360 environmental

Learmonth Pipeline
Fabrication Facility

Landscape and Visual Impact Assessment

Prepared for:
Subsea 7

June 2019

people • planet • professional

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Executive Summary

360 Environmental was commissioned by Subsea 7 to undertake a Landscape and Visual Impact Assessment for the proposed Learmonth Pipeline Fabrication Facility, located approximately 35 km south of the township of Exmouth, Western Australia. The Project involves the construction and operation of a subsea pipeline bundle fabrication facility at Heron Point, where completed bundles are launched via dedicated bundle tracks into the shallows at Heron Point, before being towed through the Exmouth Gulf and taken to offshore oil and gas fields.

The scope of works primarily required characterisation of the existing landscape, the identification of valued places and points, and the assessment of potential visual amenity and landscape impacts the Project could have in relation to existing and potential future impacts.

Following the findings of a desktop assessment during which valued places and points were identified (in consultation with the Western Australian Environmental Protection Authority), we undertook a site assessment that characterised the landscape and surveyed the visual amenity values associated with 35 valued places. Based on the findings of the field assessment, a detailed visual impact assessment was undertaken for eight key sites which encapsulate the various visual amenity values of the region. The assessment made use of viewshed and photomontage analysis, using a scaled 3D model of the Project.

The results of the assessment indicated differing levels of impact associated with various project components:

- The fabrication facility located close to the Minilya-Exmouth Road appeared to mostly affect views from the road itself, although typical road users are travelling at high speed through the area;
- The launchway and bundle tracks appeared to largely impact coastal receptors at Heron Point, which is considered to be a locally significant area for landscape and visual amenity values. Although a significant impact is likely to be experienced during bundle launches, impacts for most of the year are considered low, due to the small footprint of the Project in this area, the similarity of the structure to others in the area (e.g. jetty) and the minor impact on the use of the area; and
- Offshore operations, which involve the towing of completed bundles through the Gulf did not appear to have any significant impact on any valued receptors, apart from Schofield Shoal and Heron Point, locally valued locations where impacts during bundle launches were considered significant (it should be noted that there is minimal impact on this location for most of the year).

The assessment found that minimal impacts can be expected from the Project for the majority of the year, outside of the bundle launch phase, during which locally valued sites may be significantly impacted. A number of Visual Mitigation Measures aimed to minimise these impacts have been proposed. The assessment also found that the Visual

Management Objectives for the Proposal can be achieved, if a number of Visual Mitigation Measures are implemented

Negligible impacts are expected to the nationally and internationally significant areas of the Exmouth Peninsula (e.g. the Ningaloo World Heritage Area and Commonwealth Marine Reserve), as activities in these areas will not persist for any significant amount of time, and are similar to existing impacts in the area (large vessel operations).

In terms of impacts to landscapes, all Landscape Character Units affected by the Project were not found to be of high regional value, with the exception of the 'Gulf Coast' Landscape, which was considered to be relatively rare and locally valued. The Project is only expected to directly affect 0.2% of the extent of this Landscape within the assessment's Study Area.

Cumulative impacts from the project are expected to be minor, with the Project contributing to a small portion of existing land uses and activities in the region. It is expected that onshore activities will impact approximately 177 ha of land, which is approximately the same as that of nearby communication stations, and half that of the surrounding airfields and defence facilities. Cumulative impacts from offshore activities are also considered to be minor, primarily from the low frequency of offshore operations (3 bundle launches per year, with an estimated total time of 48 hours per launch). No information on future activities in the gulf were found; existing activities in the gulf, such as commercial prawn trawling, pearl shell harvesting and freight are likely to continue. The Project represents a relatively low impact proposal that would not affect the visual amenity values of the region.

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Appendix A Other Surveyed Sites

Definitions of Terms, Acronyms and Abbreviations

Term	Definition
Apparent Horizon	The theoretical limit of visibility where the surface of the earth is no longer visible, accounting for atmospheric diffraction.
Background	Elements at the furthest reaches of a view.
Development Envelope	The conceptual maximum disturbance boundary used in this assessment.
Foreground	Elements at the closest reaches of a view.
Landscape	A spatially heterogeneous area scaled relative to the process of interest. Encompasses physical/environmental values and human values.
Landscape Character Type/Unit	A large-scale geographic area with broad similarities in land use, landform types, soils and vegetation.
Land System	A fine scale geographic area with a specific combination of landforms, soils, vegetation and drainage patterns.
Midground	Elements between the foreground and background.
True Horizon	The theoretical limit of visibility where the surface of the earth is no longer visible, assuming a perfect sphere and no atmosphere.
Vantage Point	A location assessed under this assessment as potentially being impacted by the Project.
Viewpoint	A location that offers views of the surrounding area.
Viewshed	The area visible from a particular location.
Visual Amenity	Range of values associated with experiencing a landscape.
Visual Absorbance Capacity	The capacity of a landscape to accommodate physical changes without a change in its character
Visual Impact Assessment	The analysis of changes in the appearance of the landscape because of a development. Impacts may be negative and positive.
Visual Mitigation Measures (VMM)	Specific recommendations to improve visual amenity at the Project site.
Zone of theoretical visibility	A computer-generated tool to identify the likely (or theoretical) extent of visibility of a development. The elevation (or a set of elevations) of the development is tested against a 3D terrain model.
Acronym	**Definition**
4WD	Four Wheel Drive (Vehicle)
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AHTS	Anchor Handling Tug Supply Vessel
AGL	Above Ground Level
ASL	Above Sea Level
BoM	Bureau of Meteorology

CALM	Department of Conservation and Land Management (Western Australia)
DAFWA	Department of Agriculture and Food (Western Australia)
DoEE	Department of the Environment and Energy (Commonwealth)
DMIRS	Department of Mines, Industry Regulation and Safety (Western Australia)
DPI	Department of Planning (Western Australia)
DWER	Department of Water and Environment Regulation
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority (Western Australia)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System
LCU	Landscape Character Unit
LOA	Length Overall (of Vessel)
LVIA	Landscape and Visual Impact Assessment
NOPTA	National Offshore Petroleum Titles Administrator
NNTT	National Native Title Tribunal
RAAF	Royal Australian Airforce
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VLF	Very Low Frequency
VMO	Visual Management Objective
VMM	Visual Management Measures
WAPC	Western Australian Planning Commission
ZTV	Zone of Theoretical Visibility

ABBREVIATION	DEFINITION
ha	Hectare
m	Metre
km	Kilometre
km^2	Square kilometre
Km/h	Kilometres per hour
Kt	Knots
Rd	Road

1 Introduction

Subsea 7 Australia Contracting Pty Ltd (Subsea 7) is proposing to construct and operate an onshore pipeline fabrication facility ('the Project') at Lots 233 and 1586 to the east of Minilya-Exmouth Road, Learmonth approximately 35 km south of the Exmouth town site. The Project consists of two bundle tracks approximately 10 km in length, fabrication site, launch way facilities and access roads. The total area covered by the Project is estimated to be 177 ha within the 502 ha Development Envelope.

The Project was referred to the Environmental Protection Authority (EPA) and it was determined that the proposal should be assessed under Part IV of the *Environmental Protection Act 1986* (EP Act). The level of assessment has been determined as a Public Environmental Review.

One of the key environmental factors identified for the Project is Social Surroundings. This is due to potential impacts to amenity and social values, including visual landscape, scenic and visual aesthetic values, recreation and tourism in a marine park, and social impact of aesthetics or active use of the proposal area.

360 Environmental Pty Ltd (360 Environmental) was commissioned by Subsea 7 to conduct a Landscape and Visual Impact Assessment (LVIA) to support stakeholder consultation, the environmental impact assessment and approvals required for the Project.

The Project Envelope is provided in Figure 1 and the layout of the Project is provided in Figure 2. The Study Area covered by this assessment is provided in Figure 3.

1.1 Project Description

The onshore components of the Project include a pipeline bundle fabrication site (which includes site offices and various buildings); two bundle tracks (approximately 10 km in length) along which the bundles will be constructed and launched; a bundle launchway that crosses the beach and extends into the subtidal zone at Heron Point in the Exmouth Gulf; access roads; spray field; a borefield; a drainage sump and a hydro testing water pond.

The offshore components of the Project include a bundle tow route, comprising of a Bundle Parking Area and a marine vessel spread (two tugs, a command vessel, and a guard vessel).

An average of two bundles will be launched per year (and no more than three). When bundles are launched, they will be slowly towed, along a pre-determined route, by two tugs. The bundle will be in 'Off bottom tow', meaning that the bundle (including towheads) will be clear of the seabed at a controlled depth beneath the ocean's surface. On arrival at the Bundle Parking Area, the bundle will be stopped, and various checks and reconfiguration of the subsequent surface tow completed. The Bundle may remain within this area for up to 24 hours. On exit from the Bundle Parking Area the tow vessels will increase the tow speed to 5-6 knots (up to a maximum of 8 knots) to produce a lift component and the bundle will rise to the surface in a controlled manner. In this 'Surface

tow' configuration the bundle lies right at the surface, ensuring maximum clearance from the seabed within Ningaloo Marine Park and World Heritage Area. Once the bundle and tow fleet exit the Exmouth Gulf and enter deeper waters, the bundle tow speed will be reduced slightly, and the tension from the trailing tug reduced, to allow the bundle to be lowered to sit at mid-depth in the water column. This depth varies, but once the bundle is stable, the tow has entered the 'Controlled Depth Tow Method' (CDTM)[1] which will continue until the bundle reaches its installation location.

1.1.1 Project Elements

This LVIA considers impacts from the physical elements of the Project to stem from two major components during the construction and operational phases:

- Onshore Operations: Construction and operation of a fabrication facility (Plate 1-3):
    - A fabrication site where pipeline segments are constructed. This area includes a fabrication shed, site offices, staff and messing facilities, pipeline storage area, car park, a winch assembly and control station to allow the controlled release of the bundle along the tracksTwo 10 km bundle tracks to transport the constructed pipeline bundle;
    - Fencing – the entire fabrication site and bundle track corridor will be fenced only up to the landward side of dune line, before the beach;
    - A concrete and rock launchway, crossing the beach and extending up to 380 m (measured from dune line) by 15 m wide into water at Heron Point. The construction of the launchway will necessitate a cut through the dune system. The construction of the launchway will reduce the elevation of the coastal dune in this area from approximately 5 mAHD down to an elevation of around 2.5 mAHD at the foundation level. A launchway crossing will be installed to maintain public beach access at Heron Point; and
    - A hydro testing water pond.
- Offshore Operations: Towing of completed bundles through the Exmouth Gulf. This includes (Plates 4 - 6):
    - Two tow heads attached at each end of the bundle pipeline assembly;
    - Marine vessel spread – two tugs towing the bundle, a command vessel and a guard vessel;
    - Off-bottom tow of bundle to the Bundle Parking Area for reconfiguration of ballast; and
    - Surface tow through the Ningaloo World Heritage Area.

[1] For more technical details of a bundle launch and tow refer to Section 2.3 of Subsea 7's Public Environmental Review (PER) report (Subsea 7 2019) available on EPA's website.

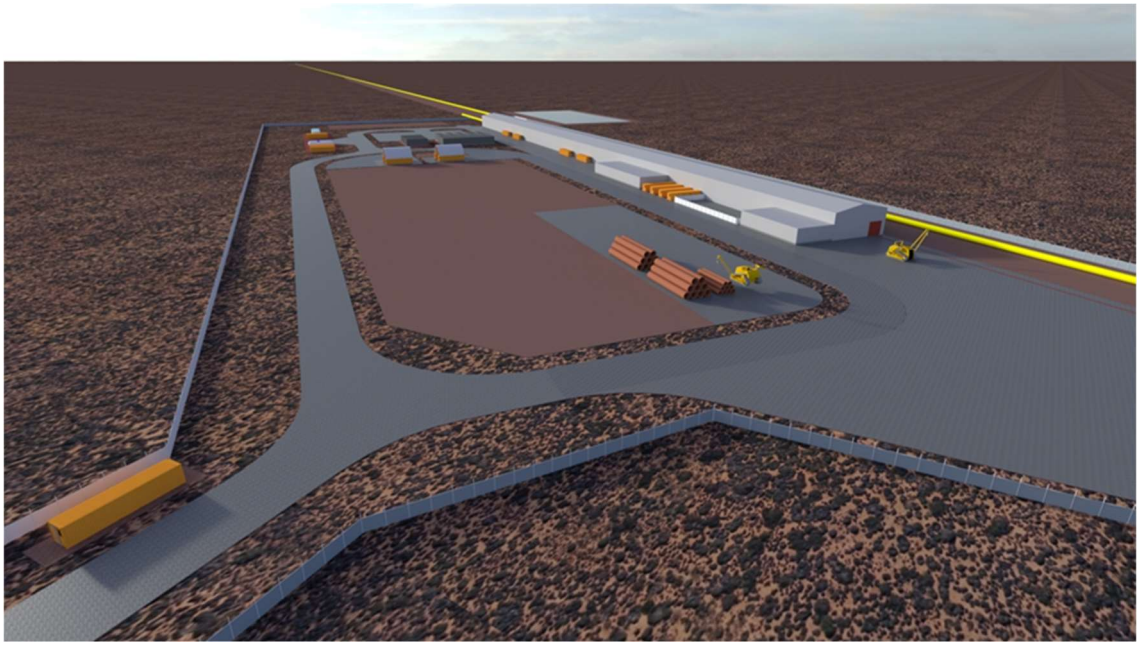

Plate 1. 3D model of the fabrication facility

Plate 2. 3D model of bundle tow head at launchway area, Heron Point

Plate 3. Bundle tow arrangement - Off Bottom Tow

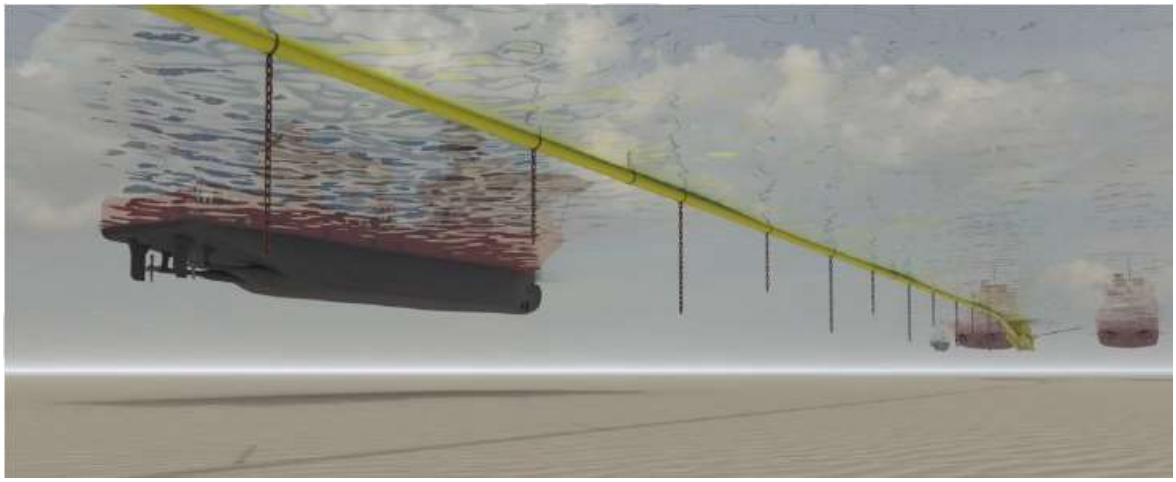

Plate 4. Bundle tow arrangement - Surface tow

Plate 5. 3D model of the offshore bundle tow operations (surface tow)

1.1.2 Project Activities

This LVIA considers impacts from the Project may stem from various activities during the construction and operational phases.

1.1.2.1 Construction Phase

Onshore Activities

The construction phase will take up to 9-12 months and will occur during daylight hours (12 hour shifts). Activities that may impact visual amenity are as follows:

- Some artificial light sources at the fabrication site and launchway appropriate to the task and compliant with occupational health and safety requirements. Shrouded or directional lighting as well as motion-sensor or timed lighting will be used and placed such that the majority of light is focused on the working areas and not out to sea;
- Temporary restricted access to the launchway area (<3 months) during construction;
- Noise will be generated during the construction phase by the various plant and vehicles operating. No loud noise sources, such as piling or blasting, are proposed;
- Dust is likely to be generated during construction as a result of clearing for the fabrication site; access roads and bundle tracks. Dust is also likely to be generated at the launchway area particularly at the dune line. This will be minimised via dust suppression from a frequent water cart as well as the provision of a workforce bus to minimise vehicles entering site, and
- Direct, temporary visibility of moving plant and equipment (e.g. cranes).

Offshore Activities

During the construction phase, offshore areas are not expected to be impacted as no activities are proposed.

1.1.2.2 Operational Phase

The operational phase is expected to be 40 years and will include onshore operations such as bundle builds and fabrication, operation of machinery, and bundle launch and tows.

Onshore Activities

It is intended that the onshore fabrication site will operate on a 12-hour day shift basis, with occasional 24-hour operations (during bundle launch, or during occasional peak fabrication times where the delivery schedule requires it). Onshore activities that may impact visual amenity are as follows:

- The entire Project area (except the launchway) will remain restricted due to safety reasons. The launchway area to the east (seaward) of the dune line will only be temporarily (108 hours or 1.2 % of the year) restricted during bundle launches. This area was identified during stakeholder engagement processes as having important recreational values. Subsea 7 has proposed that a launchway crossing will be incorporated into the launchway design that allows off-road vehicles to continue along the beach to Heron Point and the Bay of Rest.
- Direct visibility of land-based infrastructure with heights that are significantly over the existing topography, which may be at variance to the character of the landscape (e.g. fabrication shed, winch station, fencing up to dune line, cranes). Note that Subsea 7 is proposing to use mobile cranes as opposed to fixed cranes (e.g. Goliaths/gantry) during 12-hour day shift;

- Dust may be generated from equipment, but also from vehicles using the access road into the facility, which may affect amenity values. This will be minimised via dust suppression from a frequent water cart as well as the provision of a workforce bus to minimise vehicles entering site;
- Light pollution may be evident in the fabrication facility during operation as well as the launchway, Shrouded or directional lighting as well as motion-sensor or timed lighting will be used and placed such that the majority of light is focused on the working areas and not out to sea.

Offshore Activities

Offshore activities will include bundle launch and tows. An average of two bundles will be launched per year and no more than three. Nominally two days of offshore activity will occur per launch. Offshore activities that may impact visual amenity are as follows:

- Direct, temporary visibility of vessels and in some areas, the towhead and bundle which may be at variance to the character of the landscape/seascape and/or conservation areas. It is estimated that each bundle launch will take approximately 48 hours to complete its launch and tow through the Gulf. This is approximately 144 hours per year (based on three launches a year). Therefore, the bundle launch and associated marine vessel spread will be operational for a maximum of 1.64 % of the year in the Gulf;
- Access to the Heron Point / Schofield Shoal offshore area will restricted for up to 36 hours per launch, equating to 1.2 % of the year (based on three launches a year). This coincides only with bundle launch operations; and Lighting design during bundle launches will be shrouded or directional lighting such that the majority of light is focused on the working areas and not out to sea.

Legend

- Project Envelope
- Tow Route
- Offshore Operations Area
- Bundle Parking Area
- Major Roads
- Local Roads

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2018
- LOCALITY MAP SOURCED FROM LANDGATE 2007
- AERIAL PHOTOGRAPHY SOURCED FROM ESRI 2019
(© Western Australian Land Information Authority 2018)

subsea 7

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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0 10 20 30
Kilometers
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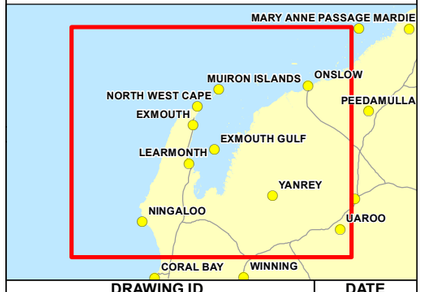
LOCALITY MAP



DRAWING ID	DATE
2061	30/4/2019

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	HT	HT	0

Subsea 7
Learmonth Pipeline Fabrication Facility

Landscape and Visual Impact Assessment

Figure 1 **Project Location**

K:\Projects\1.0 EBS\805\Figures

EXMOUTH

EXMOUTH GULF

BAY OF REST

POINT LEFROY

170000 180000 190000 200000 210000 220000 230000 240000 250000

7620000 7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000 7520000

Subsea 7
Learmonth Pipeline Fabrication Facility

Landscape and Visual Impact Assessment

Figure 2 Project Layout

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Legend

- Major Roads
- Roads

Onshore Components

- Project Envelope (Estimated 474 ha)
- Development Footprint (Estimated 177 ha)

Offshore Components

- Tow Route
- Tow Area (16,489 ha)
- Bundle Parking Area (2,429 ha)

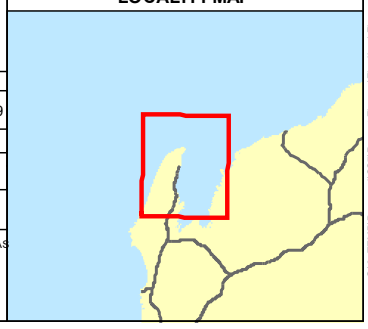
0 2 4 6 8 10
Kilometers
1:300,000 @ A4

PROJECT ID			DATE
2061			10/01/2019
CREATED	CHECKED	APPROVED	REVISION
JJR	HT	HT	0

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

N
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2017
- ELEVATION FROM GEOSCIENCE AUSTRALIA STRM DATA
- AERIAL PHOTOGRAPHY SOURCED ESRI 2018
(© Western Australian Land Information Authority 2018)

LOCALITY MAP



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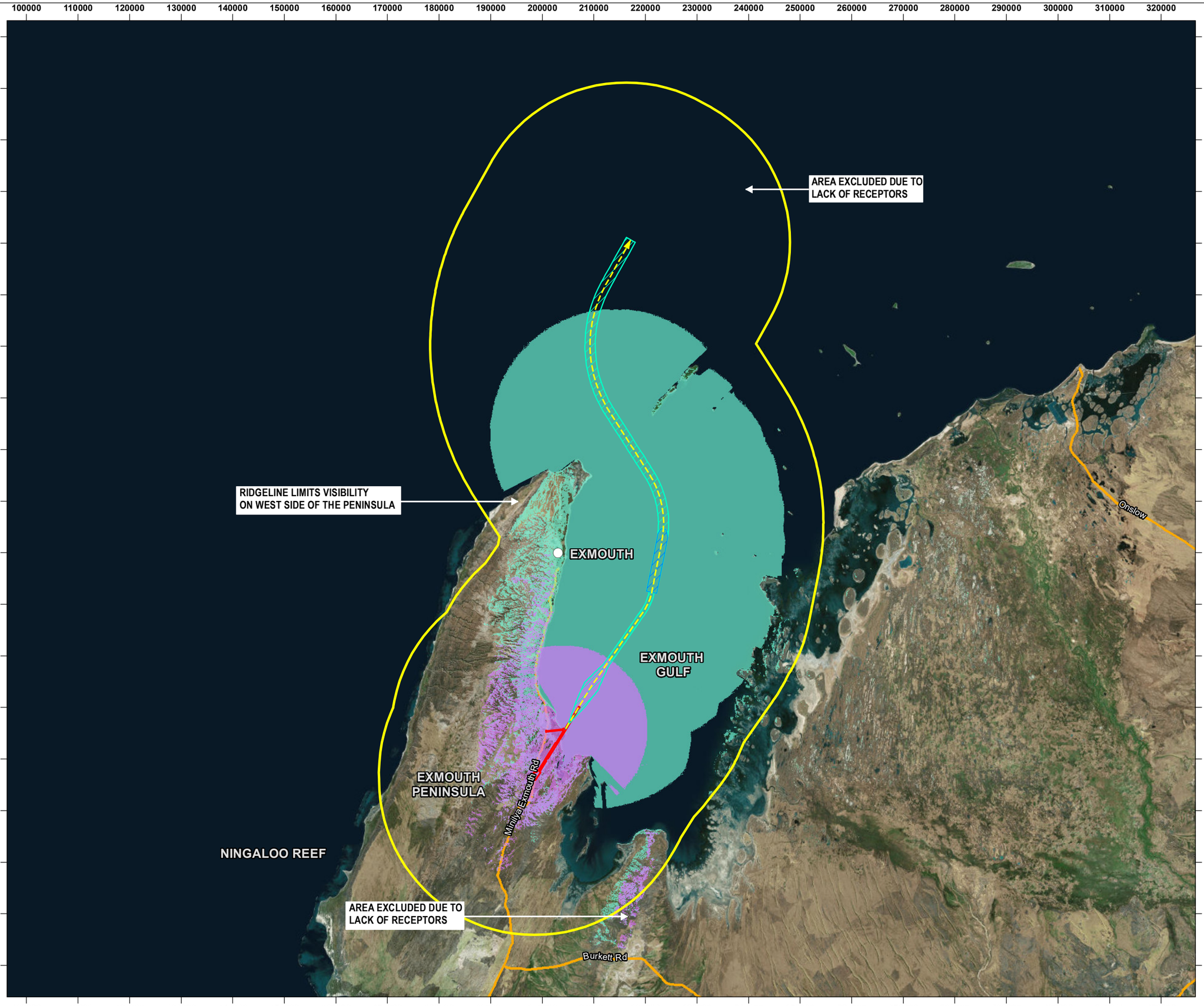

Legend

- Study Area
- Major Roads

Onshore Operations

- Project Envelope (Onshore)

Offshore Operations

- Tow Area
- Tow Route
- Bundle Parking Area

Zone of Theoretical Visibility

- Onshore ZTV
- Offshore ZTV

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2018
- LOCALITY MAP SOURCED FROM LANDGATE 2007
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subsea 7

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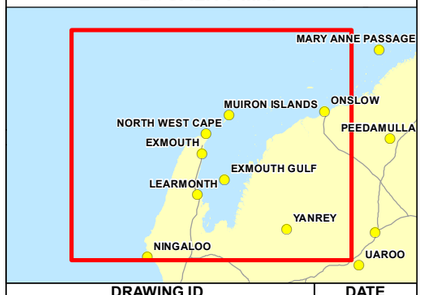

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2061	30/4/2019

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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Subsea 7
Learmonth Pipeline Fabrication Facility

Landscape and Visual Impact Assessment

Figure 3 Study Area and Zone of Theoretical Visibility

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1.2 Objectives and Scope of Work

The objective of this LVIA is to demonstrate how the Project can meet the EPA's objective for Social Surroundings. The EPA objective is:

To protect social surroundings from significant harm

The scope of work relevant to this LVIA is outlined in the EPA's Environmental Scoping Document (EPA 2018) and is listed in Table 1 below, along with the corresponding section of this report.

Table 1. Scope of Works

No	Scope	Relevant Sections
73	Characterise the environment by providing a description of the visual landscape character and scenic quality values and provide maps of the visual landscape units that may potentially be visually affected. This should include, but not be limited to: landforms; vegetation; and waterways/bodies and can be undertaken by way of 3-dimensional modelling and/or photographs.	Sections 4.2
74	Characterise the current, and any other reasonably foreseeable, land and recreation uses and amenity values (including for visual, noise, odour and dust) of the proposal area.	Sections 4.2, 4.3 and 4.6 Social Impact Assessment (360 Environmental 2019) Social Surrounds Chapter of Public Environment Review (Subsea 7 2019)
75	Identify and discuss the potential sources and impacts of noise, dust, light-spill and alteration to landscape from the proposal.	Sections 4 and 5 Social Impact Assessment (360 Environmental 2019) Social Surrounds Chapter of Public Environment Review (Subsea 7 2019)
76	Design and undertake a visual impact assessment (VIA) for before, during construction, after construction, during operations, and after closure and decommissioning, to assess the impacts of the proposal on visual amenity in accordance with the Western Australian Planning Commission (WAPC 2007) Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design.	This Report

No	Scope	Relevant Sections
77	The VIA will identify and describe the aspects of the proposal which may potentially affect the visual landscape character and scenic quality values both temporarily and permanently, using agreed (by the EPA) reference and vantage points of surrounding areas and use area's viewer positions and perceptions.	Sections 4 and 5 Social Impact Assessment (360 Environmental 2019) Social Surrounds Chapter of Public Environment Review (Subsea 7 2019)
78	Predict the residual amenity impacts from the proposal on the landscape, land and recreation use and amenity values (including visual, noise, odour and dust) after considering and applying avoidance and minimisation measures. Impact predictions are to include, but not be limited to: a) The likely extent, severity and duration of the impacts; b) Simulations/modelling of the predicted residual impacts from the proposal, including changes to the landscape from the agreed reference and vantage points. Include the cumulative impacts on amenity (visual, noise, odour and dust) from the proposal and other currently approved developments.	Sections 4, 5 and 6 Social Surrounds Chapter of Public Environment Review (Subsea 7 2019)
79	Review the social implications of the proposal to planned activities within Ningaloo Marine Park, in the context of the stated objectives of each of the relevant social values outlined in the Management Plan	Section 5.3 – only two relevant social values (seascape and wilderness) The Social Surrounds Chapter of Public Environment Review addresses all remaining social values (Subsea 7 2019)
80	Identify management and mitigation measures for the proposal to ensure residual impacts to land and recreation uses, and amenity (including visual, noise, odour and dust) are not greater than predicted.	Section 5.6 Social Surrounds Chapter of Public Environment Review provides further mitigation measures for noise, dust and odour (Subsea 7 2019)

1.3 Visual Management Objective

Visual Management Objectives (VMOs) were developed based on the expectations for the Project from a land use and planning perspective (Table 2).

Table 2. Visual Management Objectives

Project Element		Visual Management Objective
Onshore Operations		
1	Fabrication Facility	Activities at the Fabrication Facility should not significantly degrade the visual landscape character of the surrounding areas.
2	Bundle Tracks	Activities on the bundle tracks should not significantly degrade the visual landscape character of surrounding areas.
3	Launchway Facilities	Activities at the launchway should not degrade the visual landscape character and amenity values of the surrounding areas.
Offshore Operations		
5	Bundle Launch	Bundle launch activities should not interfere with access to surrounding high value offshore and inshore sites.
6	Off Bottom Tow	The 'Off-Bottom' tow phase should not degrade the visual landscape character of the Exmouth Gulf or interfere with access to surrounding areas within the Exmouth Gulf.
7	Surface Tow	The Surface tow phase should not degrade the visual landscape character of the Ningaloo Marine Park and World Heritage Area during the surface tow phase.

1.4 Legislative and Policy Framework

Legislative instruments exist at both Federal and State levels that directly or indirectly support the protection of landscapes and their resulting visual amenity. These are outlined in Table 3.

Table 3. Legislative and Policy Framework and Relevance to the Project

Applicable Legislation	Relevance	Consideration Under this Assessment
Federal Law		
Environment Protection and Biodiversity Conservation Act 1999	Under Section 528 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the term 'environment' is defined as: a) Ecosystems and their constituent parts, including people and communities; and b) Natural and physical resources; and c) The qualities and characteristics of locations, places and areas; and d) Heritage values of places; and e) The social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), (c) or (d). While the Project has the potential to affect all aspects of the 'Environment' as defined under the EPBC Act, impacts to subsection (c) and (d) are directly related to landscape and visual amenity values.	This assessment has been prepared using a methodology that assesses and documents the qualities, characteristics and social importance of the site, and presents an estimated level of impact using a combination of professional judgement and statistical methods.
Native Title Act 1993	The *Native Title Act 1993* recognises the traditional 'rights and interests' that certain groups of Aboriginal or Torres Strait Islander People have to certain areas of land. These rights and interests may include: ● The right to build shelters, live and camp on the area;	360 Environmental understands that ongoing consultation is being carried out with the registered Gnulli Claimants of the area, the West Thalanyji / Jinigudira People on matters of culture and heritage.

Applicable Legislation	Relevance	Consideration Under this Assessment
	• The right to hunt, fish or collect food; • The right to visit and protect places of cultural importance; and • The right to conduct ceremonies. Impacts to these rights and interests from Landscapes and Visual Amenity impacts may stem from: • Direct loss of mythological sites associated with specific or rare landforms (rock pools, outcrops etc.); and/or • Loss of a sense of enjoyment or fulfilment when practicing Native Title rights or interests (access restrictions to high value areas, loss of camp sites etc.). Native Title can exist alongside the rights of other land holders (e.g. pastoral lessees, *Mining Act 1978* tenure). As Native Title is a legal recognition of traditional lands, it is important that the needs of Claimants and Determinants are considered when assessing visual and landscape impact.	The Gnulli Claimants are seeking (among others), rights to use and enjoy the area, to control access of others to the area and the right to control the use and enjoyment of others of resources of the area (NNTT 2018). This assessment considers the rights listed above when proposing impact mitigation strategies. At the time of writing it is expected that further negotiations and consultation with the Gnulli Claimants will be required prior to a final list of mitigation measures.
State Law		
Environmental Protection Act 1986 (EP Act)	Under the EP Act, 'environment' is defined as: subject to subsection (2), means "living things, their physical, biological and social surroundings, and interactions between all of these" When a proposal is assessed under the EP Act, the EPA may consider a proposal's impacts to visual amenity under its guidance framework for environmental factors based on a number of environmental factors and protection objectives listed in the Statement of Environmental Principles, Factors	Under the Landforms factor, the EPA considers possible impacts as the removal or alteration of the landforms defining geology, morphology or abiotic processes and the level of dependent environmental values (EPA 2018b).

Applicable Legislation	Relevance	Consideration Under this Assessment
	and Objectives (EPA 2018a). The factors and objectives generally relevant to landscape and visual impacts are: • Landforms: "To maintain the variety and integrity of significant physical landforms so that environmental values are protected"; and • Social Surroundings: "To protect social surroundings from significant harm" (EPA 2016). The EPA's consideration of impacts to Landforms is distinctly separate from impacts to Social Surroundings. Where a landform and associated landscape may hold socio-cultural significant, assessment of potential impacts falls under the Social Surroundings factor. Typically, the significance of landforms is valued based on their variety, integrity, ecological importance, scientific importance and rarity (EPA 2018b). This LVIA does not assess impacts to ecological function as these are assessed by other technical disciplines.	Similarly, under the Social Surroundings Factor, the EPA will consider activities that may impact the amenity of social surroundings or aesthetic values (EPA 2016).
Aboriginal Heritage Act 1972 (AH Act)	The AH Act provides for the identification and protection of places and objects of traditional importance to Aboriginal People in Western Australia. Aboriginal Heritage 'Sites' are typically divided into two overarching categories: • Mythological Sites: ethnographic sites with values that are not necessarily physical in form, often associated with the Dreamtime (e.g. rivers, waterholes, landforms); and • Archaeological Sites: sites with culturally important physical relics or artefacts (e.g. artefact scatter, middens, rock art).	Requirements under the AH Act are being considered under a separate process. It is not considered appropriate for 360 Environmental to make professional judgement on cultural values under this report.

Applicable Legislation	Relevance	Consideration Under this Assessment
	Although not explicitly stated, any sites with Aboriginal Heritage importance are also highly valued in terms of their landscape and/or visual amenity values.	
Non-Legislative Requirements		
Statement of Planning Policy No 2: Environment and Natural Resources Policy (2003)	The Western Australian Planning Commission's (WAPC) Statement of Planning Policy No. 2: *Environment and Natural Resource Policy* (2003) states that the objectives of the policy is to: ● Identify and safeguard landscapes with high geological, geomorphological or ecological values, as well as those of aesthetic, cultural or historical value to the community, and encourage the restoration of those that are degraded. ● Consider the level or capacity of the landscape to absorb new activities and incorporate appropriate planning and building design and siting criteria to ensure that new development is consistent and sensitive to the character and quality of the landscape. ● Consider the need for a landscape, cultural or visual impact assessment for land use or development proposals that may have a significant impact on sensitive landscapes.	This assessment aims to meet the objectives of the Policy by identifying landscapes with high values and considers their capacity to absorb changes.
State Planning Policy 6.3: Ningaloo Coast (2004)	The WAPC's State Planning Policy 6.3: Ningaloo Coast (2004) states that the following key policy objectives for development within the Ningaloo Coast policy area:	A key purpose of this assessment is to assess the impacts of the Project to the values of the Ningaloo Coast and Exmouth area. Where possible, Visual Management Objectives have been

Applicable Legislation	Relevance	Consideration Under this Assessment
	● Provide proponents, state agencies, local government and the community with clear guidance regarding acceptable and sustainable development on the Ningaloo Coast; ● Maintain the Ningaloo coast as an all-seasons recreation and nature-based tourism destination and limit growth with managed staged development, to ensure that the community continues to enjoy a remote and natural experience; ● Preserve and protect the natural environment and enhance and rehabilitate degraded areas within the environment; ● Consolidate future residential, commercial, higher-impact tourism and industrial development in the towns of Carnarvon and Exmouth and provide strategic directions for their future growth.	recommended based on the objectives of this Policy.
Ningaloo Coast Regional Strategy Carnarvon to Exmouth (2004)	The Ningaloo Coast Regional Strategy Carnarvon to Exmouth (WAPC 2004) sets the framework for planning for sustainable tourism and development on the Ningaloo coast and includes a number of 'Guiding Principles', grouped around the following: 1. Sustainable development; 2. Community aspirations; 3. Aboriginal heritage; 4. Economic development; 5. Interdependence; 6. Limits of acceptable change; 7. Precautionary principle;	While all guiding principles are considered important to the Project, this assessment considers Principles 1, 4, 6, 7 and 8 in further detail. A desired outcome of this assessment is to recommend mitigation measures that will allow the Project to have a visual impact footprint similar to a 'low-impact development.

Applicable Legislation	Relevance	Consideration Under this Assessment
	8. Cumulative Impacts; 9. Protection of high conservation values; 10. Protection of remoteness values; and 11. Protection of biodiversity. Additionally, the Strategy sets out a definition for what is considered a 'Low-impact development', in the context of tourism developments on the Ningaloo coastline: ● Development being located so as to avoid ridgelines, escarpments or visually exposed sites and situated where screening vegetation or land form can be utilised; ● Use and development being sensitively located and designed to minimise impact on vegetation, water courses, soil quality and existing land uses; ● Development being of a scale and nature so as to be self sustaining on the lot, or demonstrating the ability to provide servicing without significant modifications to existing infrastructure ● Development that by the nature of its scale, design, colours, materials, landscaping and use, has minimal impact on its site and surrounding areas; and ● Where the lands use and any development has minimal off-site consequences.	
Gascoyne Coast Sub-Regional Strategy (2015)	The Sub-Regional Strategy for the Gascoyne highlights the need to:	The purpose of this assessment is to define the values of the landscapes in the Study area as well as identifying and

Applicable Legislation	Relevance	Consideration Under this Assessment
	● Retain high visual quality of rural landscapes, including preservation of view corridors/vantage points.	cataloguing view corridors and vantage points.
Cape Range National Park Management Plan (DEC & CCWA 2010)	This management plan provides for the protection of the park's significant values. Key values identified in the management plan include: ● Conservation; ● Cultural; ● Recreational and tourism; ● Education and Research; and ● Community.	The Project does not intersect with the Cape Range National Park. However, the national park has several viewing points which look out onto Exmouth Gulf and the Project area. Therefore this assessment considers impacts of the Project on the key values of listed for the park.
Ningaloo Marine Park and Muiron Islands Marine Management Area Management Plan (CALM 2005)	This management plan identifies the need for careful management of a number of social values related to landscapes: ● Seascapes: Panoramic vistas of turquoise lagoon waters, reefs, beaches, breaking surf and the blue open ocean beyond the reef line are major attractions of the reserves. ● Wilderness: Areas of secluded coastline and remote coastal waters offer opportunities for remote experiences that are integral to the Ningaloo experience. These values have been given a specific management objective:	Although the marine park and management area is located a significant distance from onshore activities, offshore activities will temporarily pass through the area. The assessment will consider the impact of the Project on the management objectives for only two out of twelve social values (wilderness and seascapes) listed in the Management Plan. These two values are considered relevant to visual amenity. The remaining values are evaluated in the

Applicable Legislation	Relevance	Consideration Under this Assessment
	• Seascapes: To identify designated seascapes of the reserves and seek to minimise degradation of seascapes by coastal development, island structures or marine infrastructure within the reserves. • Wilderness: To identify designated 'wilderness' areas of the reserves and manage the water and adjacent coast so that these values are maintained.	Social Surrounds Chapter of the PER (Subsea 7 2019).

1.5 Assessment Guidelines and Standards

This report was prepared in accordance to the following guidelines and standards:

- Environmental Protection Authority 2016, Environmental Factor Guideline – Social Surroundings (EPA 2016);
- Environmental Protection Authority 2016, Environmental Factor Guideline – Landforms (EPA 2018a);
- Environmental Protection Authority 2018, Statement of Environmental Principles, Factors and Objectives (EPA 2018a);
- Western Australian Planning Commission 2007, Visual Landscape Planning in Western Australia: A manual for evaluation, assessment, siting and design; and
- Landscape Institute 2013, GLVIA3- Guidelines for Landscape and Visual Impact Assessment. Third edition.

This report also makes reference to the following guidelines and standards:

- Australian Institute of Landscape Architects 2018, Guidance Note for Landscape and Visual Assessment;
- Landscape Institute 2011, Photography and photomontage in landscape and visual impact assessment, Landscape Institute Advice Note 01/11;
- Landscape Institute 2017, Technical Guidance Note – Visual Representation of Development Proposals;
- Landscape Institute 2018, Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Technical Guidance Note Public Consultation Draft;
- Natural England 2012, An Approach to Seascape Character Assessments;
- Natural England 2014, An Approach to Landscape Character Assessment;
- New Zealand Institute of Landscape Architects (NZILA) (2010a), Best Practice Note – Landscape Assessment and Sustainable Management 10.1;
- New Zealand Institute of Landscape Architects (NZILA) (2010b), Best Practice Guide – Visual Simulations BPG 10.2; and
- New Zealand Transport Agency (NZTA) (2013), NZTA Landscape and Visual Assessment Guidelines (Draft).

Note that many of the guidelines above apply largely to non-Australian and/or non-rural environments, however relevant areas were considered for the purpose of this assessment.

2 Regional Context

In this section, we explore the social, economic and environmental context in the areas surrounding the Project. This provides important insight into the way landscapes are experienced, contributing to the overall 'View Experience'. While the elements that make a landscape are based on environmental and other physical factors, socio-economics and demographics are largely responsible for how landscapes are experienced.

2.1 Social Surrounds

The Study Area falls entirely within the Shire of Exmouth local government area.

2.1.1 Population

The closest major population centre is the Exmouth town centre.

According to ABS data, the social and economic development of the Gascoyne Region has been in the past driven by agriculture, forestry and fishing (ABS 2016).

The Australian Bureau of Statistics (ABS) 2016 census data shows that the population of the Gascoyne Region was 9,485, the population for the Exmouth Region was 4,405 and the population of the Shire of Exmouth Local Government locality was 2,728 people (ABS 2016).

2.1.2 Infrastructure

The Study Area contains a range of existing infrastructure (Figure 4 and 5):

- State and Local Roads;
- Learmonth Aerodrome (also an Australian Defence Force Base);
- Radio communication stations (Low Frequency and Very Low Frequency); and
- The township of Exmouth.

2.1.3 Land Tenure

The Study Area represents a combination of various land tenures. Most of the tenure is overlapping and is predominantly:

- Pastoral Lease;
- Mining Tenements;
- Petroleum Titles;
- Native Title Claim; and
- Conservation estates (Cape Range National Park, Ningaloo Coast and Ningaloo Marine Park).

Table 4 provides a further breakdown of the extents of the above interests. Figure 4 illustrates the range of land tenure above in relation to the Study Area.

Table 4. Extent of Notable Land Tenure and Interests within the Study Area.

Tenure	Source	Area (km^2)	Proportion of Study Area (%)*
Pastoral Lease	Landgate 2015	1194.0	11.77%
Mining Tenements	DMIRS 2018c	1689.5	16.65%
Petroleum Titles	DMIRS 2018d NOPTA 2018	3215.0	31.68%
Conservation Estate – DBCA	DBCA 2018	1485.6	14.64%
Conservation Estate – Commonwealth Marine Reserve	DoEE 2018a	332.2	3.27%
Ningaloo Coast World Heritage Site	DoEE 2018b	1724.5	16.99%
Native Title Claim Area	NTTT 2018	7800.4	76.87%
Pearling Leases	DPIRD 2018a	79.9	0.79%
Exmouth Gulf Prawn Fishery	DPIRD 2018b	2,426.8	23.9%
The Project (Offshore Operations Area)		189.2	1.86%
The Project (Project Envelope [Onshore Operations])		1.77	0.06%
** Note: Percentages were calculated based on the total area of each land tenure that intersected with the Study Area (i.e. land tenure area km^2/Study Area km^2) (Figure 4). Some land tenures overlap each other within the Study Area and therefore a total of more than 100% occurs.*			

2.1.4 Land Use

Surrounding land uses include pastoral activities (Exmouth Gulf pastoral station intersects the Project Envelope) and a number of Federal Government facilities. These uses are summarised below:

- Learmonth Royal Australian Air Force (RAAF) Base and Airport located to the northwest;
- Learmonth Solar Observatory to the north;
- Naval Communication Station Harold E Holt Area C to the north;
- A number of basic raw material quarries surrounding Exmouth town;
- Minilya-Exmouth Road to the west; and
- The Exmouth Gulf prawn fishery and various aquaculture lease areas occur within Exmouth Gulf offshore of Learmonth.

Table 5 provides an estimated area breakdown of these various land uses within the Study Area. The dominant land use is pastoral enterprise.

Table 5. Extent of Land Uses within the Study Area

Land Use	Source	Area (km^2)	Proportion of Study Area (%)*
Airfields / Defence	Aerial Imagery 2018	3.5	0.034%
Built Areas (Exmouth Town)	Aerial Imagery 2018	5.0	0.05%
Communications	ACMA 2018 Aerial Imagery 2018	1.7	0.017%
Conservation	DBCA 2018 DoEE 2018a	1,817.8	17.9%
Extractive Industries	DMIRS 2018a	0.4	0.004%
Industrial	Aerial Imagery 2018	0.6	0.006%
Other (large private complexes)	Aerial Imagery 2018	0.2	0.002%
Pastoral Leases	Landgate 2015	1,194	11.8%
Main Roads	MRWA 2018	3.1	0.030%
Oil and Gas Wells (historic and present)	DMIRS 2018b	363 wells	N/A
Commercial Prawn Trawling	Department of Fisheries 2018 (2016 and 2017 Trawled Areas)	1,521	15%
The Project (Offshore Operations Area)**		189.2	1.9%
The Project (Onshore Operations Area Development Envelope)		1.77	0.017%
** Note: Percentages were calculated based on the total area of each land use that intersected with the Study Area (i.e. land use area, km^2/Study Area, km^2) (Figure 5). Some land uses overlap each other within the Study Area and therefore a total of more than 100% occurs.*			
*** Note: Offshore land uses are typically transient (exception of oil and gas wells)*			

2.1.5 Visitor Demographics

The Gascoyne region receives many visitors and tourism is the largest component of the industry. Exmouth is recognised by the State government as one of the 10 key cruise shipping ports in Western Australia. Table 6 provides an estimate of the number of overnight visitors to the Study Area (ABS 2016).

Table 6. Overnight Visitor Summary in the Shire of Exmouth

Overnight visitor origins for the North West region	Average Annual Visitors (Year Ending [YE] 2015/16/17)	YE Dec 2015/16/17 %
Estimated Visitors		
Domestic Total	110,800	79
International Total	28,900	21

Overnight visitor origins for the North West region	Average Annual Visitors (Year Ending [YE] 2015/16/17)	YE Dec 2015/16/17 %
Total	139,700	100
Average Length of Stay (Estimated Nights)		
Domestic	7.9	-
International	5.0	-
Total	7.3	-

2.1.6 Valued Characteristics

The Study Area contains a variety of valued characteristics related to landscapes and visual amenity. These primarily include:

- Recreation values;
- World Heritage values; and
- Conservation values.

At present, recreational uses of the Study Area follows several distinct trends; the western side of the Peninsula, around to Bundegi Coastal Park (Figure 6) are commonly used for activities such as swimming, snorkelling and SCUBA diving. The eastern coast of the peninsula, south of Bundegi Coastal Park is generally used for boating, fishing and to a lesser extent, swimming. The central areas of the Peninsula are typical of landbased activities such as hiking, camping and observation of surrounding areas.

World Heritage Values of the Study Area are primarily due to the presence of the Ningaloo Coast World Heritage Site. According to UNESCO, this section of the Study Area is considered to have 'outstanding universal value', due to in part, the striking landscape and seascape (among other biodiversity related factors; UNESCO 2019). These values are generally not attributed to other areas of the Peninsula, as the combination of landscape and seascape (intact, arid coastline adjacent to a fringing reef system) is not common. Landscape-seascape combinations elsewhere in the study area is relatively common in the broader region.

The Exmouth Peninsula contains two key areas of high conservation value, The Ningaloo Marine Park (and nearby Muiron Islands), and the Cape Range National Park. The Ningaloo Marine Park is valued in a similar manner to the associated World Heritage Site.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 4
Notable Land and Waters Tenure

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w www.360environmental.com.au

Legend

- Study Area

Onshore Infrastructure
- Project Envelope

Offshore Infrastructure
- Tow Route
- Tow Area
- Bundle Parking Area

Land Tenure
- Commonwealth Marine Reserve
- DBCA Managed Lands and Waters
- Petroleum Titles
- Mining Tenements
- Native Title Claim
- Ningaloo Coast World Heritage Site
- Pastoral Lease
- Exmouth Gulf Prawn Managed Fishery
- Pearling Leases

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2061			7/12/2018
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HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

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- LOCALITY MAP SOURCED LANDGATE 2017
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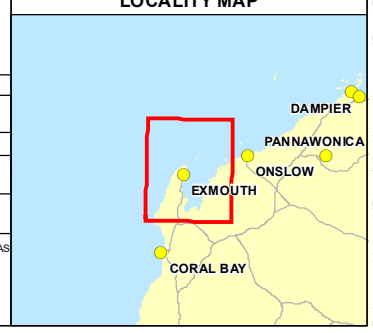

Environmental Approvals\Figures\Visual Impact Assessment\Report Figures\Figure 4 - Notable Land Tenure.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 5
Surrounding Land Use

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Legend

Land Uses
- Airfields
- Communications
- Conservation
- Extractive Industries
- Industrial
- Other
- Pastoral
- Roads
- Prawn Fishery Trawled Areas 2016/17
- Petroleum Wells (363 drilled)

- Study Area
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Onshore Infrastructure
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Offshore Infrastructure
- Tow Route
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2061			10/01/2019
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LOCALITY MAP

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Gascoyne Marine Reserve
Muiron Islands Marine Management Area
Muiron Islands Nature Reserve
Serrurier Island Nature Reserve
Round Island Nature Reserve
Vlamingh Head Lighthouse
Jurabi Turtle Centre
Mauritius Beach
Ningaloo Marine Park
Jurabi Coastal Park
JURABI POINT
SS Mildura Wreck
Surfer's Beach
Exmouth VLF Station
Bundegi Beach Jetty and Cafe
Bundegi Coastal Park
Rocky Island Nature Reserve
Ningaloo Marine Reserve
Tantabiddi Boat Ramp
1752/934
EXMOUTH
Town Beach
Exmouth Marina
Victor Island Nature Reserve
Y Island Nature Reserve
Gnandaroo Island Nature Reserve
Observation Bird Hide
Milyering Discovery Centre
Lakeside
Pebble Beach
Tent Island Nature Reserve
Shothole Canyon
Thomas Carter Lookout
Turquoise Bay
Charles Knife Gorge
Burnside And Simpson Island Nature Reserve
Oyster Stacks
EXMOUTH GULF
Mandu Mandu Gorge
Cape Range National Park
Potshot Memorial
Learmonth Jetty
Whalebone Island Nature Reserve
Sandy Bay
BAY OF REST
POINT LEFROY
EXMOUTH PENINSULA
Yardie Creek
Minilya Exmouth Rd
Whitmore,Roberts,Doole Islands And Sandalwood Landing Nature Reserve
ex Giralia
Burkett Rd
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

160000 170000 180000 190000 200000 210000 220000 230000 240000 250000 260000
7630000 7620000 7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000 7520000 7510000 7500000

Subsea 7
Learmonth Pipeline Fabrication Facility

Landscape and Visual Impact Assessment

Figure 6 Sensitive Receptors and Valued Areas

subsea 7
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f (08) 9381 2360
w www.360environmental.com.au

Legend

- Study Area
- Major Roads
- Roads

Onshore Infrastructure
- Project Envelope

Offshore Infrastructure
- Tow Route
- Tow Area
- Bundle Parking Area

Sensitive Receptors and Valued Places
- DBCA Managed Lands
- DBCA Managed Waters
- Commonwealth Marine Reserves
- Places of Interest

0 2 4 6 8 10
Kilometers
1:400,000 @A4

PROJECT ID			DATE
2061			7/12/2018
CREATED	CHECKED	APPROVED	REVISION
JJR	HT	HT	0

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

N
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2017
- ELEVATION FROM GEOSCIENCE AUSTRALIA STRM DATA
- AERIAL PHOTOGRAPHY SOURCED ESRI 2018

LOCALITY MAP
ONSLOW
EXMOUTH
CORAL BAY

2.2 Physical Surrounds

While socio-economic and demographics are largely responsible for view experiences, the inherent visual amenity or landscape value is defined by environmental factors.

2.2.1 Climate

The climate of region is hot semi-arid with hot summers and mild winters. Climate data from 1945 to 2017 was obtained from the Learmonth Airport Station located approximately 1.5 km northwest of the Site (Figure 7). The annual mean maximum temperature is 31.9°C and the annual mean minimum temperature is 17.7°C. The mean annual rainfall was recorded at 260.7 mm (BoM 2017).

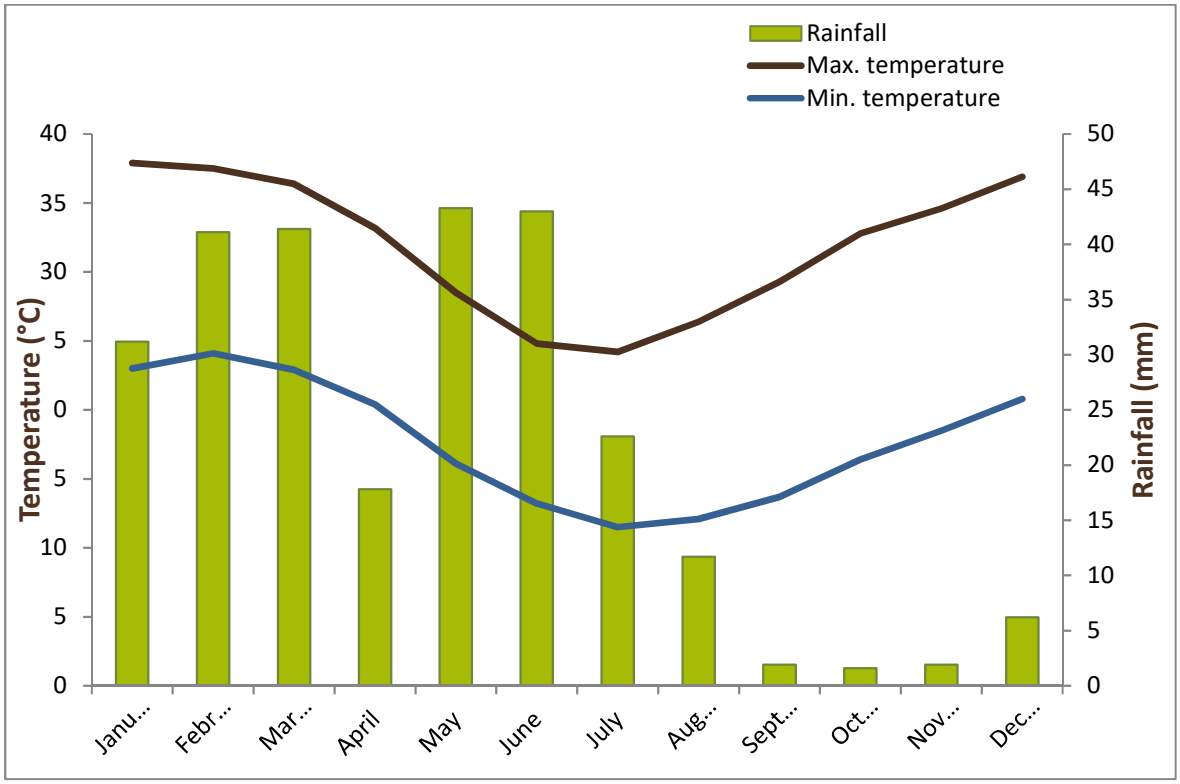


Figure 7. Climate Statistics for Learmonth Airport Station 1945-2017 (BoM 2017)

2.2.2 Topography

The Site is relatively flat to gently sloping with the elevation ranging from approximately 25 m Australian Height Datum (AHD) inland to 0 m AHD to the coast, sloping from the south west to the north east (GHD 2017a).

2.2.3 Soil and Vegetation

The Site is within the Carnarvon bioregion and the Cape Range sub-region of the Eremaean Botanical Province. The Eremaean Province forms part of the Burbidge's Arid Zone and has a desert climate without an assured growing season. In the north there is dry spinifex grassland of *Triodia* and *Plectrachne* where summer rainfall peaks, through deserts with intermittent rainfall, to low *Acacia-Eucalyptus* woodlands receiving evenly distributed rains (DPaW 2013a).

The Carnarvon 1 (CAR01) Cape Range sub-region is an arid region composed of quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrubs on clay flats and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with *Acacia startii/bivenosa* shrublands outcrop in the north, where extensive tidal flats in sheltered bays support Mangal communities (DPaW 2013a).

2.2.4 Landforms

An assessment of impacts to Land Systems has been provided to estimate impacts to Landforms (Table 7; Figure 8). Unlike a Landscape Character Unit (LCU), a Land System is a classification system that excludes land uses and other human activities. Considering that many areas of the Gascoyne are relatively untouched, using Land Systems as a proxy for landforms allows us to estimate impacts to various landform types.

Using Land System classification also allows for reference to EPA guidance factors and other environmental data, such as ecological communities, land capability, soil mapping and these are often tied into the same soil-landscape classification system. Similarly, as the methodology for defining Land Systems is largely consistent and covers the whole State, assessments of landform rarity at various scales may also be undertaken.

Table 7. Extent of Land Systems within the Study Area

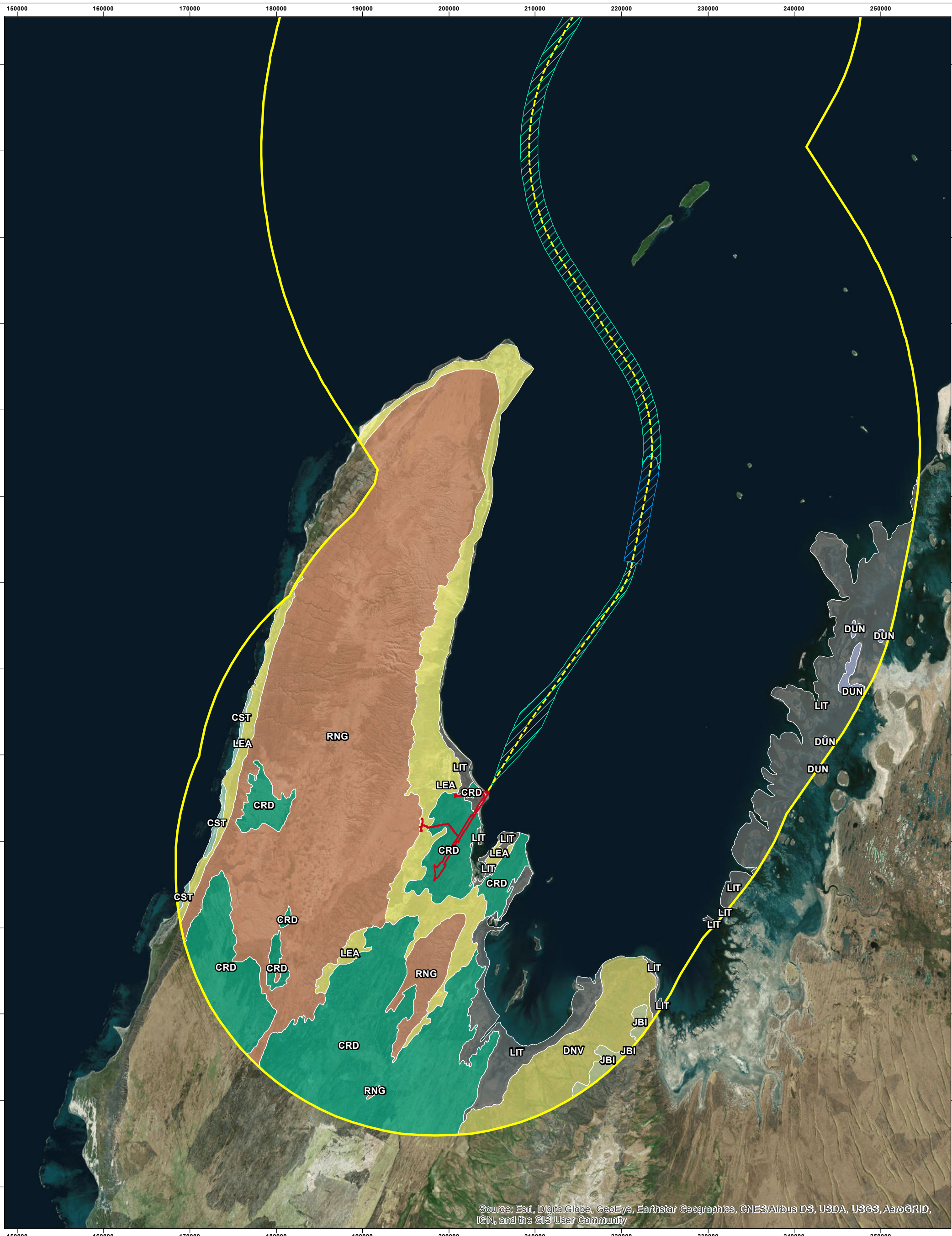
Land System	Description (DAFWA 2012)	Dominant Landform	Area (km^2)	Proportion Of Study Area (%)
Range System	Dissected limestone plateaux, hills and ridges with gorges and steep stony slopes supporting hard spinifex, sparse shrubs and eucalypts.	Hills and Ranges	1,212.4	45.78%
Jubilee2 System	Limestone hills and stony plains supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs.	Slopes and Plains	16.0	0.6%
Littoral System	Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests.	Flats	360.6	13.62%
Dune System	Dune fields supporting soft spinifex and minor hard spinifex grasslands.	Dunes	10.7	0.40%
Coast System	Large coastal dunes (some unvegetated) with narrow swales, limestone plains, wave-cut platforms and beaches, supporting diverse tall and low shrublands.	Dunes	9.8	0.37%
Learmonth System	Sandy outwash plains marginal to the Cape Range, supporting mainly	Plains	288.2	10.88%

Land System	Description (DAFWA 2012)	Dominant Landform	Area (km^2)	Proportion Of Study Area (%)
	soft spinifex hummock grasslands with scattered acacia shrubs.			
Cardabia System	Undulating sandy plains with linear dunes, minor limestone plains and low rises, supporting mainly soft spinifex hummock grasslands with scattered acacias and other shrubs.	Dunes	610.0	23.04%
Donovan System	Gently sloping outwash plains and minor stony plains with alkaline loamy and clayey soils supporting tall shrublands of snakewood and other acacias and low shrublands of bluebush.	Plains	140.5	5.31%

The Land Systems which make up the majority of the Study Area are the Range and Cardabia system, consisting of Hills / Ranges and Plains Landforms.

The Land Systems within the Study Area are illustrated in Figure 8, grouped by dominant landform type:

- Slopes and Plains;
- Dunes; and
- Plains.



Subsea 7
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Landscape and Visual Impact Assessment

Figure 8
Land Systems

subsea 7
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Legend

- Study Area
- **Onshore Infrastructure**
  - Project Envelope
- **Offshore Infrastructure**
  - Tow Route
  - Tow Area
  - Bundle Parking Area
- **Flats**
  - LIT - Littoral System
- **Hills and Ranges**
  - RNG - Range System
- **Slopes and Plains**
  - JBI - Jubilee2 System
- **Plains**
  - DNV - Donovan System
  - LEA - Learmonth System
- **Dunes**
  - CRD - Cardabia System
  - CST - Coast System
  - DUN - Dune System

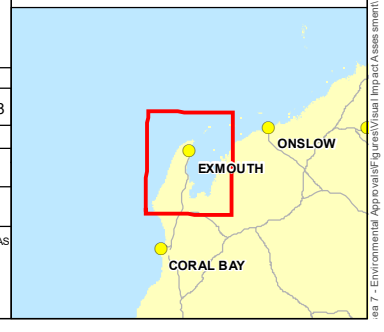
0 2 4 6 8 10
Kilometers
1:400,000 @A4

PROJECT ID			DATE
2061			05/01/2018
CREATED	CHECKED	APPROVED	REVISION
JJR	HT	HT	0

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

N
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2017
- BASE DATA FROM DAFWA 2012
- AERIAL PHOTOGRAPHY SOURCED ESRI 2018 (© Western Australian Land Information Authority 2018)

LOCALITY MAP



3 Methods

3.1 Section Summary

This LVIA follows the methodology outlined in the DPI/WAPC (2007) Guidelines for Visual Impact Assessments:

- Step 1. Describe existing visual landscape character and determine objectives for managing visual landscape character;
- Step 2. Describe the proposed development;
- Step 3. Describe and evaluate the potential visual impacts;
- Step 4. Develop visual management measures; and
- Step 5. Prepare final recommendations.

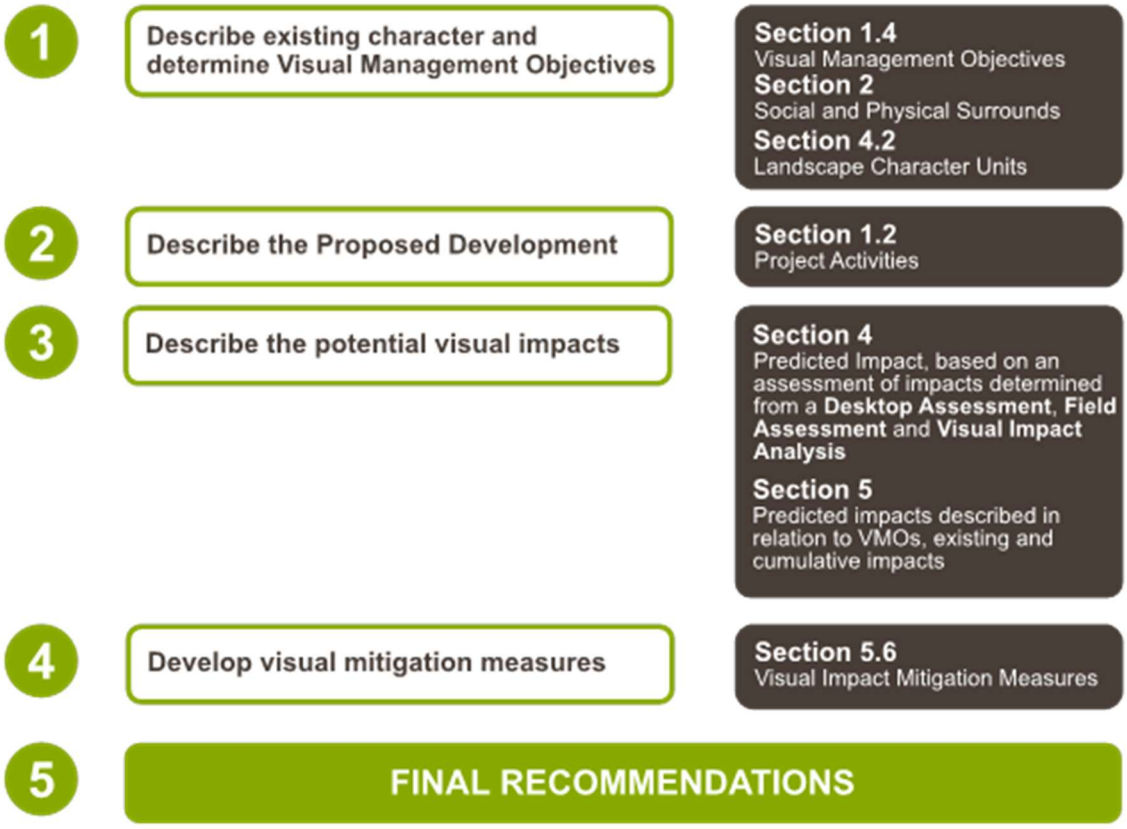


Figure 9. LVIA Methodology

The methods used are consistent with the current guidance for Landscape and Visual Impact Assessments: the WAPC (2007) and GLVIA3 (Landscape Institute 2013).

Impacts described in this report were determined from a combination of a Desktop Assessment, Field Assessment and Visual Impact Analysis. Methods used during these are described below.

3.2 Desktop Assessment

3.2.1 Defining the Study Area

The selection of an appropriate Study Area was a key component of this assessment as it defines the area within which all impacts from the Project were assessed.

When defining the Study Area, several key requirements needed to be met:

- Covers the entirety of the area of the Project's operations;
- Fully encompasses the Zone of Theoretical Visibility (ZTV) for the Project (and therefore encompasses all possible visual impacts); and
- Covers an area that is representative of the landscapes valued in the region for landscape impact assessment.

The Study Area for this assessment was defined by considering the ZTV from a viewshed analysis carried out using the maximum heights of offshore and onshore elements within the Project Envelope (10 m AGL for onshore infrastructure, 37m ASL for offshore infrastructure along the entire offshore activity area). Based on the ZTV, a 30 km radial buffer of the Project was used as a Study Area (which includes a 20% 'contingency' radius of 5km over the actual ZTV).

This process and the resultant Study Area are illustrated in Figure 3.

The Study Area is 10,148 km^2 in size.

3.2.2 Identifying Landscape Character Units

Landscape Character is typically defined by the combination of physical / environmental elements and aesthetic elements and socio-cultural elements. While it is possible to define the former using data available on soil, geology, vegetation etc, the latter can only be defined through consultation and firsthand experience.

Landscape Character Units (LCUs) were initially based on Landforms (derived from Land System data), as the physical component of landscapes are generally heavily influenced by the geomorphology and vegetation of an area. The distribution of these LCUs across the Study Area is illustrated in Figure 12.

To determine which landscape character unit is most prominent in the Study Area, the geographical area of the LCU was calculated as a percentage of intersecting the Study Area (Section 4.2). To determine to what extent a LCU may be potentially impacted by the Project, the proportion of the LCU that will be taken up by the Project footprint was calculated as a percentage (Section 4.6).

3.2.3 Identification of Vantage Points and Receptors

Vantage points and potential sensitive receptors were identified using a high-level desktop analysis, review of local topography and input from stakeholder engagement sessions in evaluating the way the visual landscape character is viewed, experienced and valued at a local scale in proximity to the fabrication site location.

The following questions, as per Step 3 of the WAPC (2007) guideline were posed:

- How is the landscape assessed and experienced?
- What are the important views and where are they seen from?
- What is the community's attitude towards this landscape?
- What is it about this landscape's features and views that are valued?

Subsea 7 held several community engagement sessions in Exmouth to understand community priorities and concerns regarding the Project. These sessions revealed the public's interest in the Heron Point and Bay of Rest as these areas are used for recreational activities such as camping, fishing, four-wheel driving and as well as fishing charter businesses. Other community groups were also consulted to gain input on the potential visual impacts for local users of the area, including:

- Shire of Exmouth President;
- Chairperson of the Cape Conservation Group;
- Chairman of the Exmouth Chamber of Commerce and Industry;
- Consultation between Subsea 7, 360 Environmental and the EPA; and
- Commonwealth Department of the Environment and Energy (DoEE) regarding the Ningaloo World Heritage Area.

A number of sources were also consulted to develop vantage points:

- *Mid West Western Australia* Map (Hema 2014);
- *Exmouth and Coral Bay Holiday Guide* (Ningaloo Visitor Centre 2018); and
- ExplorOz website.

Following on from stakeholder engagement and desktop analysis, several preliminary vantage points and receptors were identified from trails and lookout points within the Cape Range National Park, the travel route along Minilya-Exmouth Road passing the development site, an offshore location as well as recreational sites (camping and fishing) along beaches within the Exmouth Gulf.

A site visit was then undertaken which included officials from the EPA, DoEE and Subsea 7. The group visited a number of the preliminary vantage points, including Charles Knife Canyon, Minilya-Exmouth Road and offshore locations at Heron Point to gain local context of the site within the natural landscape. The preliminary vantage points were agreed as being suitable for the purposes of the LVIA.

Following the site visit, eight final vantage points were selected and presented to the EPA for final endorsement. The exact location of each vantage points was determined during the LVIA field assessment and a number of additional vantage points were also identified.

3.3 Field Assessment

3.3.1 Survey Dates

Visual amenity and landscape values in the Study Area were surveyed on 15th and 16th November 2018 by an experienced 360 Environmental Pty Ltd Environmental Scientist. The Study Area was travelled by vehicle and foot. Tracklogs of the area covered is illustrated in Figure 13.

3.3.2 Site Data Collected

Each site visited was given a unique name and its Global Position System (GPS) coordinates recorded. Key information on the site was also recorded, in the format detailed in Table 8.

Table 8. Field Assessment Criteria

CRITERIA	CHARACTERISTICS	
Location	Latitude: (decimal degrees)	Longitude: (decimal degrees)
Site Name	Unique identification given for each site	
Viewpoint Setting	The location of the site assessment described (e.g. 'north east corner of lookout' or 'end of pier')	
Estimated View Distance	Estimated distance where views are terminated (either by the true horizon, or an apparent horizon caused by topography)	
Local Vegetation Type	General classification of vegetation at a site (shrubs, grasses, trees etc.)	
Vegetation Screening Potential	Potential of surrounding vegetation to obscure views of the Project	
Foreground Elements	Elements that make up the landscape in the immediate vicinity of the observer	
Mid-Ground Elements	Elements that make up the landscape in between the foreground and background	
Background Elements	Elements that make up the landscape furthest away from the observer	
Viewer Motion	Speed that an observer may be moving at (affects view duration)	
Accessibility	Level of accessibility of the area by members of the public (major roads = high, minor/local roads and tracks = moderate, private roads/remote tracks = low)	
Usage Type	Apparent level of usage (based on signs of human activity such as vehicle tracks, extinguished fires, visual observation of activity etc.)	
Receptor Sensitivity	The likely sensitivity of the site to changes in visual amenity (See Section 3.3.3)	
Photography	Number of, direction, settings and any notes on photography from the location	

3.3.3 Assessment of Landscape Values and Receptor Sensitivity

During the field assessment stage, these preliminary LCUs were ground-truthed and further defined with the consideration of human perception. The results of this characterisation exercise are provided in Section 4.2.

The finalised LCUs were than evaluated based on the combination of environmental, social and cultural values in the context of rarity in the Study Area using the matrix shown in Table 9.

Table 9. Evaluation Matrix for Landscape Values

Rarity	Combined Environmental, Social and Cultural Usage		
	Low (No known visual amenity values)	Moderate (Some values which are related to visual amenity)	High (Nearly all values are related to visual amenity
Not Rare (>20% Study Area)	Low	Low	Moderate
Somewhat Rare (>5% but <20% Study Area)	Low	Moderate	High
Rare (<5% Study Area)	Moderate	High	High

Receptor sensitivity was determined on site in accordance to the following guidelines, adapted from GLVIA3.

Table 10. Receptor Sensitivity/ Value Ratings

Sensitivity	Definition
High	• Long viewing periods, residential properties close to the development • Users of outdoor areas for nature-based recreation, where part of the enjoyment stems from the landscape and its amenity values • Communities that place high value upon the landscape and enjoyment of views of their landscape setting • Internationally significant for values that have landscape and amenity components
Medium	• Intermittent viewing periods • Users of outdoor areas for recreation, where most of the attention is focused on the activity being undertaken • Long viewing periods or residential properties at a distance to or screened from the development • Regionally significant for values that have landscape and amenity components
Low	• Short term views of partially screened/obscured development (e.g. motor vehicles) • Generally indoor activities undertaken • Locally significant for values that have landscape and amenity components
Negligible	• Short term views of screened/obscured development (e.g. motor vehicles)

3.3.4 Site Photography Specifications

All digital photos captured were taken with a Sony a6300 interchangeable lens camera system with a Sigma 16 mm f/1.4 (equivalent to a horizontal Field of View [FOV] of 71) and Nikon 35 mm f/1.8 (equivalent to a horizontal FOV of 36) fixed focal length (prime) lenses, equivalent to approximately 24 mm and 50 mm focal lengths in 35 mm format. Images were taken from a height of approximately 1.7 m above ground.

All images were captured using manual exposure settings, in RAW format and at a resolution of 24 megapixels. No in/on camera filters or effects were used for photographs that were used for the photomontage assessment. In some instances, polarising filters were used for site characterisation purposes to minimise the amount of glare from the sub-optimal lighting during the site visit (e.g. from water surface).

3.3.5 Consideration of Cumulative Impacts

To comprehensively consider existing and potential future cumulative impacts, information was gathered during the desktop assessment from several sources:

- EPA's List of Ministerial Statements;
- DWER's Clearing Permit Database;
- DMIRS' Minedex and Petroleum Wells Database; and
- Manual mapping from Aerial Imagery.

The field assessment collected information on cumulative impacts identified from the sources above.

3.4 Visual Impact Analysis

3.4.1 3D Site Model

Two sets of site models were created for this assessment: a low resolution height based model for use in the viewshed analysis (incorporating maximum building and vessel heights) and a detailed model for rendering into photomontages.

To allow for simulations of the predicted impact and generation of photomontages, key Project elements were modelled using a combination of Trimble's SketchUp software and Blender. These elements included:

- Fabrication Site infrastructure;
- Bundle track infrastructure;
- Launchway infrastructure;
- Offshore vessels; and
- Typical bundle and tow head.

Specifications used for the creation of the site model are available in Table 11.

Table 11. 3D Site Model Specifications

Element Type	Component	Criteria	Specification
Offshore Infrastructure	Tug Vessel	LOA Length	91 m
		Width	22 m
		Draft	7.95 m
		Materials / Colour	Colour and material approximated from reference photographs
		Speed (during tow)	5 kt
	Support Vessel	LOA Length	87.80
		Width	22m
		Draft	5.5m
		Materials / Colour	Colour and material approximated from reference photographs
		Speed (during tow)	5 kt
	Bundle	Length	10 km
		Diameter	1600 mm
	Tow Head	Height	7 m
		Width	15 m
		Length	37.5 m
Onshore Infrastructure	Bundle tracks	Track configuration	2 tracks
		Track Width	2.5 m
		Track Formation Width	Nominal 30 m
		Batter ratio	1:4
		Longitudinal Elevation	Provided by GHD *(z-des-6135431-RAIL_LSECTS.dwg)*
	Launch way	Length	Provided by GHD *(z-des-6135431-RAIL_LSECTS.dwg)*
		Width	
		Slope	
		Materials	Local limestone rock armour
	Fabrication Facility	Dimensions (l x w x h)	Provided by GHD
		Materials	Shiny corrugated steel cladding, concrete and asphalt

The Site models created are illustrated in Figure 10.

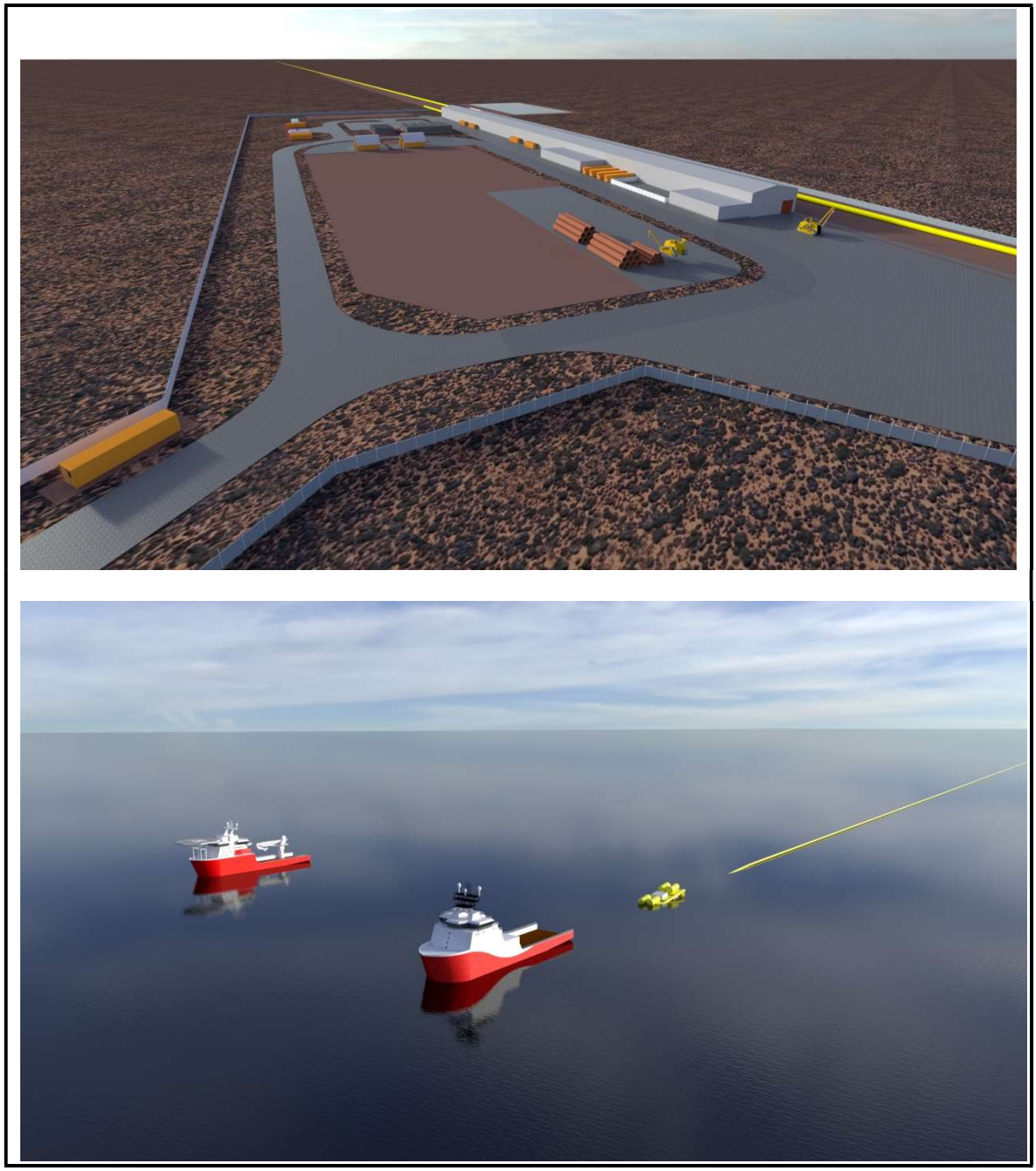


Figure 10. 3D Site Model

3.4.2 Viewshed Analysis

Viewshed analysis that were carried out, estimate the amount of the Project that may be visible from key vantage points. The areas designated as visible relates to a hypothetical scenario where a feature with a specific height may be visible (Table 12; OFFSET B). It does not identify areas of the ground surface that is visible.

Specifications used for viewshed analysis for the key vantage points is provided in Table12. The viewshed analysis provides a number of 'Viewshed Statistics' that may be useful in understanding visual impacts:

- Viewshed Size (ha): the geographical area of land that may be visible (2D), given the conditions listed in Table 12; and

- Percentage Viewshed Impacted: The geographical area of the site footprint as a percentage of the viewshed size (2D).

The viewshed analysis results are provided in the tables of Figures 14-21, see Section 4.4.

Table 12. Vantage Point Viewshed Analysis Specifications

CRITERIA	EXPLANATION	SPECIFICATION
Azimuth	Limits the angle of view used in the analysis	360°
OFFSET A	Observer eye height	1.7m
OFFSET B	Height offset for the target feature. A blanket offset for highest visible element (top of fabrication shed or tallest vessel)	10 m 37 m (where sea views were noted)
Refraction Compensation	Corrects for refraction caused by the curvature of the earth (key consideration for offshore, horizon limited views)	13%
Input Grid Resolution	Resolution of the surface model used	5 m x 5 m nested grid for Project Area, 30 m x 30 m elsewhere

3.4.3 Photomontage Analysis

Photomontages were created by superimposing a photorealistic render of the proposed development over a high-resolution digital photograph from the relevant vantage point.

Images captured at a 50 mm focal length were used for photomontages as a panoramic image covering a 60° horizontal field of view (stitched from two single frames with 50% overlap). 24 mm images were used largely for site and landscape characterisation due to the broader 80° horizontal field of view (e.g. VP01 and VP02). However, the images were then cropped (horizontally and vertically) to present a 60° horizontal FOV, equivalent to a 50mm focal length. The crop from an approximately 80° field of view down to a 60° field of view did result in a slight resolution loss from 24 megapixels to 13.5 megapixels. However, the final resolution still exceeds the minimum requirement set out in current guidance (Landscape Institute 2011). No compression/foreground/background foreshortening was introduced from this process due to the subject to camera distance being unchanged. The rendering process accounts for the angle and position of the sun (adjusted to match conditions of the field assessment), the characteristics of the materials used in the 3D model, and the settings of the camera used in the field assessment (exposure settings and focal length are specified in the renderer).

Where natural materials are likely to be used (e.g. rock protection for the launch way), the rendered image is manually textured using high resolution textures collected during the field assessment.

The rendered image and the base photograph are then brought into image editing software to be blended (largely through masking and layering of foreground elements such as vegetation, to simulate vegetation screening). Minimal post-processing was applied to the raw image, such as exposure compensations to balance the ground and sky exposures and white balance adjustments.

The resulting photomontage is then cropped to fit a 3:1 aspect ratio and exported at a resolution of 4,500 x 1,500 pixels (equivalent to approximately 300 dots per inch in this report).

This process is illustrated in Figure 11 below.

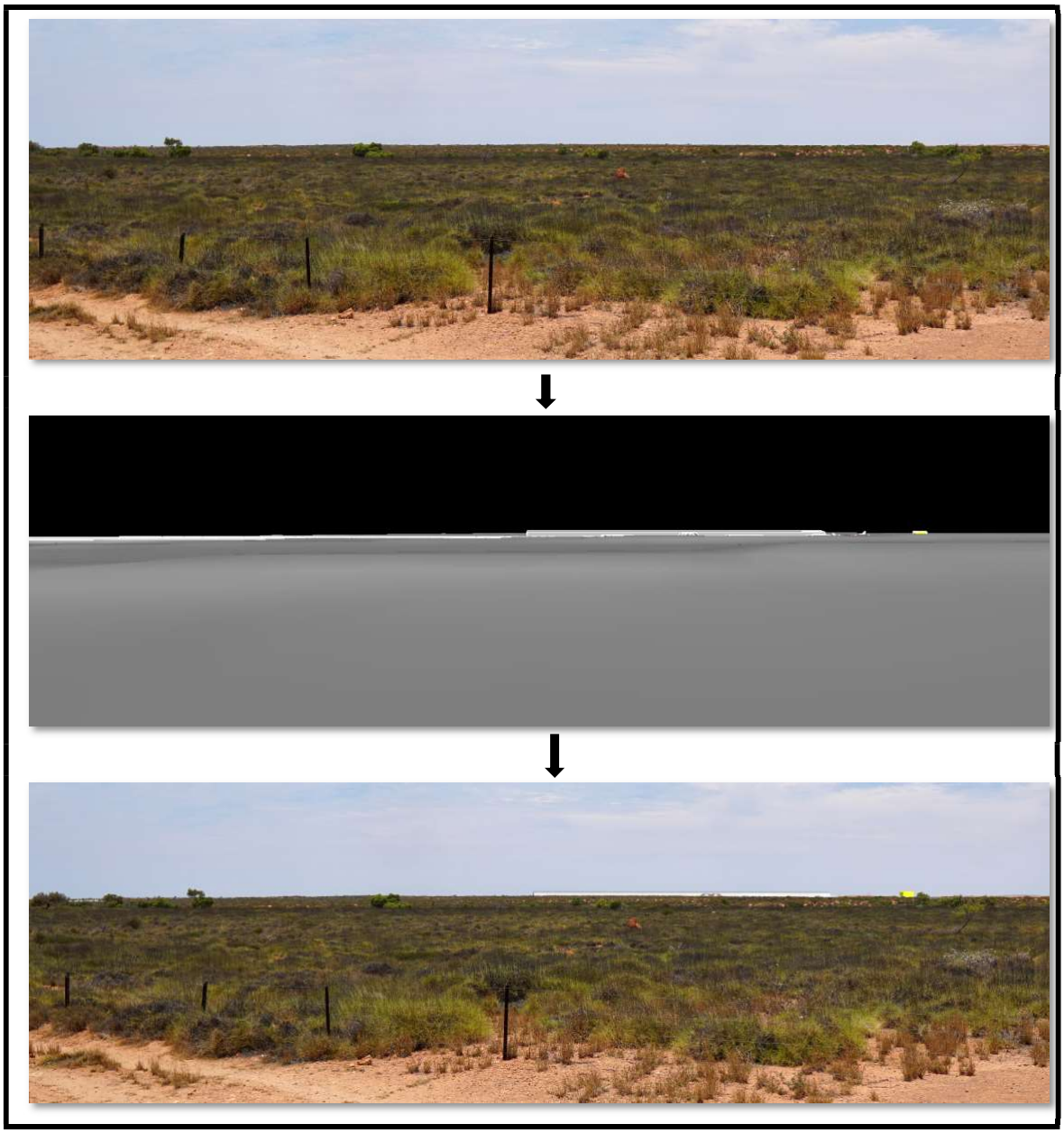


Figure 11. Photomontage Creation Process

The scope of works required a number of photomontages to be provided, at various stages of the project. This study provides photomontages at the following phases:

1. Pre-Construction: base imagery, reflective of current site conditions;
2. Post-Construction: base imagery with a rendered model of site infrastructure (no fabrication activity);
3. Operations: base imagery with a rendered model of the site and all proposed activities (depicts a bundle being fabricated, launched and towed, along with

all support operations such as plant, material stockpiles, tug and support vessels); and

4. Select photomontages which aim to estimate impacts following the implementation of Visual Mitigation Measures (VMMs).

In addition to the above, a schematic or wireframe photomontage which highlights which elements of the development are visible in the previous montages.

It is worth noting that the Operations photomontage is a conservative estimate of impact (over-estimate). It is likely that not all operations depicted will be occurring simultaneously (e.g. bundle being fabricated, launched and towed at the same time). This is considered appropriate for this assessment as most vantage points only have views of certain areas of the site.

3.4.4 Assessing Significance of Impacts to Landforms

As landforms are an entirely physical element of the landscape, this study determines 'significance' based on impact statistics, calculated from the direct loss of a Land System caused by the Project's footprint. Impacts to a landform types under 5% of its regional extent are considered insignificant in this assessment.

3.4.5 Assessing Impacts to Landscapes and Receptor Sites

Using impact statistics for determining landscape impacts in isolation of other human elements is not considered to be best practice under GLVIA3. At present, there are no standard categories for significance in consideration of all landscape components. GLVIA3 recommends that any method used is to be clear and consistent.

Once the extent and type of change to the landscape is identified from the results of the Photomontage and Viewshed Analysis, a rating can be applied to categorise the significance of landscape and vantage point impacts. The significance ratings used in this report considers the 'value' of the landscape (based on characterisation of landscape types) or receptor, in relation to the nature of the impact. Three categories for impact nature have been used for this assessment, based on how the proposal is likely to interact with existing landscape character:

- Compatible: Not practically visible or if visible, the proposed development fits the existing character and values of the landscape (e.g. Lookout site constructed in a tourist destination or a jetty/boat ramp at coastal areas)
- Somewhat Compatible: Visible; proposed development has aspects that may be incompatible with landscape values and character without management or is an incompatible development that is transient in nature (e.g. mobile or temporary developments or roads in a tourist destinations)
- Incompatible: Proposed development goes against the existing character and values of a landscape (e.g. Mining activity in a conservation area)

For the purposes of this assessment, the following evaluation matrices was used for Landscapes and Vantage points (Table 13 and 14).

Table 13. Evaluation Matrix for Landscape Impact Ratings

Nature of Impact	Landscape Value		
	Low Value Landscape	Moderate Value Landscape	High Value Landscape
Compatible	Very Low Impact	Low Impact	Low Impact
Somewhat Compatible	Low Impact	Medium Impact	Medium Impact
Incompatible	Low Impact	Medium Impact	High Impact

Table 14. Evaluation Matrix for Receptor Impact Ratings

Nature of Impact	Receptor Sensitivity		
	Low Sensitivity	Moderate Sensitivity	High Sensitivity
Compatible	Very Low Impact	Low Impact	Low Impact
Somewhat Compatible	Low Impact	Medium Impact	Medium Impact
Incompatible	Low Impact	Medium Impact	High Impact

The above rating was also applied to all surveyed sites based on the assessment's findings for comparable Key Vantage Points (Appendix A). Sites which had a 'negligible' level of sensitivity were not given an impact rating. Instead these are states as being 'insignificant'.

The final impact rating for landscapes or sensitive receptors may be summarised as below:

- Very Low Impact: The Project has little to no impacts and will not require any VMMs to meet the VMOs;
- Low Impact: The Project has very low levels of impact on a relatively low value receptor or landscape and may not require any VMMs to meet the VMOs;
- Medium Impact: The Project may have some impact on the values of a receptor or landscape if no VMMs are implemented. VMMs should give consideration on methods to meet the VMOs and further minimise impacts or improve on existing values; and
- High Impact: The Project will have significant impacts on a particular site or landscape if no VMMs are implemented. VMMs should be developed to reduce impacts or improve values as much as practicable, however it is possible that the VMOs will not be achieved

3.4.6 Limitations and Assumptions of the Analysis

There are several limitations to consider when interpreting the results of the assessment. Most notably:

- Impact statistics provided for the Project are a conservative estimate, as actual impacts are likely to be lower;
- Viewshed analyses do not account for the effect of vegetation screening. Where this is relevant, it is discussed;