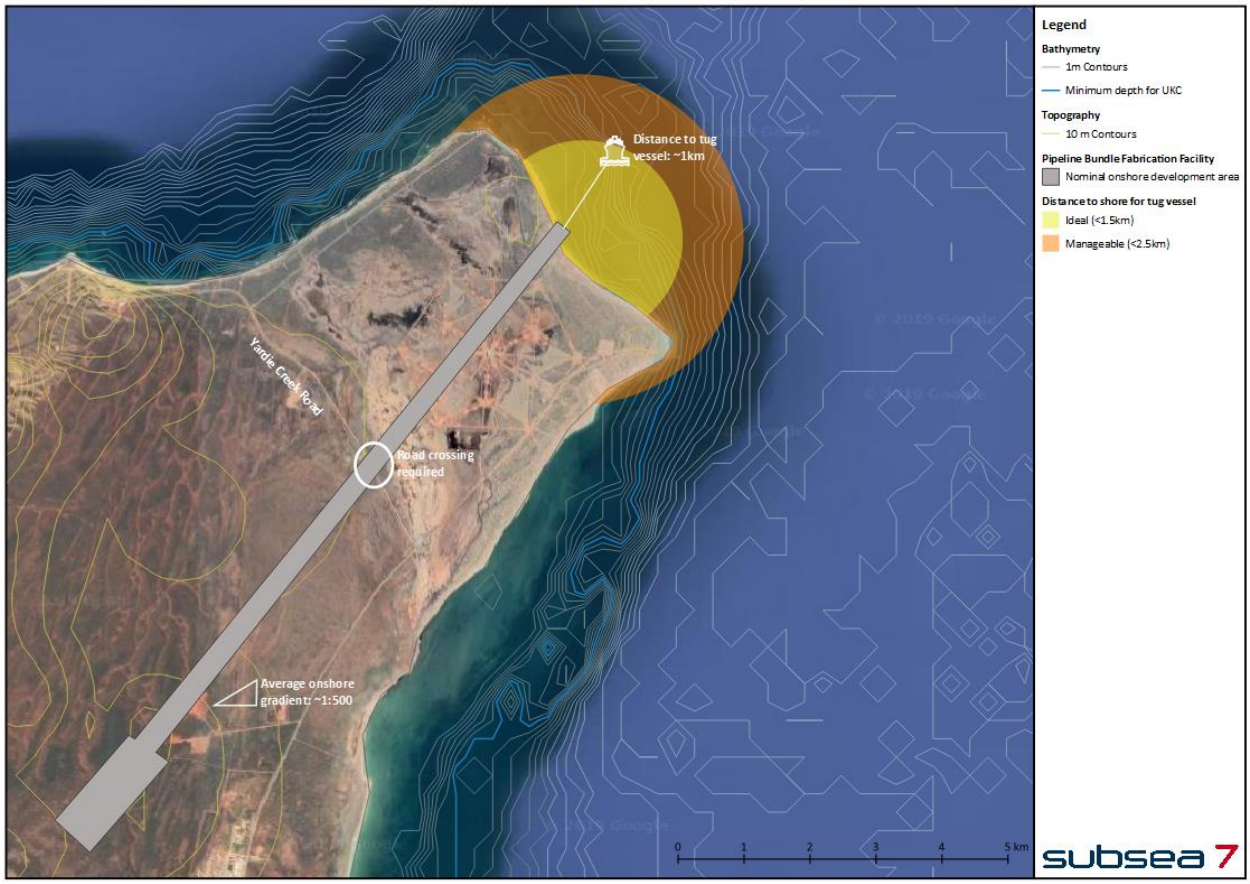
## 4.11 EXMOUTH

The Exmouth site was not progressed to the Site Inspection Assessment stage due to unsuitable land tenure and terrestrial conditions (Table 4.10, Figure 4.16).

While not formally assessed as part of the Desktop Assessment, significant environmental and heritage values were known to occur in the immediate vicinity of this site. The onshore and offshore footprints would intersect with World and National Heritage Places (Ningaloo Coast) and/or Commonwealth Heritage Places (Ningaloo Marine Area), as well as State and Commonwealth Ningaloo Marine Parks (Figure 4.17).

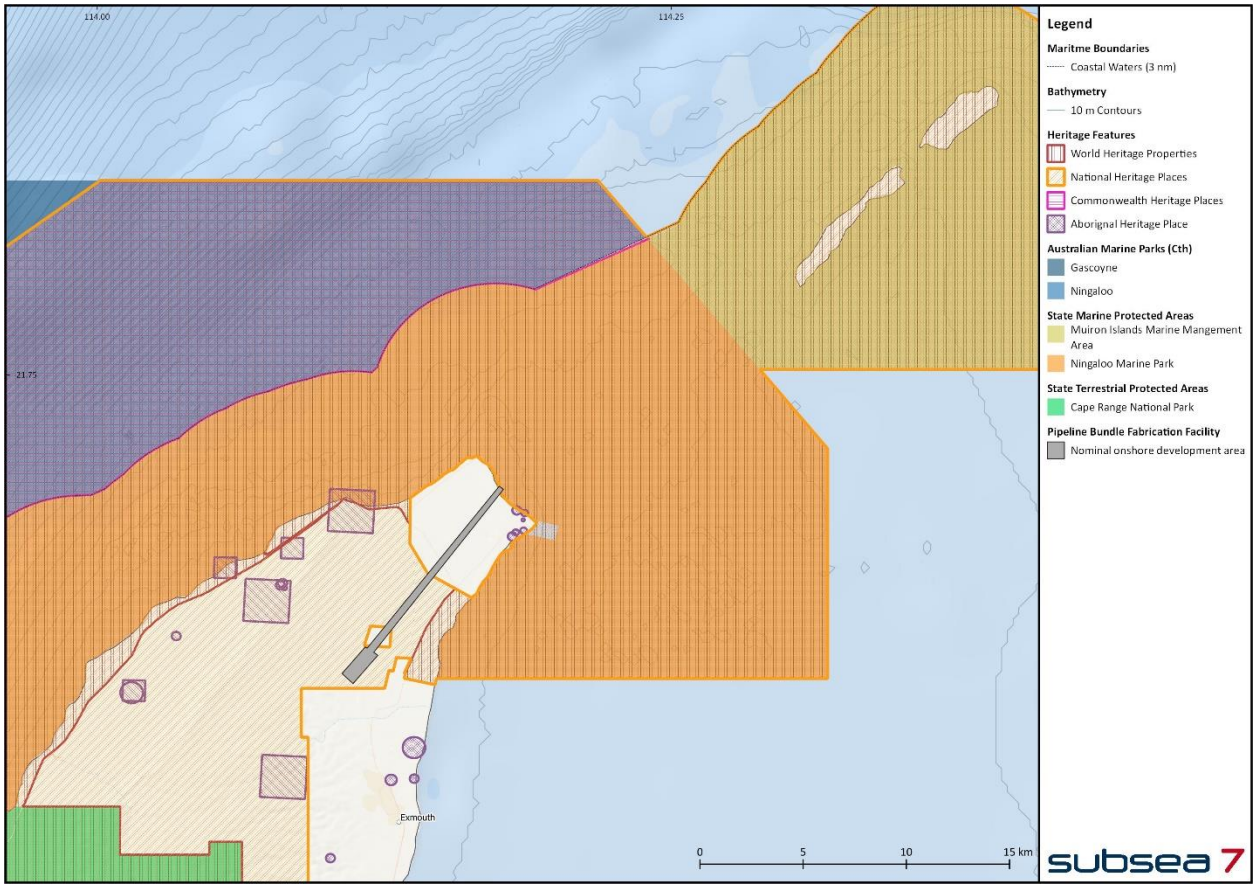
**Table 4.10: Exmouth – Summary of Desktop Assessment outcomes**

| Factor | Summary | Assessment |
|---|---|---|
| Marine conditions | • Suitable beach interface with steady sloping beach access (Figure 4.16).<br>• Sufficient nearshore water depth to allow the tow vessels to be positioned close to the shore (<1.5km) (Figure 4.16).<br>• Oceanographic conditions (e.g. cross currents and swell exposure) were considered high risk. | |
| Terrestrial conditions | • Relatively flat onshore area (Figure 4.16).<br>• Suitable track length is not available. A straight access pathway is unavailable (see Land Tenure), and the alternatives would have too much horizontal curvature to be feasible. | |
| Land tenure | • Onshore development footprint would intersect land operated by the by the Department of Defence (DoD) as part of the Naval Communications Array, which is currently operational. Preliminary engagement indicated that Subsea 7 would be highly unlikely to gain permission to operate a Bundle fabrication facility in association with a naval communications base.<br>• The pipeline track would require the construction of a crossing over Yardie Creek Road (Figure 4.16); this is a public road, with high usage particularly during peak tourist seasons. It was considered that obtaining access across this road, and the required road closure during launches and associated traffic management presents a significant risk. No alternate access road is available for public use during road closures. | |
| Local infrastructure | • Distance to nearest town ~15 km.<br>• Limited local industry and support base. | |
| Heritage values | • No assessment completed for this factor. | |
| Environmental values | • No assessment completed for this factor. | |
| | **Progress to the next stage of assessment:** | **No** |




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site.

**Figure 4.16: Nearshore bathymetry and topography of proposed Exmouth site**




Note: The nominal onshore development area in the above figure shows the 10 km track length used for the desktop assessment; it is not considered a feasible option at this site.

**Figure 4.17: Heritage features and marine/terrestrial protected areas within the vicinity of the proposed Exmouth site**

# 5. SITE INSPECTION ASSESSMENT

## 5.1 OVERVIEW

Following the Desktop Assessments (Section 4), the following three potential sites were identified for the Site Inspection Assessment:

- Anketell Point;
- Gnoorea Point; and
- Learmonth.

This stage of assessment included site inspections by Subsea 7 project personnel (including project managers, engineers, and fabrication and launch specialists; Table 2.1) with the purpose of identifying if appropriate terrestrial site access and marine interface were available, and a general visual examination of the topography, ground condition, local infrastructure and services available to support a fabrication facility. The site visits also included preliminary stakeholder engagement (Section 5.1.1).

The site inspections and assessments included consideration of all factors where additional information was required. The decision to progress a site to the next Site Investigation Assessment stage was based on an integrated review of these assessment factors

A summary of the key outcomes from the Site Inspection Assessments are presented in the following subsections.

### 5.1.1 Stakeholder engagement

During the Site Inspection stage, the requirement for stakeholder engagement was assessed for each site individually:

- Anketell Point: Given that the site was already pre-approved for use as an iron ore loading port, where the volume of industrial activity would far exceed that of a Bundle facility, Subsea 7 considered the risk to project viability from a lack of stakeholder support to be low. Therefore, Subsea 7 did not perform targeted stakeholder engagement at the time of site selection.
- Gnoorea Point: As this site was already in question from a technical feasibility perspective following the Desktop Assessment, targeted stakeholder engagement was not performed at this site during this stage.
- Learmonth: Given Learmonth's location within the Exmouth Gulf, and the proposed site not being within an existing industrial area, Subsea 7 considered it important to engage with local shire and land owners to gain a broad understanding of any initial concerns about the potential Bundle facility.

The outcomes of the stakeholder meetings for Learmonth are summarised in Table 5.1. The discussions with the Shire of Exmouth and local land owner supplemented the feedback received from initial engagements with government departments and agencies about this site. At the end of the Site Assessment stage, the overall stakeholder position regarding the proposed Bundle facility at Learmonth was summarised as:

- There was a genuine need and desire from the local Exmouth population for additional employment opportunities.
- Development was welcomed when it would be able to work collaboratively with the tourism industry, and risks to the environment were appropriately low or able to be mitigated.

- The local Exmouth population are generally well informed and remain involved in what is happening in the community, and stakeholder engagement is important going forward.

**Table 5.1: Summary outcomes from stakeholder engagement for Learmonth**

| Date | Stakeholders | Engagement Summary |
|---|---|---|
| 28 Nov 2016 | Shire of Exmouth personnel, including:<br>• Acting CEO<br>• Planning Officer<br>• Exmouth Council President | An initial introductory meeting was held with relevant members of the Shire of Exmouth, including the Council President, to gauge the potential level of interest from the Exmouth community.<br><br>The potential for the Bundle facility was well received in general, noting that the town remained in need of further job creation and economic investment. A significant portion of the discussion was around a general overview of the proposed development and an explanation of bundle technology.<br><br>Initial discussions and feedback primarily concerned the potential interface between the Bundle facility and tourism operations. The Shire explained the importance of tourism to the town, and the need to ensure this was maintained. Subsea 7 explained that the currently operating site in Scotland was also adjacent to a tourism location, and this had shown that the two can work collaboratively together.<br><br>The Shire also explained that the town had a history of proponents putting forward proposals or development ideas, but they rarely came to fruition. In some ways, the town had been "beaten by hope". Subsea 7 confirmed that the proposal was real.<br><br>The Shire also provided feedback on:<br>• The requirement for planning re-zoning to support the development.<br>• Any potential to restrict access to the Bay of Rest. Subsea 7 advised that there was no plan to restrict access<br>• FIFO – Subsea 7 confirmed that there was no plan to conduct any FIFO operations, and that the workforce was intended to be local<br>• Environmental sensitivity – the importance of the environment was discussed, although it was generally considered that this proposal was a low impact operation. |
| 28 Nov 2016 | Exmouth Gulf Station Pastoralist | Prior to this meeting, Subsea 7 and the Pastoralist had engaged generally about the proposal. The Pastoralist had also escorted Subsea 7 on the site visit on the 22nd August 2016.<br><br>This meeting was a further opportunity to discuss the development, and the potential to engage in a land use agreement. The parties agreed in principal to generating a land use agreement, and actions were taken to commence the drafting and negotiation process.<br><br>The overall feedback from the Pastoralist considered that the oil and gas industry was a key to the future for Exmouth, and that this kind of proposal was fully supported. |

## 5.2 ANKETELL POINT

### 5.2.1 Marine conditions

The proposed site has access to the ocean and the beach interface is free of any major dunes (Figure 5.1). However, mangrove habitat is present along the mainland coast to the east and west of Anketell Point, and pavement reef, intertidal / subtidal hard coral, and filter feeder habitat occur immediately offshore (see Section 5.2.6). As such a significant amount of marine disturbance would be required to facilitate a Bundle launchway.

**Figure 5.1: Anketell Point beach interface**

The nearshore bathymetry was not considered suitable as the water depth does not reach a minimum required for UKC until ~13 km offshore (Figure 4.2). For suitable UKC, the vessels would be located at this distance offshore, and require a longer tow line to reach the launchway; these longer tow lines reduce the operability of the site, and in particular reduce the vessels ability to control the position and alignment of the Bundle. The vessels able to operate under these conditions with long tow lines are also restricted, and ongoing availability for launches would be an unknown.

In an attempt to remove the operability risks, construction of a ~7 km launchway from Anketell Point was also investigated (Figure 5.2). This method is not used for existing Bundle operations, and additional engineering design would be required to confirm the effectiveness and safety of this method. In addition, the ~7 km launchway still requires vessels to be located >2.5 km away from the coast for tow operations (therefore engineering of an extended tow-line rigging arrangement would be required). Construction of an extended launchway is also considered to significantly increase environmental impact, and is therefore not a preferred option.

The following concerns regarding tow routes and the suitability of the site were also identified:

- the proposed Anketell Port limits the tow corridor towards the West of the launch point. This is due to the position of a (approx. 3km) causeway that is proposed for the future port, that would extend directly adjacent to the bundle launchway. As the bundle naturally deflects with tide and current during launch, the position of the causeway would be restrictive;
- The tow corridor at ~8 km from the launchway is limited to approximately ~1,000 m. This specific area to the east is also uncharted (Figure 5.3) and therefore there is

potential that a risk of vessel grounding exists and a greater vessel distance from the shore is required.

Protected from most swell directions excluding northerly swell (typically experienced during cyclone events), desktop studies suggested the marine environment to be relatively benign, and potentially suitable for launching operations.

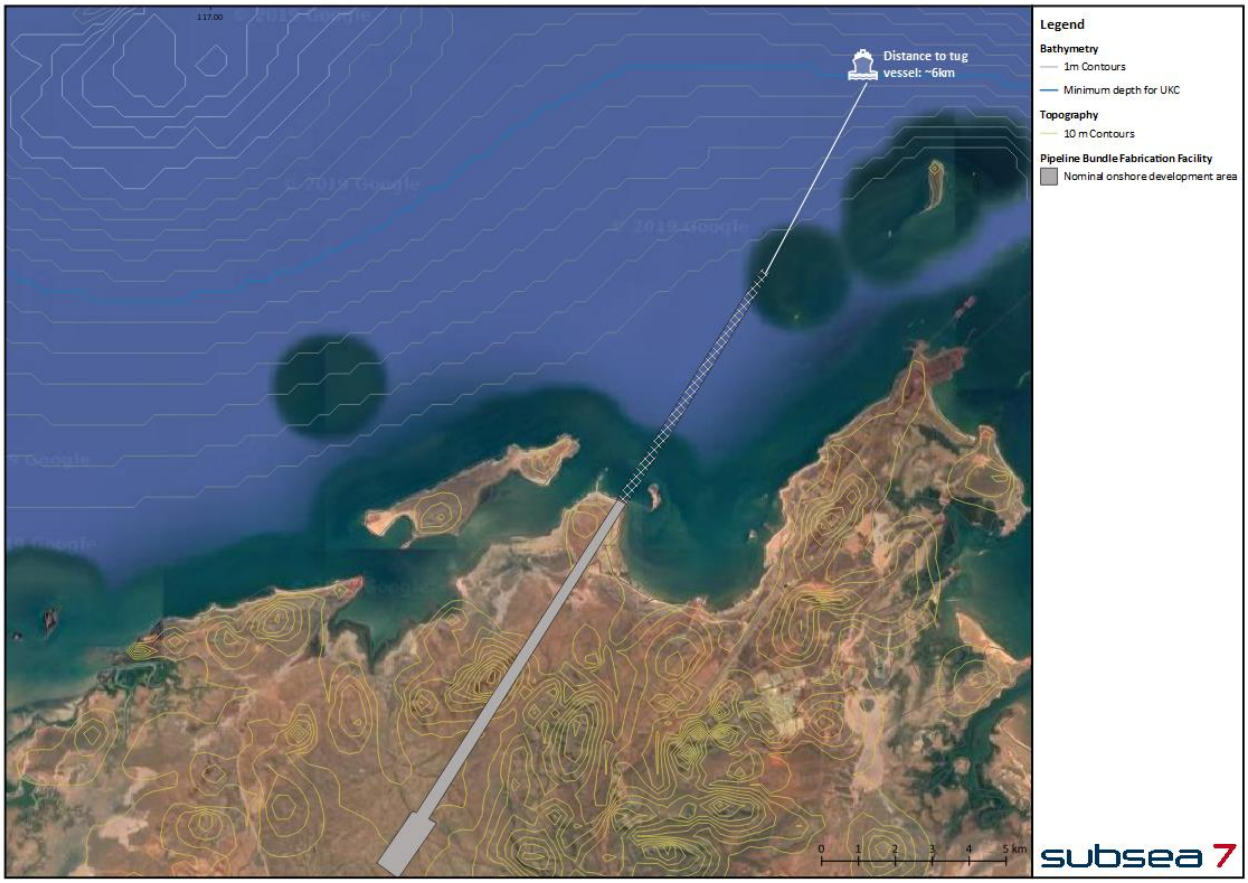
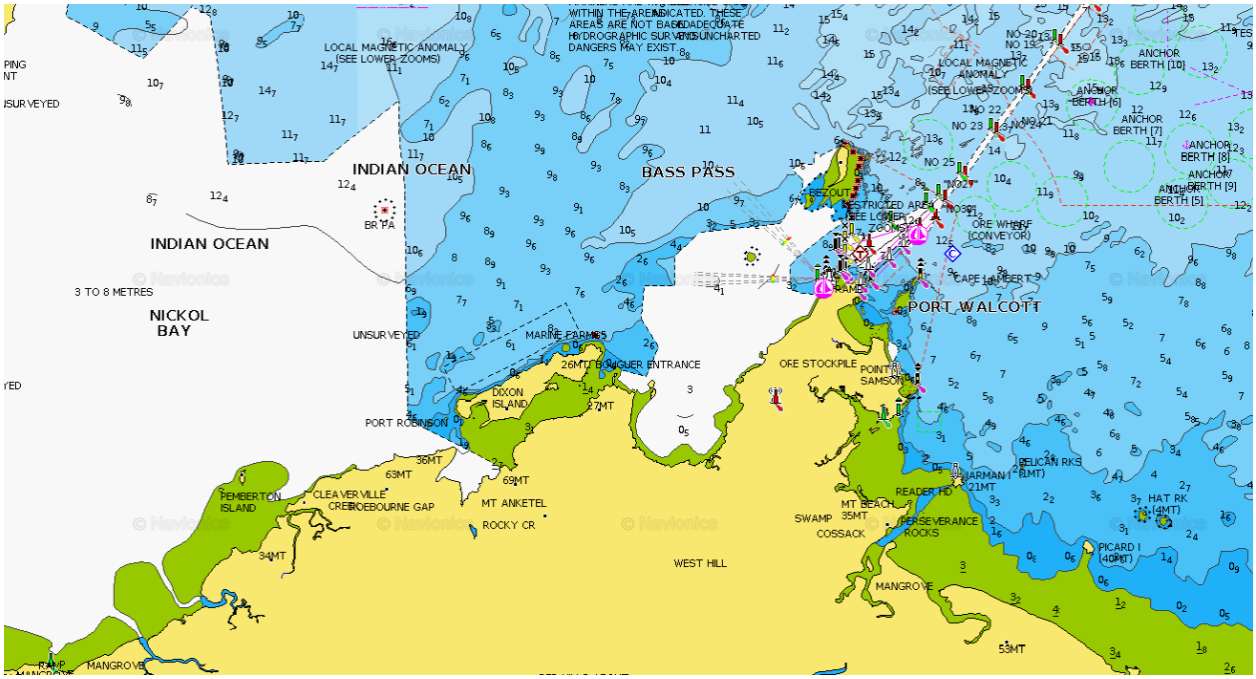



**Figure 5.2: Anketell Point with proposed extended launchway**




(Source: Navionics 2019)

**Figure 5.3: Marine charts with uncharted areas east and west of Anketell Point**

### 5.2.2 Terrestrial conditions

The available track length at Anketell Point is less than the preferred 10 km; the site would be restricted to an 8.8 km Bundle track. The length restriction is primarily due to the existing and planned infrastructure of the Anketell Port, which includes access roads and service lines in addition to the direct construction footprint.

The proposed track route is relatively flat. However, it does requires crossing an area of mudflats that are subject to regular flooding. The proposed track route is subject to flooding between the beach interface and the cross over at the Anketell Port access road, (yellow shading in Figure 5.4). This equates to approximately 2.5 km of mudflats that would require reclamation; which would represent a significant increase in capital expenditure. Increased environmental impacts would also be associated with these additional construction requirements.

The site requires a large radius bend to maintain a low elevation profile and accommodate the Anketell Port development footprint. This track alignment is within allowable limits for the Bundles, however it is noted that a deviation of this size has never been implemented in any permanent or temporary fabrication facilities.

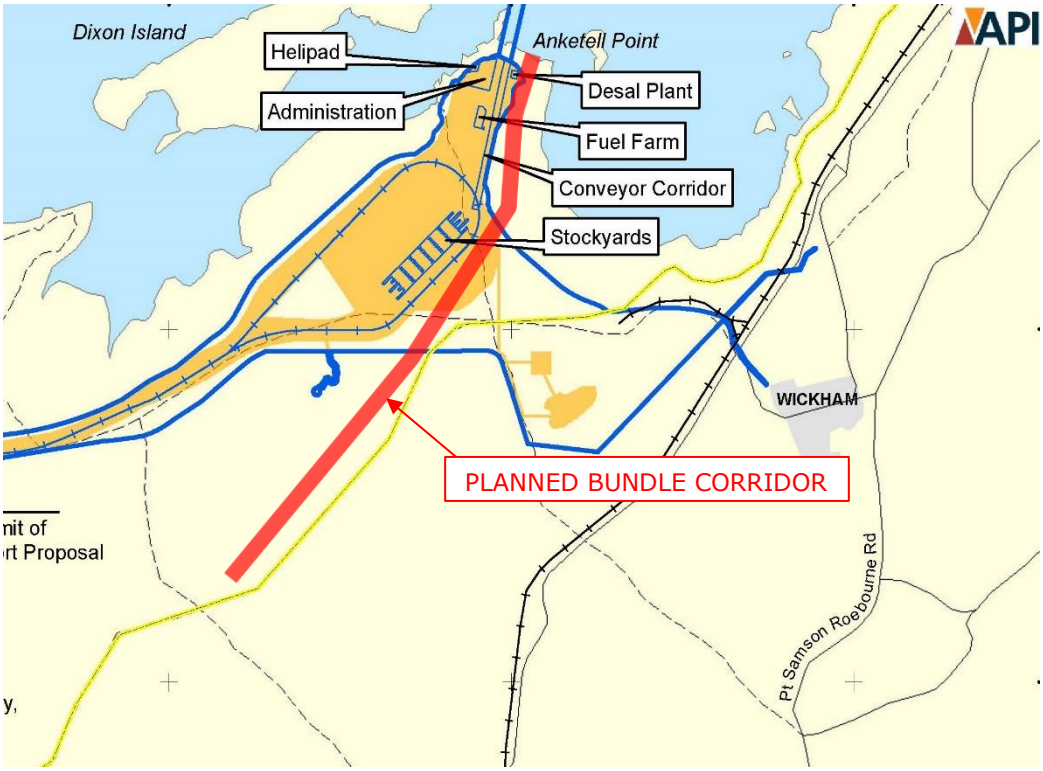



**Figure 5.4: Anketell Point proposed Bundle track with flood-risk (yellow shaded) area**

### 5.2.3 Land tenure

The proposed Bundle site was aligned along the eastern edge of the approved Anketell Port development. It was also acknowledged that working agreements with both the Port proponent (API Management) and the Pilbara Ports Authority would be required to ensure long-term security of land-use and marine access within the area.

During consultation with Pilbara Ports Authority, Subsea 7 were advised that the primary purpose for this area is as an iron ore port. This presents a major risk to the long-term security of tenure at the site. It also raised the risk that any Bundle launch operations are unlikely to be given priority over potential future iron ore offloading operations. While Bundle launches are relatively infrequent, the potential requirement to frequently pause or delay launches would introduce additional operational risk.

The Anketell Port, which received State and Federal environmental approval in May 2013, is the priority project for the area. The Anketell Port Master Plan (June 2014) states an expected ultimate capacity of not less than 350 Mtpa for Stage 1 of the development. This export volume would be expected to generate significant vessel traffic and presents an additional significant risk to the ability to schedule and safely launch Bundles from this site.

### 5.2.4 Local infrastructure

The Anketell Point site is suitably located near key offshore oil and gas precincts, which include existing field developments such as the NWS Venture, Gorgon and Jansz-Io, Wheatstone, and the Browse Basin.

The site is approximately 50 km from Karratha, which hosts numerous industrial service providers and accommodation options for long-term staff. With a local population of 21,473

(ABS 2016) there is the potential for local labour employment, with the existing resource sector having already led to the development of the region. Dampier Port is also only approximately 60 km from the proposed site at Anketell Point; and would be capable of receiving the large Bundle 'towhead' structures. It is noted that Karratha airport is also approximately 60 km from the proposed site at Anketell Point, and would be suitable for servicing freight and personnel transfer requirements. Both light and heavy industry services within Karratha and Dampier are well developed and are considered to meet the requirements of a Bundle fabrication facility.

A new, approximately 6 km long access road from the North West Coastal (NWC) Highway would be required for the proposed site, which is a significant development.

### 5.2.5 Heritage values

No additional survey on heritage values was completed during the Site Inspection Assessment stage, as no significant Native Title or aboriginal heritage issues were noted during the Desktop Assessment.

The Pilbara Port Authority are already engaged with the Ngarluma people via the Ngarluma Aboriginal Corporation and the State has entered into an Indigenous Land Use Agreement (ILUA) for the area. Although the proposed Bundle fabrication facility would likely be within the original port development envelope, the ILUA would likely require amendment to include details of the development.

### 5.2.6 Environmental values

Nearshore benthic habitats and communities (e.g. corals, filter feeders) and coastal habitats (e.g. mangroves) are known to occur within the vicinity (Figure 5.5).

A high percentage of cover and a diverse range of corals is known to occur on the pavement reef and intertidal/subtidal reef habitat surrounding Anketell Point (Wilson and Fromont 2011).

Previous approvals for the removal of benthic habitat in the area was granted to API Management for the Anketell Port proposal (EPA 2012). However, the cumulative removal of benthic habitat required for the Bundle facility within a similar area may exceed the objectives for the EPA's Benthic Communities and Habitat environmental factor (EPA 2018b). Various alignments of the Bundle track were investigated, for example, to remove the intersection with coral habitat the track could move to the east, but would then intersect with pavement reef and filter feeder habitat.

Other areas of benthic habitat were also considered to be at potential risk from the construction of the launchway, including seagrass in the area north of Poverty Island, and mangroves and algal mats to the east of the Anketell Port development.

Surveys at Dixon Island and Anketell Point have recorded flatback turtle nesting (Pendoley Environmental 2010). Recorded nesting includes areas immediately adjacent to the proposed Bundle track alignment.

The sand dunes surrounding Anketell Point are habitat for the EPBC-listed fossorial skink, *Lerista nevinae,* which only occurs within the Anketell Point / Cape Lambert area (Wilson and Swan 2013; Teale pers. comm. 2017). Its distribution is known to be restricted to primary

and secondary dunes between Pope's Nose Creek and Dixon Headland; an area of approximately 498 ha along about 18 km of coast (Biota 2009).

Previous approvals for the clearing of fossorial skink habitat was granted to API Management for the Anketell Port proposal (EPA 2012). However, again, the cumulative remove of this habitat required for the Bundle facility within a similar area may exceed the objectives for the EPA's Terrestrial Fauna environmental factor. If Anketell Point was selected as the preferred site it would require clearing approximately 6.5 ha (1.1%) of the remaining *Lerista Nevinae* habitat.

Significant numbers of migratory shorebirds have been recorded at Anketell Point; including the EPBC-listed lesser sand plover and greater sand plover within survey areas known as 'South-East Mudflats' and 'Anketell Point Far East', and the whimbrel and eastern curlew also within the 'South-East Mudflats' (AECOM 2011). These areas are both identified as being intersected by the proposed Bundle track alignment.

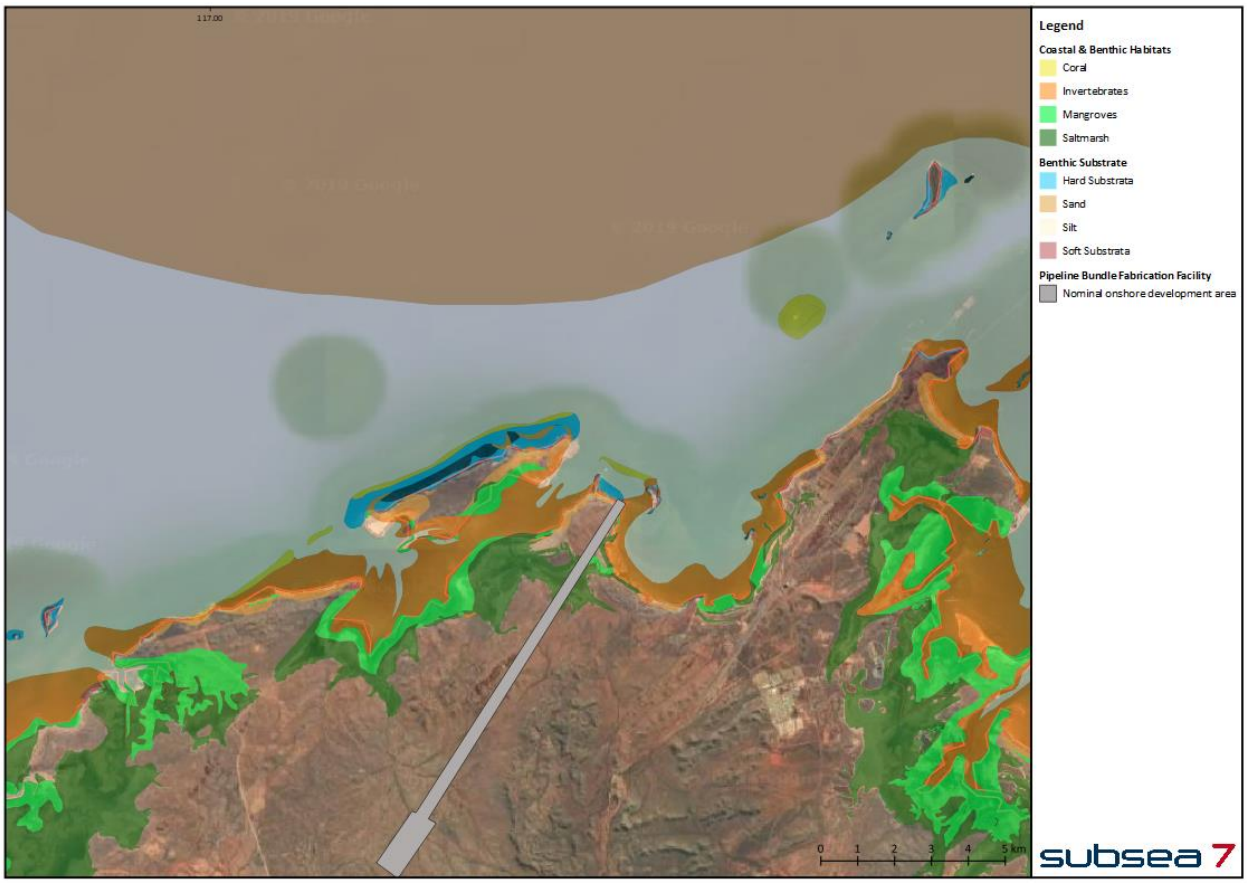



**Figure 5.5: Coastal and benthic habitats within the vicinity of the proposed Anketell site**

### 5.2.7 Site summary

Anketell Point was progressed to the Site Investigation Assessment stage despite being assessed as having unsuitable terrestrial conditions and land tenure (Table 5.2). Subsea 7 selected to investigate the knowledge gaps around marine conditions before making a final assessment of site suitability.

**Table 5.2: Anketell Point – Summary of Site Inspection Assessment outcomes**

| Factor | Desktop Assessment | Site Inspection Assessment |
|---|---|---|
| Marine conditions | | |
| Terrestrial conditions | | |
| Land tenure | | |
| Local infrastructure | | |
| Heritage values | | |
| Environmental values | | |
| **Progress to the next stage of assessment:** | | **Yes** |

## 5.3 GNOOREA POINT

### 5.3.1 Marine conditions

The Bundles previously fabricated and deployed from Gnoorea Point were a short (<2 km) and simpler design (compared to current Bundle designs). This had a number of follow on advantages, including:

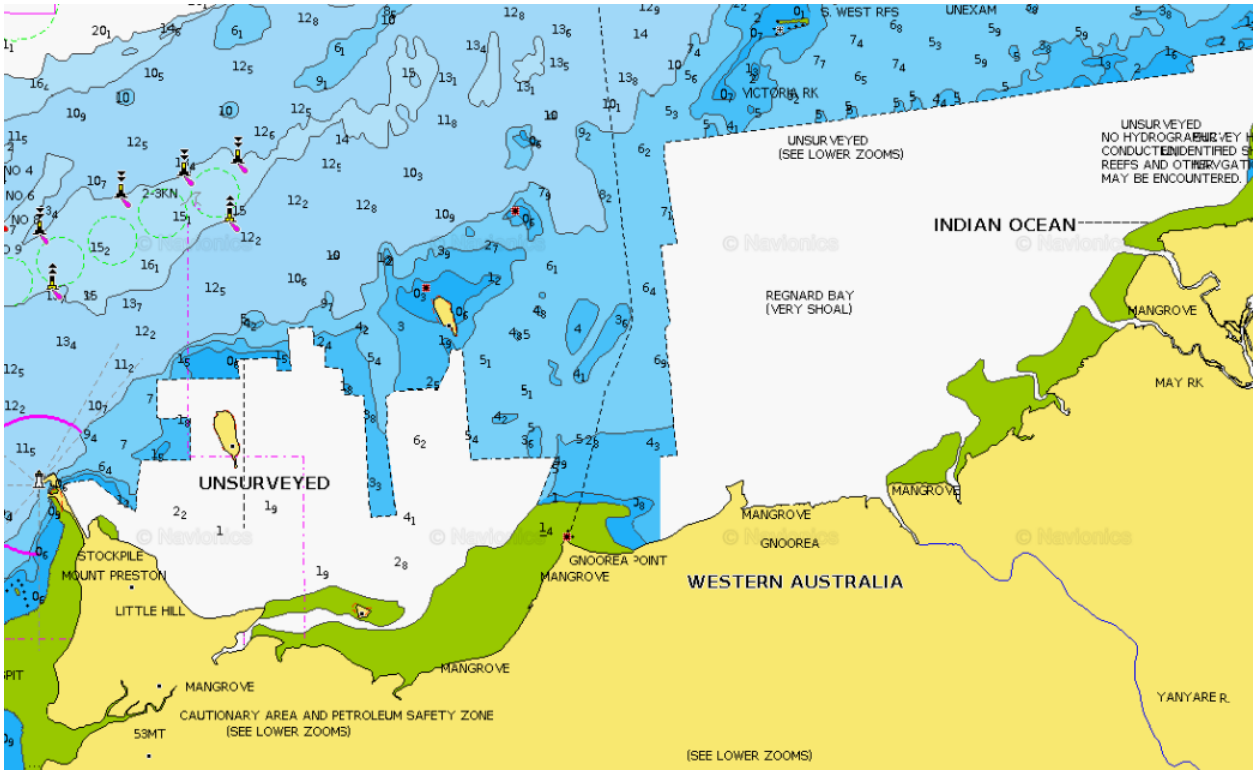
- that the typical Bundle towhead termination could also be replaced with a smaller flange;
- the tow vessels required were smaller and had a shallower draft, and therefore could position closer to shore; and
- the small Bundles could be surface towed immediately from the launchway.

None of these advantages are applicable to the Bundle fabrication facility that is currently being proposed. The size and complexity of the Bundles to be fabricated does not allow for the towhead to be substituted or for a surface tow to occur directly from the launchway.

There were a number of concerns over the marine conditions of the Gnoorea Point site, including:

- The nearshore bathymetry was not considered suitable as the water depth does not reach a minimum required for UKC until ~20 km offshore (Figure 4.8).
- The nearshore bathymetry showed a lot of variation within the proposed launch and tow routes, and therefore additional constructions works (e.g. dredging, seabed profiling etc) were considered likely to be required.
- Areas to both the east and west of Gnoorea Point remain uncharted (Figure 5.6), representing and unknown risk.

It was also noted that pipelines for the Devils Creek Gas Plant are also located at Gnoorea Point (Figure 4.8). Bundle launching and towing operations would therefore occur over and immediately around live production pipelines. While the smaller Bundles have previously been launched in this same area, it is unknown if the operator and/or regulators would approve continual simultaneous operations in the area to extend over the life of the project.




(Source: Navionics 2019)

**Figure 5.6: Marine charts with uncharted areas east and west of Gnoorea Point**

### 5.3.2 Terrestrial conditions

The available track length at Gnoorea Point is considered unsuitable. If the track was positioned to avoid flood grounds, then much less than the 10 km design distance is available. The previous Bundle deployments in the 1990's were limited to a 2.6 km track length, and this is not considered a commercially viable option for a permanent fabrication facility.

Longer track length alignments were investigated, however these would intersect areas of intertidal mudflats, mangroves and/or saltmarsh (Figure 4.9). Significant engineering and construction works would be required to facilitate a pipeline track across these features. This was considered to be an unacceptable financial and environmental option.

### 5.3.3 Land tenure

Gnoorea Point is an approved camping ground with the City of Karratha; camp use is available all year, but May to September is listed as high-season (CoK 2019). The area is popular for camping and fishing (with natural boat ramp) and facilities (toilets, sullage disposal) are available on site (Figure 5.4). Investigations were completed along the Gnoorea Point coast to understand if the existing campsite could be avoided; but no viable alternative was found.

The site has significant recreational value for both locals and tourists and any development of Gnoorea Point would restrict this use; this was considered to be a high risk of an unacceptable social impact.


(Source: Google Maps 2019)

**Figure 5.7: Recreational use of Gnoorea Point**

### 5.3.4 Local infrastructure

No additional information sourced.

### 5.3.5 Heritage values

No additional information sourced.

Post Site Selection note: The Gnoorea Point site had not reviewed favourably at the Desktop Assessment stage. As discussed previously, this was taken forward to the Site Inspection primarily on the basis that it had been used previously for bundle operations. Given the unfavourable review, Subsea 7 did not consider it to be necessary expenditure to commission a heritage or native title assessment at this stage.

### 5.3.6 Environmental values

Habitats identified at Gnoorea Point and within Regnard Bay included seagrass, macroalgae, corals, mangroves and soft sediment habitats (EPA 2009) (Figure 5.8).

Gnoorea Point consists of an extensive mid-littoral rock platform reef with a low algal turf and lagoons supporting seagrass and corals (Apache 2008). Macroalgae cover reaches 50-100%, with brown macroalgae, especially *Sargassum* and *Dictyopteris* spp., dominating the shallow limestone pavement reef (RPS 2008). Coral cover, dominated by *Turbinaria* spp., *Porites* spp. and *Faviidae*, reaches 5% and seagrass cover reaches 50-100% (Apache 2008). Other corals that were recorded in this area also included species from the following genera: *Favites*, *Leptastrea*, *Goniastrea*, *Platygyra*, *Montipora*, *Siphastrea*, *Galaxea* and *Lobophyllia*.

Mangroves occur along the shoreline to the west of Gnoorea Point (Apache 2008). The Pilbara region has seven recorded mangrove species, while six species occur in the Dampier Archipelago/Cape Preston region[6] (Wells & Walker 2003). The mangroves at Gnoorea Point

[6] Gnoorea Point occurs within this region.

have historically been exposed to localised human disturbance in the form of trampling, littering and petroleum industry onshore activities and therefore are not considered regionally significant (RPS 2008).

A survey undertaken in 2014/2015 showed moderate numbers of migratory and/or EPBC listed birds (e.g. Grey-tailed tattler, Whimbrel) use the Gnoorea Point area (Western Wildlife 2015).

Guidance from the previous approvals associated with the Devil Creek Gas Development indicated that 'development proposals should not cause significant direct or indirect loss of BPPH (benthic primary producer habitat) and/or their associated BPP (benthic primary producer) communities, and the ecosystem integrity of the BPPH dependent ecosystems must be maintained' (EPA 2009). It is considered that any Bundle launch operations from this site would impact to some extent the nearshore benthic habitats, and therefore not be aligned with previous regulatory advice given for the area.

The site is also within the proposed Regnard Marine Management Area; extending from Eaglehawk and West Intercourse Islands westwards to South West Regnard Island. This management area replaces the former proposed Cape Preston Marine Management Area. It has been previously reported (e.g. LeProvost 2008) that gazettal has been delayed to a future date that is yet to be determined; and remains ungazetted to date.

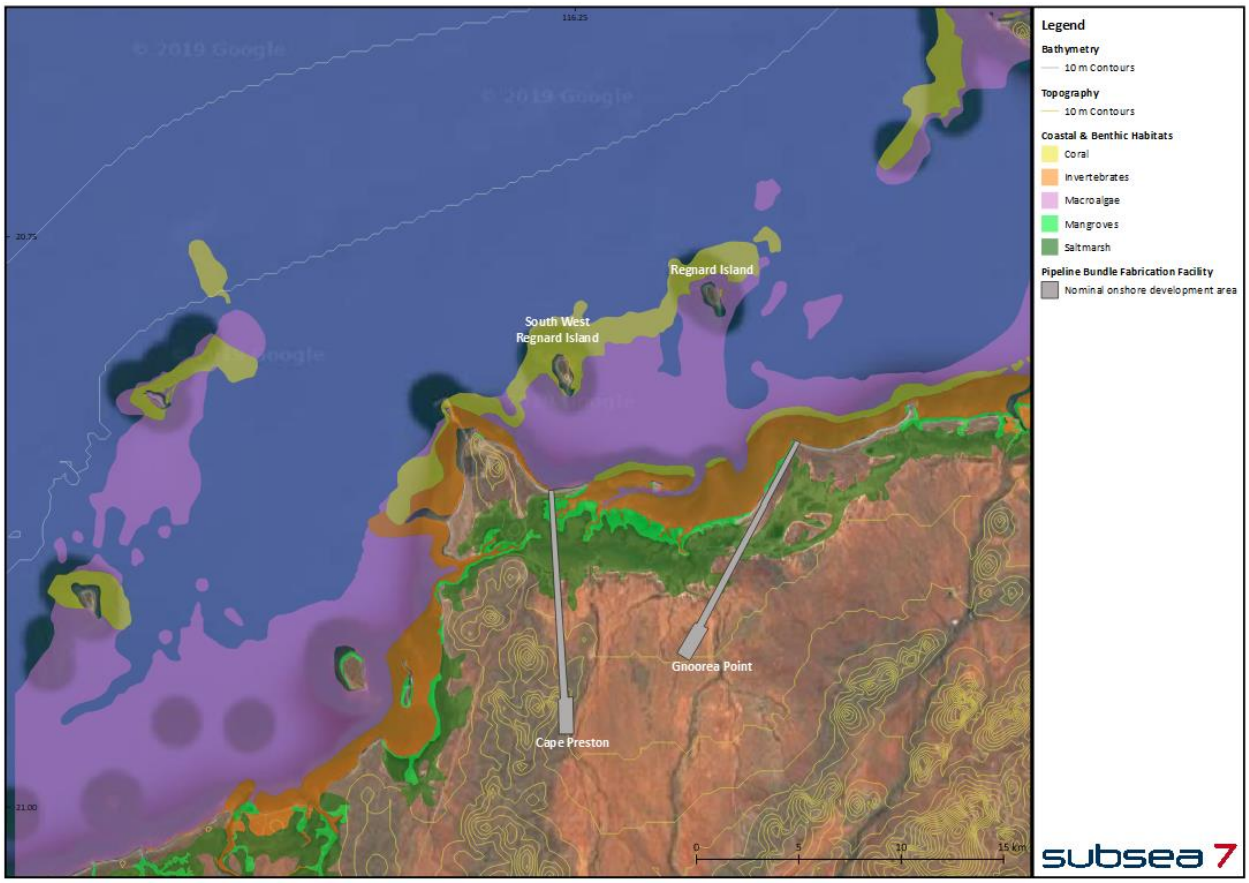



**Figure 5.8: Coastal and benthic habitats within the vicinity of the proposed Gnoorea Point and Cape Preston East sites**

### 5.3.7 Site summary

Gnoorea Point was not considered appropriate for the development a Bundle fabrication facility due to unsuitable land tenure, marine and terrestrial conditions; and the risk to environmental values was considered high (Table 5.3). No further investigation into this site was undertaken.

**Table 5.3: Gnoorea Point – Summary of Site Inspection Assessment outcomes**

| Factor | Desktop Assessment | Site Inspection Assessment |
|---|---|---|
| Marine conditions | | |
| Terrestrial conditions | | |
| Land tenure | | |
| Local infrastructure | | |
| Heritage values | | |
| Environmental values | | |
| **Progress to the next stage of assessment:** | | **No** |

## 5.4 LEARMONTH

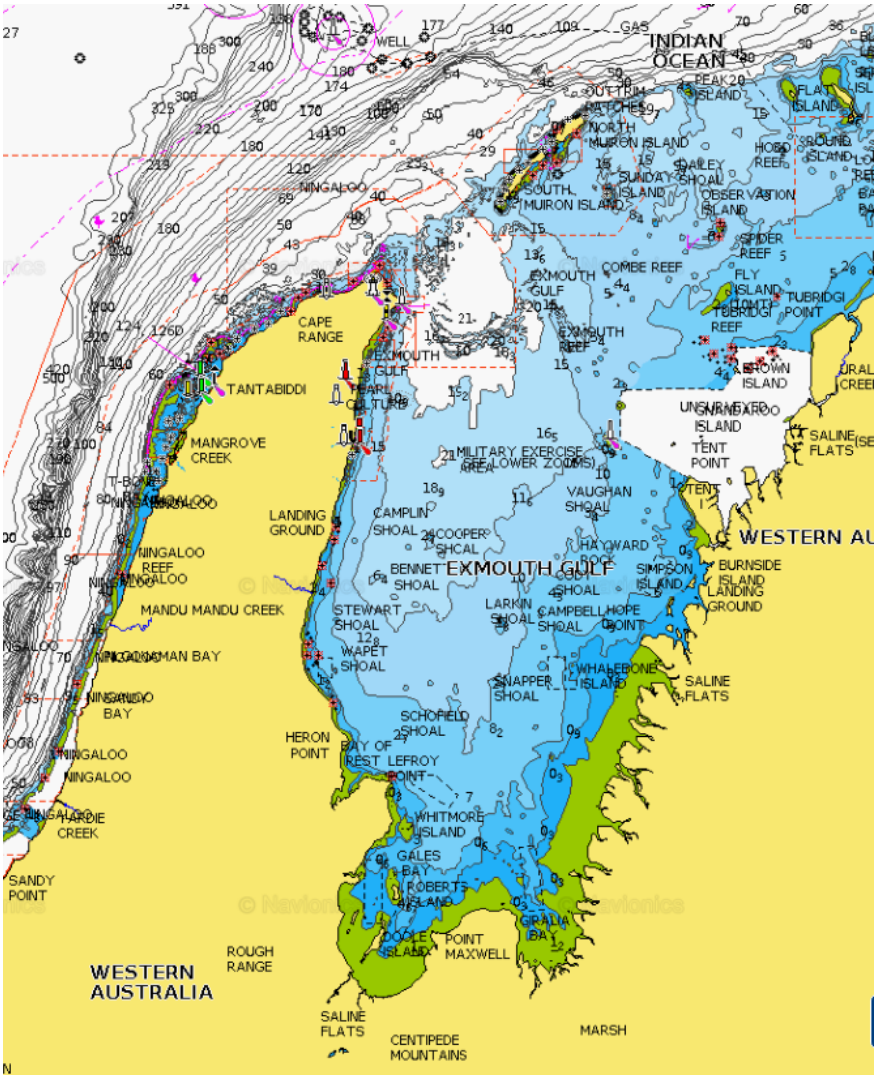
### 5.4.1 Marine conditions

The Learmonth site is coastal with a suitable marine interface at Heron Point. There are no significant land features or infrastructure that inhibit a beach crossing and the installation of a launchway. The near-shore beach environment is fine sand with intermittent, unvegetated pavement reef.

The water depth at Heron Point also allows for tow vessels to be positioned close to the shore (<2.5km), to connect the tow line. It is also expected that the sheltered waters of Exmouth Gulf would provide suitable marine conditions, ideal for Bundle launch operations.

Some areas within / near the proposed tow routes are currently uncharted (Figure 5.9); so, there is an unknown design risk. Numerous shallow reefs and offshore islands are also likely to restrict tow route selection. State marine protected areas (see Section 5.4.6) have also been identified within the area.




(Source: Navionics 2019)

**Figure 5.9: Marine charts with uncharted areas within vicinity of Exmouth Gulf**

### 5.4.2 Terrestrial conditions

The onshore development envelope can be positioned such that a 10 km pipeline track can be situated between the beach interface and Minilya-Exmouth Road. Commonwealth land adjacent to the development would not be disturbed.

A site assessment of the inland track alignment and the transition into the beach launchway confirmed there were no significant bends required. It also concluded that the surface formations are minor as they run parallel to the proposed track alignment and therefore substrate profiling, for construction of the Bundle track, could be kept to a minimum. An area of profiling would be required at the beach interface where a section of primary sand dune would require an existing surface level alignment.

### 5.4.3 Land tenure

The proposed site is within Lots 233 and 1586, which is Crown Land leased to the Exmouth Gulf Station. The Exmouth Gulf Station has a pastoral lease that was renewed on the 15 June 2015, with a term extending for 40 years.

Tenure options associated with this land were investigated, noting the critical importance to the feasibility of the proposal includes long-term security of land access.

Initial investigations commenced via discussion directly with the pastoralist. No significant concerns or issues were raised by the pastoralist regarding the proposed land use, or ongoing access[7]. In-principal support of the pastoralist was seen as critical to the site selection and assessment process.

### 5.4.4 Local infrastructure

The Learmonth site is suitably located near key offshore oil and gas precincts, which include existing field developments such as the NWS Venture, Gorgon and Jansz-Io, Wheatstone, and the Browse Basin.

Learmonth is located approximately 35 km from Exmouth, which allows for a local workforce to use existing accommodation and services while maintaining relative short transit distances to the site. Local light industrial trades and services are also available from Exmouth, and the existing Exmouth marina can service small commercial vessels, ideal for ongoing inspection and maintenance activities associated with the development.

Minilya-Exmouth Road allows for local road transport of materials from Dampier Port or Onslow Marine Supply Base. A transport study has confirmed that larger towheads can be transported via road from both these ports to the Learmonth site. Learmonth airport is in close proximity to the proposed site location and therefore is suitable for servicing the site development.

### 5.4.5 Heritage values

Investigation was conducted by the legal and tenure consultants regarding both Native Title and Aboriginal Heritage (Squire Patton Boggs 2016). A summary of the early assessment outcomes is provided below:

- There are no listed aboriginal heritage sites on the proposed site;
- To the extent that investigations could identify, there had been limited documented heritage surveys of the site;
- A native title claim that included the proposed development site had been made by the Gnulli group;
- The Gnulli Group have previously shown a general willingness to work with proponents in previous matters of heritage and native title.

Based on this information the assessment on the Learmonth site identified that a complete heritage and native title process would be required in order to operate on the site. Further, an Indigenous Land Use Agreement would likely be required. Whilst these elements

[7] It is noted that the pastoralist was completely supportive of the proposal and recognised it as an opportunity for growth and development in the region.

represented a reasonably high level of input and work for the development proposal, the processes were well understood and not considered as high risk for the site assessment.

### 5.4.6 Environmental values

The Exmouth Gulf is an area recognised for its conservation values. The sheltered bays are known calving and nesting grounds for marine fauna; and the coastal and benthic habitats (Figure 5.10) support a range of fish, invertebrates and birds. The mangrove habitat within the Exmouth Gulf has been previously identified as being of regional significance (EPA 2008).

State (Ningaloo Marine Park, Muiron Islands Marine Management Area) and Commonwealth (Ningaloo Marine Park) marine protected areas occur within the vicinity of the tow route (Figure 5.10).

The Commonwealth Protected Matter Search Tool (PMST) was used to identify the matters of national environmental significance (MNES) that may occur in the vicinity of the proposed site:

- Two areas of Commonwealth Land, the Exmouth Naval HF Receiving Station and the Learmonth Transmitting Station, occur in proximity to the Project area.
- Listed marine, threatened and/migratory species or species habitat were also identified, including marine turtles, humpback whales (which pass through the region during the southern migration and rests within Exmouth Gulf; Figure 5.11) and dugong (known to aggregate within Exmouth Gulf).

No Threatened Ecological Communities (TEC) are known to occur in the vicinity of the site. Two Priority flora species are known to occur in the general area: *Grevillea calcicola* (P3) and *Brachychiton obtusilobus* (P4), however are not typically associated with coastal dune habitat.

It has also been identified that subterranean fauna may occur within the onshore development footprint (unconfirmed). Subterranean fauna and their significance have previously been recorded within with wider Cape Range area (UNESCO 2011) and are a specific environmental factor considered by the EPA.

While not within the immediate footprint of the site, the Ningaloo Coast World and National Heritage area occurs on the western side of Exmouth Peninsula. The Ningaloo Coast is recognised as having a high diversity of marine habitats including coastal mangrove systems, lagoons, and coral reefs (MPRA & CALM 2005). The dominant feature of the Ningaloo Coast World and National Heritage areas is Ningaloo Reef, the largest fringing reef in Australia. Ningaloo Reef supports both tropical and temperate species of marine fauna and flora and more than 200 species of coral (MPRA & CALM 2005). The Ningaloo Coast World and National Heritage area also provides important turtle nesting habitat, specifically around the North West Cape and Muiron Islands (DoEE 2017).

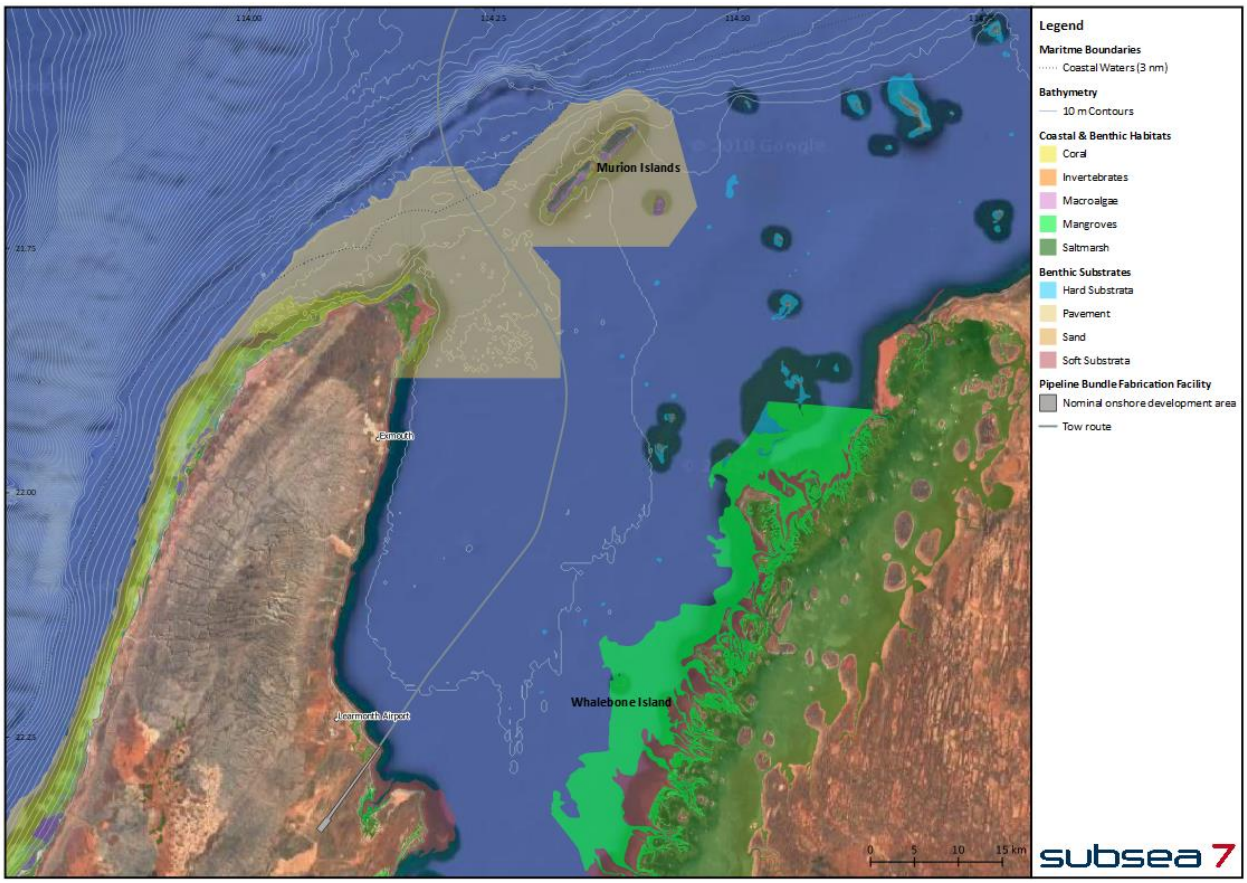
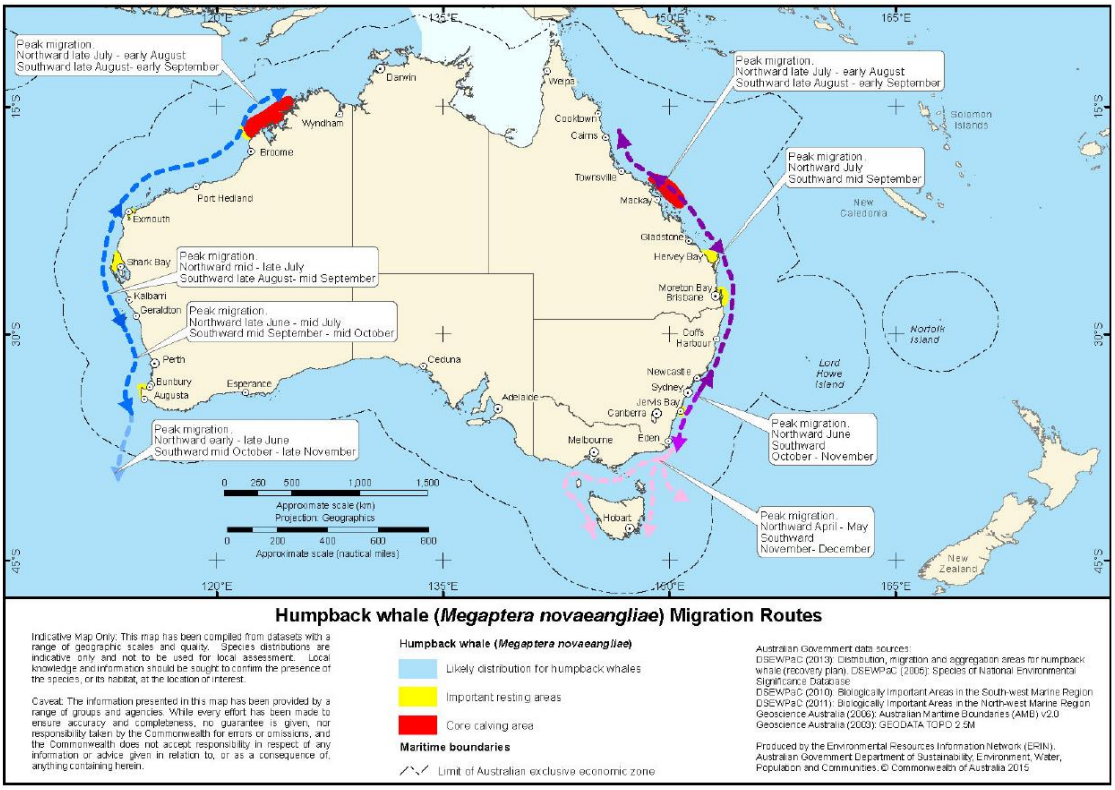



**Figure 5.10: Coastal and benthic habitats within the vicinity of the proposed Learmonth site**




(Source: TSSC 2015)

**Figure 5.11: Migration routes, resting and calving areas for the Humpback Whale**

### 5.4.7 Site summary

Learmonth was considered appropriate for further assessment as a potential development site for the Bundle fabrication facility (Table 5.4). Knowledge gaps around marine conditions and environmental values require further investigation before final assessment of site suitability.

**Table 5.4: Learmonth – Summary of Site Inspection Assessment outcomes**

| Factor | Desktop Assessment | Site Inspection Assessment |
|---|---|---|
| Marine conditions | ■ | ■ |
| Terrestrial conditions | ■ | ■ |
| Land tenure | ■ | ■ |
| Local infrastructure | ■ | ■ |
| Heritage values | ■ | ■ |
| Environmental values | ■ | ■ |
| **Progress to the next stage of assessment:** | | **Yes** |

# 6. SITE INVESTIGATIONS ASSESSMENT

## 6.1 OVERVIEW

Following the Site Inspection Assessments (Section 5), the following two potential sites were identified for the Site Investigations Assessment:

- Anketell Point; and
- Learmonth.

This stage of the assessment was primarily aimed at closing out the identified knowledge gaps around the key risks for each site. Subsea 7 engaged service providers and specialist consultants (Table 2.1) to undertake additional studies focussed on the above items:

- Neptune Marine Services undertook bathymetry surveys at both proposed site locations within the existing uncharted areas, so that final assessments on marine conditions could be undertaken.
- Environmental specialists, 360 Environmental, were engaged to undertake benthic habitat ground truthing within the vicinity of the launchway at the Learmonth site.
- Environmental specialists, 360 Environmental, were engaged to identify likely assessment pathways, timings and risks associated with environmental approvals required to develop and operate a fabrication facility at both sites.
- Legal and tenure specialists, Squire Patton Boggs and Taylor Burrell Burnett, were engaged to clarify the requirements for land access and planning approvals required at the Learmonth site.

The following sections provide a summary of the outcomes of the additional investigations and subsequent final site feasibility assessments.

## 6.2 ANKETELL POINT

### 6.2.1 Marine conditions

A bathymetric survey was attempted in the area of the proposed tow corridor that was in an uncharted marine area. During the survey, strong tidal currents were experienced between Delambre Island and the launchway site. Attempts were made to survey the marine area within the proposed launchway footprint, but accurate data could not be obtained due to the current and tidal conditions. The strong currents experienced in the area during the survey added an unacceptable risk to potential Bundle launching operations. Anecdotal discussions with the local guide that accompanied Subsea 7 on the site visit advised at the time that local currents in the area could become problematic for small boat operators that may camp and fish in the area. At the time, this was not fully appreciated, but became apparent when attempting the bathymetric survey.

The combination of high currents, the need for an extended launchway to be constructed and change in engineering required for tow procedures (which to date still does not exist), was deemed not appropriate for a development site for a Bundle pipeline fabrication facility.

### 6.2.2 Environmental values

Review by specialist consultants (360 Environmental 2016) determined that potential environmental impacts associated with development at Anketell Point were likely to include:

- Loss of mangroves within development footprint;
- Loss of the Nevin's slider skink (*Lerista nevinae)* habitat within development footprint;
- Minor changes to sediment transport across length of launchway;

- Short-term impacts to water quality during Bundle launch and tow;
- Possible minor impacts turtle nesting; and
- Possible isolated vessel/Bundle interactions with marine fauna during Bundle launch and tow.

In light of the likely environmental impacts identified above and general overall site assessment, the following EPA environmental factors were considered as likely need to require assessment at the Anketell Point site:

- Benthic communities and habitat;
- Coastal processes;
- Marine fauna;
- Marine environmental quality;
- Flora and vegetation;
- Terrestrial fauna; and
- Heritage.

It was acknowledged that given the existing studies that have already been completed within the Anketell Point area, the additional scope of works for environmental studies at this site would be reduced (e.g. short benthic habitat and onshore flora and vegetation surveys may be required to confirm no significant changes since previous surveys). It was considered likely that with appropriate management and mitigation actions in place that environmental approvals could be achieved for the Anketell Point site.

### 6.2.3 Site summary

Proximity to local infrastructure and existing development was a positive feature of this site. However, the beach interface and shallow nearshore profile would require extensive engineering and construction of an extended launchway. Other key concerns from the site selection process included unsuitable metocean conditions, future port development and expansion plans, the terrestrial topography and the unlikely long-term land access. These collectively created an operational risk that Subsea 7 could not accept. Therefore, Anketell Point was not considered appropriate for the development a Bundle fabrication facility; no further investigation into this site was undertaken (Table 6.1).

**Table 6.1: Anketell Point – Summary of Site Investigations Assessment outcomes**

| Factor | Desktop Assessment | Site Inspection Assessment | Site Investigations Assessment |
|---|---|---|---|
| Marine conditions | | | |
| Terrestrial conditions | | | |
| Land tenure | | | |
| Local infrastructure | | | |
| Heritage values | | | |
| Environmental values | | | |
| **Site selected for development:** | | | **No** |

## 6.3 LEARMONTH

### 6.3.1 Marine conditions

The bathymetry survey for the Learmonth sites was successful, and confirmed that the beach profile had a steady slope and was ideal for Bundle launch operations (Figure 6.1). This nearshore bathymetry allows for a relatively short launchway to be constructed, and vessels that can approach close to shore (<2.5 km) increases operability of the site.

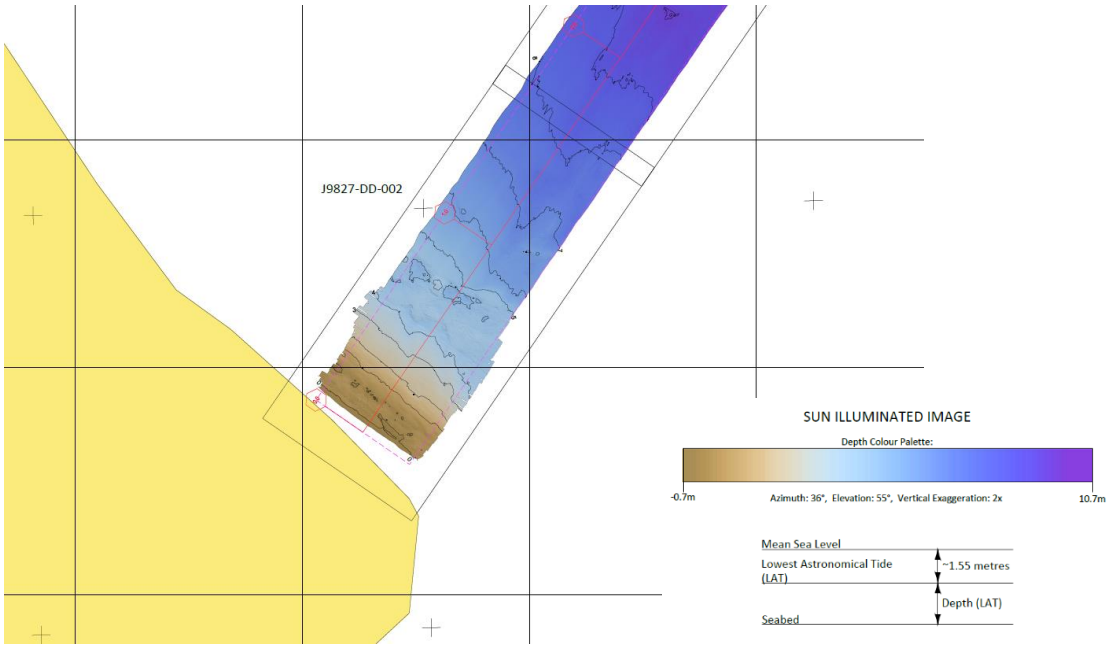



**Figure 6.1: Learmonth Seabed Survey**

The Exmouth Gulf creates relatively sheltered water in the vicinity of the proposed site. An understanding of regional hydrodynamics coupled with previous experience of operating vessels within Exmouth Gulf, indicated that marine conditions are not considered to be of concern within the vicinity of the proposed launchway.

The low currents within the area also suggest that any impact on local sediment transport and coastal processes due to the construction of the launchway would likely be minimal (see Section 6.3.3).

Potential alternative tow routes were also investigated at this stage for the Learmonth site. The proposed tow route passes between the Exmouth peninsula and the Muiron Islands (Figure 6.2). This route was selected based on suitable water depths and marine corridor for vessel and Bundle tow operations. This route is also known to be used by existing commercial and recreational vessels, and the tow vessels would be able to safely navigate the same passage. While vessel management strategies will need to be developed for the tow operations (typically 2–3 days), this is not considered to be a significant risk given the volume of vessel traffic in the area and the infrequent tow operations (e.g. up to three per year).

It is acknowledged that the tow route does pass through an area of the Ningaloo Marine Park and World and National Heritage areas (Figure 6.2). This route is also known to be regularly utilised by existing vessel traffic within the Exmouth Gulf; and tow operations are considered analogous to other vessel operations that occur through this region without restriction.

Subsea 7 commenced additional engineering design investigations and consultation with Bundle tow operators to develop a Bundle surface tow method that would ensure the Bundle would not interact with the seabed through these marine protected areas. It is estimated that vessel and Bundle tow operations through the marine protected areas would take approximately four hours to complete for each tow.

In an attempt to avoid the Ningaloo Marine Park and Heritage areas, alternative tow routes through to the east of Muiron Islands were investigated. However, it was assessed by marine and engineering experts, that these alternative routes were not viable due to the multiple shallow reefs and nearshore islands in the area (Figure 6.2). Safe navigation through this region was deemed not possible. In addition, it was considered preferable from an environmental perspective to avoid the east coast of the Exmouth Gulf, as this area has been recommended for the 'maximum' level of ecological protection (LEP)[8] (DoE 2006) (Figure 6.2).

Metocean analysis of the Exmouth Gulf was not conducted at this stage. Subsea 7 has extensive experience of performing marine operations in Exmouth from having executed a number of projects in the near vicinity. Exmouth Gulf is well known in the oil and gas offshore construction industry for being a relatively benign body of water for the operations and vessel specifications that are utilised in the industry. Therefore, this was considered to be a known condition that did not require further assessment at this stage in the process.

[8] Environmental quality conditions associated with maximum LEP is no detectable change from natural variation (for biological indicators), and no contaminant presence. By not utilising this area as part of the tow route, it removes the risk of introducing contaminants into the system from routine vessel operations.

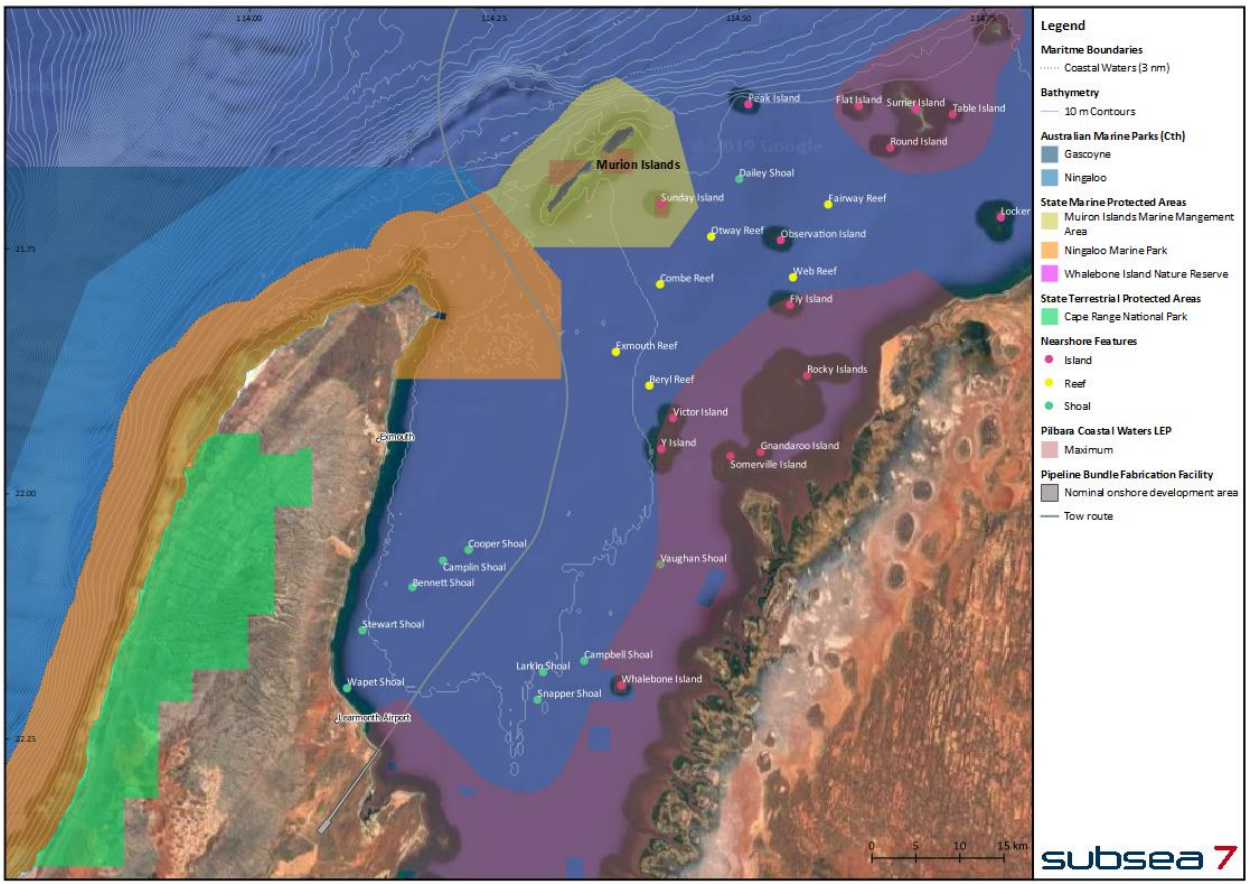



**Figure 6.2: Proposed tow route from Learmonth**

### 6.3.2 Land tenure

Investigations into tenure and planning approvals required for the Learmonth site involved specialist consultant advice and consultation with the Exmouth Gulf Station pastoralist (see Section 5.4.3), the Shire of Exmouth and the Department of Lands (now DLPH). Two key areas of concern were identified:

- Multiple options exist for obtaining a licence / permit to operate on the site. Consultation with Department of Lands indicated that obtaining the appropriate licence was unlikely to be a significant risk (in particular, given that there was support for the proposal by the pastoralist). A well-established legislative process exists to process licence applications. As such, this was considered to indicate that long-term access to the site was likely to be achievable[9].
- It was identified that a change in the zoning in relevant planning schemes would be required to allow the development and operation of a fabrication facility at the site. No significant concerns or issues were raised by the Shire of Exmouth regarding this request. As this application for a change to designated planning zones falls under an

[9] It is noted that this was not achievable for most other potential sites within this study as they would remain under the control of other third parties and often with pre-existing development strategies for the sites.

existing legislative process, and the Shire of Exmouth was supportive of the change, this was considered an achievable approval.

In summary, while the land is not currently zoned for the development and operation of a fabrication facility, the proposal is supported by the Exmouth Gulf Station pastoralist and the Shire of Exmouth., As such Subsea 7 considers that long-term security of the site would be achievable.

It is noted that subsequent to this site selection process undertaken in 2016, the Exmouth Gulf Station pastoralist and Subsea 7, have successfully entered into a Land Use Agreement, validating the Subsea 7 assessment of this risk.

### 6.3.3 Environmental values

An underwater towed video survey benthic habitat within the proposed launch area (extending approximately 1 km offshore and 400 m wide) was undertaken during December 2016 (360 Environmental 2017). A total of 47 towed video transects were conducted in the survey area offshore of Heron Point (Figure 6.3). Unvegetated soft sediment was the dominant habitat type (86.7%) with macroalgae and filter feeder-dominated reef habitats also present, all of which commonly occur within the shallow coastal waters of tropical northwest Australia 2016 (360 Environmental 2017). This initial benthic habitat survey in December 2016 did not identify any significant environmental risks within this launch area[10].

[10] Additional benthic habitat mapping and analysis has since been completed as part of PER studies and assessments.


(Source: 360 Environmental 2017)

**Figure 6.3: Benthic communities and habitats identified during ground-truthing survey in December 2016**

Review by specialist consultants (360 Environmental 2016) determined that potential environmental impacts associated with development at Learmonth would potentially include:

- Loss of seagrass/intertidal reef/macroalgae habitat along and immediately adjacent to Bundle launch route;
- Short-term impacts to water quality during the construction of the launchway, and during the Bundle launch;
- Possible impacts to subterranean fauna;
- Possible impact to tiger prawn nursery habitat; and
- Possible isolated vessel/Bundle interactions with marine fauna (turtle, whale, dugong) during pipeline Bundle launch and tow.

In light of the likely environmental impacts identified above and general overall site assessment, the following EPA environmental factors were considered as likely need to require assessment at the Learmonth site:

- Benthic communities and habitat;
- Coastal processes;
- Marine fauna;
- Marine environmental quality;
- Flora and vegetation;

- Subterranean fauna;
- Terrestrial fauna; and
- Heritage.

It was acknowledged that a number of technical studies would likely to be required to support the assessment of, and environmental approvals for, the Learmonth site. Studies are likely to be required in support of each of the EPA environmental factors, and may include benthic communities and habitat mapping, beach profiles, baseline water quality, marine fauna, flora and vegetation, terrestrial and subterranean fauna and heritage.

It was considered likely that pending outcomes of the above technical studies, and with appropriate management and mitigation actions in place, that the objectives for the EPA environmental factors could be met, and that there were no likely significant impacts to MNES, and therefore that environmental approvals could be achieved for the Learmonth site.

### 6.3.4 Site summary

Learmonth was considered appropriate for the development of a Bundle fabrication facility as it was considered both technically feasible (i.e. suitable marine conditions, terrestrial conditions and land tenure) and environmental feasible (i.e. impacts and risks associated with environmental and heritage values could be appropriately managed) (Table 6.2).

**Table 6.2: Learmonth – Summary of Site Investigations Assessment outcomes**

| Factor | Desktop Assessment | Site Inspection Assessment | Site Investigations Assessment |
|---|---|---|---|
| Marine conditions | ■ | ■ | ■ |
| Terrestrial conditions | ■ | ■ | ■ |
| Land tenure | ■ | ■ | ■ |
| Local infrastructure | ■ | ■ | ■ |
| Heritage values | ■ | ■ | ■ |
| Environmental values | ■ | ■ | ■ |
| **Site selected for development:** | | | **Yes** |

# 7. OUTCOME

The unique set of marine and terrestrial conditions required for a Bundle fabrication facility are not a common combination within the NWS region of Western Australia – or globally. To date, this has been the primary factor preventing the expansion of Bundle fabrication facilities beyond the original (and long-term) base in Wick, Scotland.

At the end of the site selection process (as outlined in this document), the Learmonth site was the only site that was a technically viable option for the development of a Bundle fabrication facility.

The Exmouth Gulf provides sheltered marine conditions, creating safe operating conditions for the launch and tow operations of a Bundle. The beach interface and onshore terrestrial conditions also allows for the minimum amount of infrastructure to be constructed on-site (i.e. no additional stabilisation or extended launchway etc.), and therefore the development footprint and subsequent environment impact can be minimised at this site.

The proximity of the Learmonth site to Exmouth (~30 km) also ensures a suitable home-base for the workforce and ability to provide light industrial support for the fabrication facility. While a change in planning zones would be required for the development to progress at Learmonth, this was not considered unachievable.

Stakeholder engagement with the Exmouth local community, Shire of Exmouth, and government agencies and regulators supported the claims that benefits from employment and business opportunities would provide the region with an alternative income source (i.e. in addition to the eco-tourism industry that is the primary source of revenue for Exmouth).

It is acknowledged that the tow route through the marine parks and the general presence of operations within the Exmouth Gulf region may pose some risks to environmentally sensitive areas or features. Based on initial environment studies, Subsea 7's well established track-record of safely managing marine operations, and the implementation of site-specific environmental control measures, it is considered that the environmental risks associated with operating in this area can be appropriately managed.

In addition, further studies and investigations (in support of the PER process, engineering design requirements, and the identification of additional management and mitigation controls, etc.) are expected to further ensure that any potential impact to the environment is aligned with the EPA objectives for the key environmental factors.

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# Appendix A: EPA Environmental Factors

This Appendix has been included to address Item 1 in Table 4 of the ESD (EPA 2018a). All information contained within this Appendix is indicative only and not based on quantitative assessments.

*Please note: this Appendix was **NOT** compiled as part of the site selection process during 2016, and as such does not form a part of the site selection process outcomes as presented in the main text of this report.*

**Key environmental factors**
Table A.1 provides a high-level comparison of the EPA environmental factors that could be expected to be considered as 'preliminary key environmental factors' for each site. This table includes all ten sites that were identified during the Regional Site Identification stage of the site selection process.

The identification of environmental factors in Table A.1 was primarily based on:

- EPA factors identified for Anketell and Learmonth by specialist consultants during the Site Investigations Assessment stage
- All four sea theme factors (i.e. benthic communities and habitat, coastal processes, marine environmental quality and marine fauna) were considered applicable at all sites
- Flora and vegetation, terrestrial fauna and social were considered applicable at non-SIA sites
- It is unknown if subterranean fauna would be applicable at the non-SIA sites.
- No EPA factors were identified for Boodarie SIA as the site was not feasible given it does not have a coastal interface

A detailed analysis of these factors, or consideration of the likely significance of impacts, has not been undertaken.

For comparative purposes the key environmental factors that were identified by the EPA as relevant for the PER assessment of the Learmonth site (EPA 2018a) have also been included in the final column of Table A.1. The only difference between the originally predicted key environmental factors at Learmonth and the actual factors as identified by the EPA, was the addition of Inland Waters.

**Objectives of environmental factors**
Table A.2 provides a high-level consideration of whether the objectives for each of the EPA environmental factors would likely be met.

To make an assessment against these objectives, an understanding of the types of environmental risks at each site is needed. Therefore, this table only includes the three sites that were progressed to the Site Inspection Assessment stage of the site selection process.

A detailed risk-assessment of these factors has not been undertaken. The assessment against the EPA objectives considered the following:

- The objectives of the environmental factors are considered likely to be met for Learmonth. This is based on the detailed studies and assessments that

 

have since been completed as part of the PER process (i.e. subsequent to the site selection process), including identifying appropriate mitigation and management actions where required.

- For Anketell and Gnoorea Point, the following assessments were made based on environmental information available during the site selection process, and knowledge of other development approvals within vicinity of these sites:
    - Without formal assessment of benthic community and habitat factor, it is unknown if this objective would be met (noting in particular the nearshore coral and/or filter feeder habitats and the cumulative loss assessment that would be required for both Anketell and Gnoorea Point given other approved operations in the area)
    - It is anticipated that any impacts to coastal processes, marine environmental quality and marine fauna would be able to be appropriately mitigated and/or managed
    - Without formal assessment of terrestrial fauna factor, it is unknown if this objective would be met (noting in particular the habitat for the EPBC-listed *Lerista nevinae*, and the cumulative loss assessment that would be required for Anketell given other approved operations in the area)
    - It is anticipated that any impacts to flora and vegetation, landforms, subterranean fauna, terrestrial environmental quality would be able to be appropriately mitigated and/or managed
    - Without additional information available, an assessment against meeting the objectives of the inland waters and social surroundings factors is unable to be made.

 

**Table A.1: Potential key environmental factors for each of the potential Bundle fabrication facility sites**

| EPA Environmental Factors | | | Potential Sites | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Theme | Factor | Objective | Browse SIA | Boodarie SIA [1] | Anketell Point | Burrup SIA | Maitland SIA | Gnoorea Point | Cape Preston East | Ashburton North SIA | Learmonth | Exmouth | Learmonth (as per EPA 2018a) |
| Sea | Benthic communities and habitats | To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Coastal processes | To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected. | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Marine environmental quality | To maintain the quality of water, sediment and biota so that environmental values are protected | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Marine fauna | To protect marine fauna so that biological diversity and ecological integrity are maintained | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Land | Flora and vegetation | To protect flora and vegetation so that biological diversity and ecological integrity are maintained | - | - | ✓ | - | - | ✓ | - | - | ✓ | ✓ | ✓ |
| | Landforms | To maintain the variety and integrity of significant physical landforms so that environmental values are protected | - | - | - | - | - | - | - | - | - | - | - |
| | Subterranean fauna | To protect subterranean fauna so that biological diversity and ecological integrity are maintained | - | - | | - | - | ? | ? | - | ✓ | ? | ✓ |

| EPA Environmental Factors | | | Potential Sites | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Theme | Factor | Objective | Browse SIA | Boodarie SIA [1] | Anketell Point | Burrup SIA | Maitland SIA | Gnoorea Point | Cape Preston East | Ashburton North SIA | Learmonth | Exmouth | Learmonth (as per EPA 2018a) |
| | Terrestrial environmental quality | To maintain the quality of land and soils so that environmental values are protected | - | - | - | - | - | - | - | - | - | - | - |
| | Terrestrial fauna | To protect terrestrial fauna so that biological diversity and ecological integrity are maintained | - | - | ✓ | - | - | ✓ | ✓ | - | - | ✓ | ✓ |
| Water | Inland waters | To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected | - | - | - | - | - | - | - | - | - | - | ✓ |
| Air | Air quality | To maintain air quality and minimise emissions so that environmental values are protected | - | - | - | - | - | - | - | - | - | - | - |
| Social | Social surroundings | To protect social surroundings from significant harm | - | - | ✓ | - | - | ✓ | ✓ | - | - | ✓ | ✓ |
| | Human health | To protect human health from significant harm | - | - | - | - | - | - | - | - | - | - | - |

Notes:
1. No EPA factors were identified for Boodarie SIA as the site was not feasible given it did not have a coastal interface.
2. ✓ (with blue shading) = expected to be considered a key environmental factor for that site.
3. ? = unable to determine (without further information) if this would be considered a key environmental factor for that site.
4. - = not expected to be considered a key environmental factor for that site.

**Table A.2: Qualitative assessment of likelihood of meeting the objectives of the EPA environmental factors**

| EPA Environmental Factors | | | Potential Sites | | |
|---|---|---|---|---|---|
| **Theme** | **Factor** | **Objective** | **Anketell Point** | **Gnoorea Point** | **Learmonth** |
| Sea | Benthic communities and habitats | To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained | Unknown | Unknown | Likely to be met |
| | Coastal processes | To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected. | Likely to be met | Likely to be met | Likely to be met |
| | Marine environmental quality | To maintain the quality of water, sediment and biota so that environmental values are protected | Likely to be met | Likely to be met | Likely to be met |
| | Marine fauna | To protect marine fauna so that biological diversity and ecological integrity are maintained | Likely to be met | Likely to be met | Likely to be met |
| Land | Flora and vegetation | To protect flora and vegetation so that biological diversity and ecological integrity are maintained | Likely to be met | Likely to be met | Likely to be met |
| | Landforms | To maintain the variety and integrity of significant physical landforms so that environmental values are protected | Likely to be met | Likely to be met | Likely to be met |
| | Subterranean fauna | To protect subterranean fauna so that biological diversity and ecological integrity are maintained | Likely to be met | Unknown | Likely to be met |

| EPA Environmental Factors | | | Potential Sites | | |
|---|---|---|---|---|---|
| Theme | Factor | Objective | Anketell Point | Gnoorea Point | Learmonth |
| | Terrestrial environmental quality | To maintain the quality of land and soils so that environmental values are protected | Likely to be met | Likely to be met | Likely to be met |
| | Terrestrial fauna | To protect terrestrial fauna so that biological diversity and ecological integrity are maintained | Unknown | Likely to be met | Likely to be met |
| Water | Inland waters | To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected | Unknown | Unknown | Likely to be met |
| Air | Air quality | To maintain air quality and minimise emissions so that environmental values are protected | N/A | N/A | N/A |
| Social | Social surroundings | To protect social surroundings from significant harm | Unknown | Unknown | Likely to be met |
| | Human health | To protect human health from significant harm | N/A | N/A | N/A |

Notes:
1. Blue shading = expected key environmental factors (as per Table A.1)
2. N/A = environmental factor not applicable to the proposal