PENINSULA PORTS

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Port Spencer Grain Export Facility

Amendment to Public Environmental Report

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APPENDIX A – Review of Evaluated Project

Port Spencer Grain Handling Facility

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Acronyms, Abbreviations and Definitions

ABS	Australian Bureau of Statistics
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Average return interval
AR&R	Australian Rainfall and Runoff
AWS	Automatic Weather Station
BAM	Bushland Assessment Method
$CO_{2\text{-}e}$	Carbon dioxide equivalent
DC	District Council
DGLC	Design Ground Level Concentration
DOG	Drive Over Grid
Evaluated Project	Port Spencer Stage 1 Project proposed by Centrex Metals as a deep-sea port facility for the export of iron ore and grain
FEL	Free Eyre Limited
GHG	Greenhouse Gas
GLC	Ground Level Concentration
HV	Heavy vehicle
kL	Kilolitre
km	Kilometre(s)
kt	kilotonnes
kw	kilowatt
LGA	Local Government Association
m	Metres
ML	Megalitre
mm	Millimetres
m/s	Metres per second
MW	Megawatt
NGERS	National Greenhouse and Energy Reporting Scheme
OSM	Over-Size / Over-Mass
PBS	National Heavy Vehicle Performance Based Standards
PER	Public Environment Report
PP	Peninsula Ports Pty Limited
PM	Particulate Matter

Proposed Amendment	A proposed amendment to the Evaluated Project by Peninsula Ports to remove the iron ore component and reconfigure grain storage, handling and export infrastructure to provide a more efficient grain only export facility.
SEB	Significant Environmental Benefit
SWAN	Simulating Waves Nearshore
t	Tonnes
t/h	Tonnes per hour
TIA	Traffic Impact Assessment

Executive Summary

Port Spencer (the site) was originally proposed by Centrex Metals Limited in 2011 as a deep-sea port facility for the export of iron ore from their Eyre Iron Joint Venture Project and grain. The project was declared a Major Development under the *Development Act 1993* and it was determined that the project would be subject to a Public Environment Report (PER) process. the Port Spencer Stage 1 Project (the Evaluated Project) successfully received Provisional Development Plan consent to export both iron ore and grain from the site.

The provisional development authorisation granted to Centrex Metals in 2012 and extended in 2014 currently remains active and was transferred to Peninsula Ports in mid-2019 following purchase of the land from Centrex Metals. Peninsula Ports is seeking to develop the site as a Grain Export Terminal (the Proposed Amendment).

Given Peninsula Ports only intends to export grain from the site, Peninsula Ports is seeking to amend the existing Development Plan consent under Section 47 of the *Development Act 1993.* The amendment process is required to take account of alterations to the Evaluated Project and to update the PER due to the length of time that has passed since the PER was originally prepared.

This document provides a detailed review and comparison of the baseline conditions, environmental effects and risks arising for the Proposed Amendment compared to the Evaluated Project. It has been prepared as supporting documentation to the Amendment to PER.

Key Project Changes

Key points of difference due to the Proposed Amendment resulting in altered effects are as follows:

Removal the mining related component from the Evaluated Project (the export of iron ore).

Reduction in ship size to be accommodated from Cape Class to Panamax (including emerging Panamax).

A significantly higher rate of grain receivals during harvest (October to December with seasonal variation) and greater on-site grain storage capability which reduces the reliance on up-country grain storage, and the resultant double handling of grain prior to export.

Heavy vehicle site access for the Proposed Amendment is proposed via Lipson Cove Road rather than Swaffers Road.

Alteration to the type and configuration of marine infrastructure.

- A straight wharf structure, approximately 600 m in length, which includes a 240 m (crest length) causeway is proposed for the Proposed Amendment, compared to a full jetty structure (515 m long jetty with a 345 m by 55 m wharf at 90 degrees to the main jetty) for the Evaluated Project.
- The Evaluated Project required an estimated 184 piles, compared to 18 for the Proposed Amendment, due to the presence of the causeway and greater span for the jetty and wharf bents of 42 m.

The orientation of vessel berthing has changed. For the Proposed Amendment all vessels will be berthed with the beam to the predominant swells. For the Evaluated Project, the vessels will be berthed bow into the predominant swells.

No significant changes to the baseline environmental conditions were identified by this review (or supporting technical studies).

Comparison of Environmental Effects

This Review of Evaluated Project has shown that most of the potential impacts considered for the Evaluated Project are expected to be similar (i.e. no change or similar level of effect) for the Proposed Amendment (refer to Table E-1). Of the 137 risk and impact issues identified, three increased effects due to the Proposed Amendment are anticipated; associated with traffic along Lipson Cove Road during construction and operations and the presence of the causeway. However, the level of impact has been assessed as acceptable to the

project. The removal of iron ore receival, storage and handling from the project scope means that several potential impacts are no longer applicable.

Table E-1 Review of the Evaluated Project -Summary of outcomes

Definition of Impact (Compared to Evaluated Project)	Number of Impacts	Relevant Environmental Aspect Categories	
No change	86	Climate change GHG Emissions Soils Surface water Groundwater Air quality	Noise Waste Terrestrial Ecology Lipson Cove Ecology Marine Ecology Visual Amenity
Similar level of effect	29	Climate change Soils Air quality Noise Traffic	Terrestrial Ecology Coastal Environment and Sediment Visual Amenity Socio-Economics
Reduced effect (impact)	2	Marine ecology	
Reduced effect (benefit)	2	Socio-Economics	
Increased effect (impact)	3	Traffic Marine Ecology	Coastal Environment and Sediment
Increased effect (benefit)	1	Socio-Economics	
No longer applicable / No impact	5	Soils Traffic Marine Ecology Lipson Island Ecology	
Altered effect	6	Traffic Terrestrial Ecology	Socio-Economics
Reduced potential for effect	2	Marine Ecology	
Increased potential for effect	1	Marine Ecology	
TOTAL	**137**		

It is acknowledged that the inclusion of a solid causeway as part of the wharf structure will increase the seagrass disturbance due to the Proposed Amendment compared to the Evaluated Project. However, in the context of the broader Spencer Gulf, the level of effect has been assessed as similar to the Evaluated Project. In addition, seagrass clearance will be offset through the provision of an SEB. Countering the increase to seagrass clearance, reduced impacts to marine fauna are expected due to the significantly lower number of piles required for construction of the Proposed Amendment.

In addition to the environmental effects considered for the Evaluated Project, the Proposed Amendment has also considered the potential accumulation of seagrass wrack during operations. Direct impacts on the local community beach access or tourism are not predicted due to seagrass accumulation

Comparison of Environmental Risk

A qualitative risk assessment was undertaken for the Proposed Amendment in accordance with the risk assessment process adopted for the Evaluated Project. The 32 risk issues considered by the Evaluated Project were reconsidered in the context of the Proposed Amendment. No changes to the risk rating resulted for the following 21 risk issues (assigned risk rating shown in brackets):

Stormwater / surface water (Low)
Groundwater (Low)
Terrestrial Fauna (Low)
Soils (Low)
Marine Pests (High)
Traffic (Moderate)
European Heritage (Low)
Maritime Heritage (Low)
Indigenous Heritage (Low)
Waste (Low)
Chemical Storage and Handling (Low)
Lipson Island Terrestrial Flora (Low)
Lipson Island Marine Fauna and Flora (Low)
Maritime Spills, Leaks and Anti- foulants - Port area (Low)
Spencer Gulf: Marine Mammal Collision (Low)
Vessel Anchored Stability (Low)
Local and Regional Economics (Low)
Local and Regional Infrastructure (Low)
Local and Regional Services (Low)
Social amenity (Low)
Tourism and Recreation Values (Low).

Differences in the mitigated risk profile between the Evaluated Project and Proposed Amendment primarily resulted due to differences in the application of the risk definitions. The following approach was adopted for the Proposed Amendment risk assessment, resulting in differences in mitigated risk ratings:

Effects experienced outside of the site boundary or local marine footprint were assigned a moderate consequence for the Proposed Amendment.

Effects expected to occur as part of normal activities such as native vegetation clearance and visual impacts were assigned an 'almost certain' likelihood.

While Greenhouse Gas emissions will result from development of Port Spencer, direct effects are considered unlikely to result.

Differences in the mitigated risk ratings and the reasoning for these differences is shown in Table E-2. The risk profile for the Proposed Amendment is not considered to materially differ due to the Proposed Amendment.

Table E-2 Summary comparison of qualitative risk assessment for the Evaluated Project and Proposed Amendment

No.	Project Aspect	Mitigated Risk (Likelihood × Consequence)	
		EP	PA
1	Air emissions – dust and fugitive emissions *Risk of exceedance of project air quality criteria.*	Low (Unlikely × Minor)	Moderate (Unlikely x Moderate) *Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.*
2	Greenhouse Gas (GHG) Emissions	Moderate (Almost Certain x Insignificant)	Low (Unlikely x Insignificant) *While Greenhouse Gas emissions will result from development of Port Spencer, direct effects are considered unlikely to result.*
3	Noise *Risk of exceedance of project air noise criteria.*	Low (Unlikely x Insignificant)	Moderate (Unlikely x Moderate) *Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.*

No.	Project Aspect	Mitigated Risk (Likelihood × Consequence)	
		EP	PA
6	Terrestrial Flora	Low (Possible x Insignificant)	Moderate (Almost certain x Insignificant) *Considered appropriate to maintain an 'almost certain' likelihood, as vegetation clearance will occur (as for the Evaluated Project) despite the fact it will be offset.*
8	Terrestrial Weeds, Pests and Pathogens	Low (Possible x Insignificant)	Moderate (Unlikely x Moderate) *The mitigation measures are considered to reduce the likelihood of weed, pest and pathogen risks, not the consequence.*
9	Lipson Island Terrestrial Fauna	Low (Unlikely x Minor)	Moderate (Unlikely x Moderate) *Moderate rating retained as by definition, effects would impact waters outside of the project area.*
13	Marine Flora (Jetty)	Moderate (Possible x Minor)	High (Almost certain x Minor) *Considered appropriate to maintain an 'almost certain' likelihood, as vegetation clearance will occur (as for the Evaluated Project) despite the fact it will be offset.*
14	Marine Fauna (Jetty)	Moderate (Possible x Minor)	Low (Unlikely x Minor) *Duration and extent of underwater noise from piling activities significantly reduced. Monitoring and controls expected to further reduce likelihood.*
16	Coastal Processes	Low (Possible x Insignificant) *Based on hydrodynamic modelling only localised sediment and scouring effects around the jetty are expected.* *Significant impacts to beaches around the Project are not expected, including Rogers Beach and Lipson Island.*	Moderate (Possible x Minor) *Based on hydrodynamic modelling localised sediment and scouring effects around the causeway are expected.* *Significant impacts to beaches around the Project are not expected, including Rogers Beach and Lipson Island.*
21	Visual Amenity	Low (Possible x Insignificant)	Moderate (Almost certain x Insignificant) *Following mitigations, development of a port at the site will still have a visual impact.*
25	Spencer Gulf: Maritime Spills	Low (Rare x Minor)	Moderate (Rare x Moderate) *Moderate rating retained as by definition, effects would impact waters outside of the project area.*

Important note about your report

This document was prepared by Jacobs Group (Australia) Pty Ltd on behalf of Peninsula Ports Pty Ltd for the purposes of an Amendment to the Public Environmental Report and development assessment for Port Spencer Grain Export Facility under section 47 of the Development Act 1993.

The sole purpose of this report is to provide a review of the Amendment to the approved Port Spencer Port facility as proposed by Peninsula Ports, compared against the approved project. The report addresses the aspects of the project relevant to the production of an Amendment to the Public Environmental Report and shall be read in conjunction with the report 'IW219900-0-NP-RPT-0003 Amendment to the Public Environmental Report' as well as report '107661001-100-R-Rev0 Centrex Metals Ltd, Port Spencer Stage 1 Public Environmental Report' and including all appendices.

The report is based on the data provided and collected through the associated technical studies as outlined in each case. Changes to this data and the manifestation of latent conditions may require aspects of the report to be re-evaluated. This report shall be read in full and excerpts shall not be taken in isolation or considered representative of the findings.

1. Introduction

Port Spencer (the site) was originally proposed by Centrex Metals Limited in 2011 as a deep-sea port facility for the export of iron ore from their Eyre Iron Joint Venture Project and grain. At this time, Free Eyre Limited (FEL) was the preferred grain supplier and was involved in the preliminary planning for the grain export aspects of the project. The project was declared a Major Development under the *Development Act 1993* and it was determined that the project would be subject to a Public Environment Report (PER) process. The Port Spencer site was owned by Centrex Metals and the Port Spencer Stage 1 Project (the Evaluated Project) successfully received Provisional Development Plan consent to export both iron ore and grain from the site.

The site provides naturally deep water with depth to 20 metres within 500 metres of the shoreline, enabling Panamax or Cape class vessels with no requirement for dredging to facilitate port operations (i.e. to allow safe passage of vessels or to create a berth pocket for vessels). The landside component of the project is located on undulating terrain consisting of cleared farmland, heavily impacted by human activity and subject to erosion.

The provisional development authorisation granted to Centrex Metals in 2012 and extended in 2014 currently remains active and was transferred to Peninsula Ports (a subsidiary of FEL) in mid-2019 following purchase of the land from Centrex Metals. Given Peninsula Ports only intends to export grain from the site, Peninsula Ports is seeking to amend the existing Development Plan consent under Section 47 of the *Development Act 1993.* The amendment process is required to take account of alterations to the Evaluated Project and to update the PER due to the length of time that has passed since the PER was originally prepared.

This document provides a:

- Review of the baseline environment documented in the PER and details of investigations undertaken to validate or update existing baseline information for the site.
- Detailed review and comparison of the environmental effects between the Evaluated Project and the Proposed Amendment.
- Risk assessment aligned with the process adopted for the PER to identify changes in the overall risk profile of the project due to the Proposed Amendment.

1.1 Overview of the Proposed Amendment

This section provides a high-level description of the Proposed Amendment infrastructure elements and a comparison with the Evaluated Project. It establishes the context for the impact assessment studies documented in this report.

The Evaluated Project comprised a deep-water marine port, capable of accommodating Panamax and Cape class vessels, suitable for export of up to 2 million tonnes of ore per annum and up to 1 million tonnes of grain, from a single berth configuration and single ship loader. The Proposed Amendment removes the mining related component from the Evaluated Project (the export of iron ore) and seeks to reconfigure the site for efficient grain handling and export. A comparison of the key infrastructure requirements for the Evaluated Project and Proposed Amended is provided in Table 1-1 and Figure 1-1.

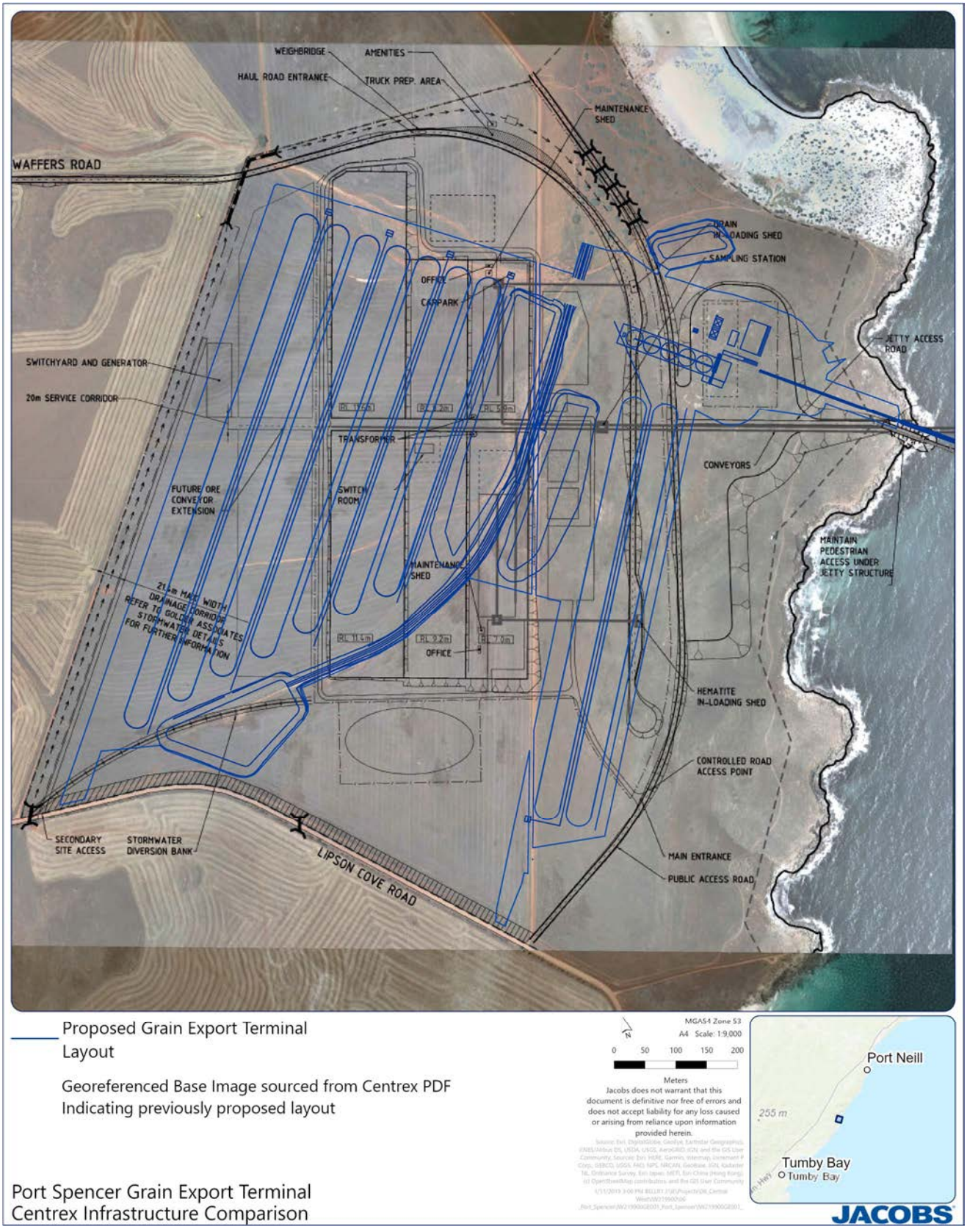


Figure 1-1: Comparison of Layout – Evaluated and Proposed Project

As a grain only export facility, the maximum ship size required to be accommodated at the port has reduced from Cape Class to Panamax. The expected number of ship movements will also reduce. The Evaluated Project

anticipated 12 Cape Class (167,000 t) or 27 Panamax (74,000 t) ore shipments a year and 8 Panamax (62,500 t) grain shipments assuming 0.5 million tonnes of grain would initially be exported. The Amended Project anticipates up to 30 ship movements comprising a combination of Handysize and Panamax vessels (33,000 t average), however recently constructed and emerging Panamax vessels are becoming slightly larger due to a recent widening of the Panama Canal. The reduction in ship size (from Cape Class to Panamax) means that a straight jetty structure is now proposed rather than a straight main jetty with a berthing wharf perpendicular to the main jetty.

The emerging Panamax vessels are still much smaller than Cape Class and can also berth at the amended wharf, as they are larger mainly in beam, not length. These emerging Panamax vessels, very few of which are currently operating with grain, can be up to 90,000 t compared with the traditional Panamax of 74,000 t assumed in the Evaluated Project. The amended wharf will be capable of safely berthing these new Panamax vessels.

The removal of iron ore related infrastructure from the project allows for a significantly higher rate of grain receivals during harvest and greater on-site grain storage capability which reduces the reliance on up-country grain storage, and the resultant double handling of grain prior to export. This reconfiguration of the project will allow most grain deliveries to the site to occur during the harvest season, to realise these logistical efficiencies for the Eyre Peninsula. The Proposed Amendment accommodates this capability through:

- Provision of dedicated truck marshalling areas at the site entry and following weighing for improved traffic management on site. This includes a marshalling area prior to the site gate (but contained within the subject land) for vehicles arriving prior to opening hours.
- An increase in sampling stations from one to eight.
- An increase in weighbridge stations from one to three on entry, and additional two on exit.
- An increase in grain n-loading points from one grain in-ground hopper to up to eight in-ground hoppers at bunkers and two at the silos.
- An increase in on-site grain storage capacity from 60 kT to approximately 860 kT (comprising at least 800kT in bunkers and up to 60kT in silo storage).

Site access for the Proposed Amendment is proposed via Lipson Cove Road rather than Swaffers Road. Lipson Cove Road has been assessed as providing safer turning conditions to and from the Lincoln Highway and minimises the risk of new roadworks into the site impacting on potential aboriginal cultural heritage areas in the vicinity of Rogers Beach.

Table 1-1 Comparison of proposed infrastructure – Evaluated Project and Amended Project

Evaluated Project	Proposed Amendment
A 515 m long jetty with a 345 m by 55 m wharf at 90 degrees to the main jetty designed for Cape size and Panamax vessels. All vessels are berthed with the beam to the predominant swells.	Straight wharf constructed in a south-east direction from the coast, with an approximate overall length of 600 m, designed to cater to Panamax vessels, **not** Cape Class. The vessels will be berthed bow into the predominant swells rather than beam to the swells.
Jetty and T head wharf with bents at 18 m for the Jetty, and 16 m for the wharf. 2 piles per bent for the jetty and 3 piles per bent on the wharf, plus 9 no 5 pile dolphins. Total number of piles 184.	Causeway structure of approximately 240 m crest length, with a toe level of -12.5 m Chart Datum. Jetty and wharf bents of 42 m typical, with 2 piles per bent. Total number of piles 18.
Industrial ship loader, suitable for loading ore and grain material into Cape class and Panamax sized vessels with an approximate loading capacity of	Industrial ship loader, suitable for loading grain into Panamax sized vessels with an approximate loading capacity of 2,000 t/h. No loading of ore proposed.

Evaluated Project	Proposed Amendment
5,000 ton per hour (t/h) for iron ore and 1,400 t/h for grain.	
Haul road transport and infrastructure access corridor, 5 km in length from the Lincoln Highway and generally following the alignment of Swaffers Road.	Access corridor, approximately 5.6 km in length from the Lincoln Highway via Lipson Cove Road.
A hematite in-loading shed.	No iron ore in-loading proposed.
A hematite storage shed, with a storage capacity of up to 240,000 t and an in-loading shed, site office, site warehouse for equipment storage.	No iron ore storage proposed.
Grain storage options, being: Grain storage shed, with a storage capacity of approximately 60,000 t; or Three 20,000 t grain storage silos with a maximum height of 20 m; or One bunker style grain storage area with a capacity of approximately 60,000 t.	The bulk of the storage will be in up to nine bunkers, each with the ability to be split for multiple grades of grain. Some (up to 60 kT) of silo storage will be provided for blending, buffer storage, in-stream sampling and fumigation (if required) immediately prior to export. Maximum height of the silo vessels will be approximately 35 m and maximum height of the silo facility will be approximately 45 m. Fumigation of the bunkers will also be conducted as is standard practice across the grain industry.
Grain in-loading shed, site office and warehouse for equipment storage;	Grain in-loading will primarily occur at the bunkers to accommodate concurrent loading and stacking of up to 6-8 grades of grain in a typical season (potentially more grades in weather affected seasons). In-loading method will depend on grade and volume. Options include: Truck directly to bunker and dump to Drive Over Grid (DOG) stacker (not preferred) Truck to in-ground road hoppers and stack via conveyor and travelling stacker (preferred).
Site administration/office building, suitable for occupation by 20-30 personnel and associated amenities.	Site administration/office building, suitable for occupation by 20-30 personnel and associated amenities. Maintenance workshops and tarpaulin storage sheds etc will be located close to the site administration building. The site facilities will be shared with the Barngarla Determination Aboriginal Corporation as a base for a future Aboriginal Ranger programme.
Enclosed conveyor galleries for proposed ore and grain in-loading and out-loading conveyor.	Enclosed conveyors for proposed grain conveyors, whenever practical to install and operate. Note that lengths of conveyors where a tripper is used to feed a bunker stacker or the ship loader cannot have covers. Instead, those conveyors may include a type of wind guard to reduce dust generation.

Evaluated Project	Proposed Amendment
No allowance for truck marshalling.	A truck marshalling area along the western boundary to handle peak harvest projected volumes.
Sampling station and enclosure for automatic sampling of iron ore and grain for quality assurance;	Four double-sided sampling stations. A large single classification stand managing multiple samples simultaneously will be co-located with the sampling stations.
A truck weighbridge station located at the haul road entrance point on Swaffers Road at the northern side of the site.	Three truck weighbridge stations located after the sampling stations. An additional two weighbridges at the site exit.
No allowance for truck marshalling.	A truck marshalling area located after the weighbridge stations to allow for surge volumes and flexibility in managing traffic movements.
68,000 litre heavy fuel oil storage tank for generation and 10,000 litres bulk diesel fuel tank for site equipment.	Approximately 30,000 litres bulk diesel fuel tank for power generation and 10,000 litres bulk diesel fuel for site machinery and equipment.
5 MW diesel generator for on-site electricity generation.	2 x 1.5 MW diesel generators for on-site power generation
Fire service tank and pump systems.	Fire Service requirements to be determined through fire engineering study. Provision made for fire service tanks.

2. Baseline Environment

The baseline environment at the Port Spencer site was investigated and described in detail as part of the Evaluated Project PER documentation. This Chapter reviews each section of **Chapter 5 – Baseline Environment** of the PER to assess the ongoing applicability of the information to inform the impact assessment for the Proposed Amendment. Where relevant, updated information is provided. For ease of reference, the chapter follows the same order as the PER.

Land use at the site and immediate surrounds has not significantly changed since the Evaluated Project PER documentation was submitted. The site is currently leased by a neighbouring landholder and continues to be used for agricultural purposes. However, due to the elapsed time since the Evaluated Project it has been necessary to review the baseline environment for each environmental aspect to confirm relevance and update where required.

2.1 Climate and Climate Change

2.1.1 Climatic Conditions

Climate data from North Shields (Port Lincoln Automatic Weather Station (AWS)) located approximately 70 km south of Port Spencer was reviewed in August 2019 as only rainfall data was available from the Bureau of Meteorology (BoM) station at Tumby Bay.

A summary comparison between the 2011 and 2019 mean data is shown in Table 2-1. While the numbers have increased slightly, the general trends remain similar (refer to Figure 2-1 to Figure 2-3). Annual rainfall is approximately 340 mm at Tumby Bay compared to approximately 390 mm at North Shields (Port Lincoln AWS).

No additional wind data is available from North Shields (Port Lincoln AWS) since the Evaluated Project, with data collection ending in 2010. As reported in the PER, wind direction in the spring and summer months (October to March) is predominantly from the south-east. Although winds are observed from all directions in autumn and winter (April to September), they predominantly come from the north-west through to the west. High winds (> 5 m/s) are more common in summer, and light winds (<2 m/s) are more common in autumn.

Table 2-1 Comparison of Climate Data (BoM 2011 to BoM 2019), North Shields (Port Lincoln AWS)

Climate Feature	Evaluated Project (BoM 2011)	Proposed Amendment (BoM 2019)
Mean Maximum Monthly Temperature (degrees Celsius)	25.6 - January	26.3 - January
Mean Minimum Temperature (degrees Celsius)	7.1 - August	7.2 - August
Annual Rainfall (mm/year)	385 mm – Major rainfall during winter	390 mm – Major rainfall during winter
Wind Direction	October – March: predominantly from the south-east April – September: All directions, but predominantly from the north-west to west	*No change - Data only available to 2010*

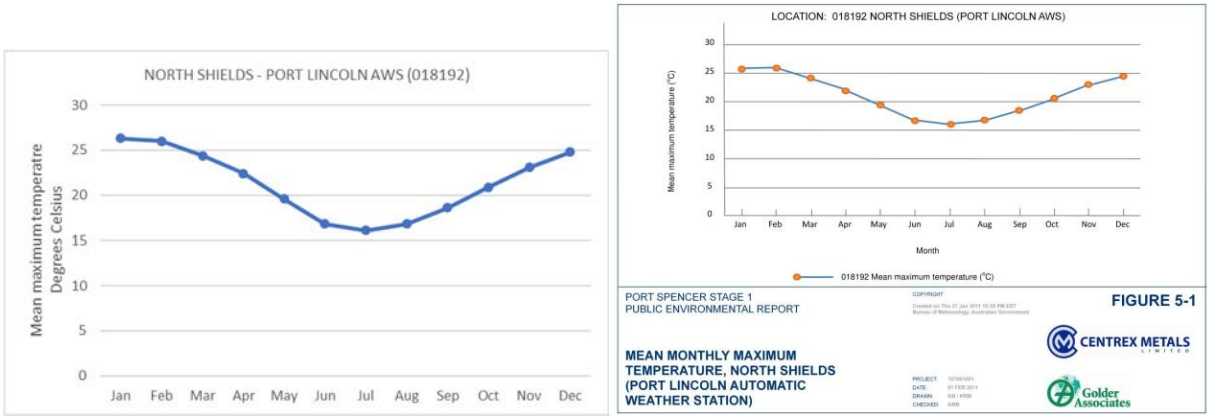


Figure 2-1 Mean monthly maximum temperature comparison (Left: BoM 2019; Right: PER sourced from BoM 2011)

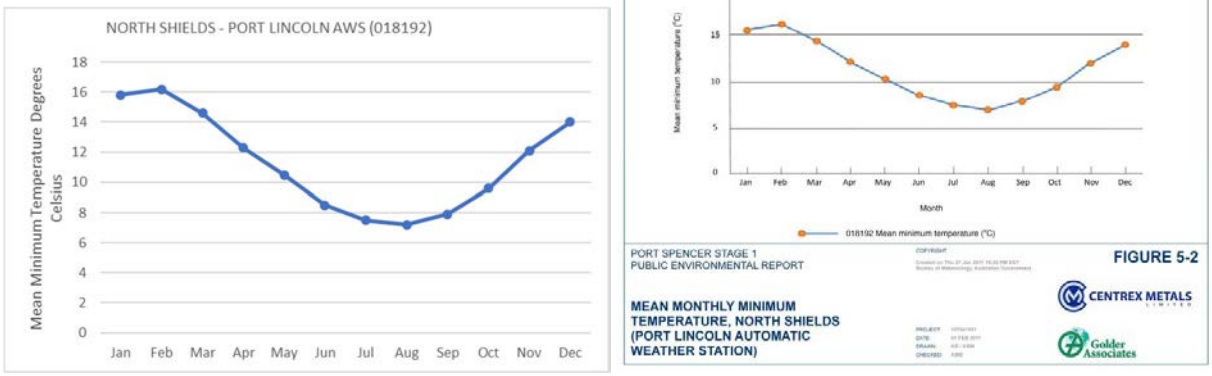


Figure 2-2 Mean monthly minimum temperature comparison (Left: BoM 2019; Right: PER sourced from BoM 2011)

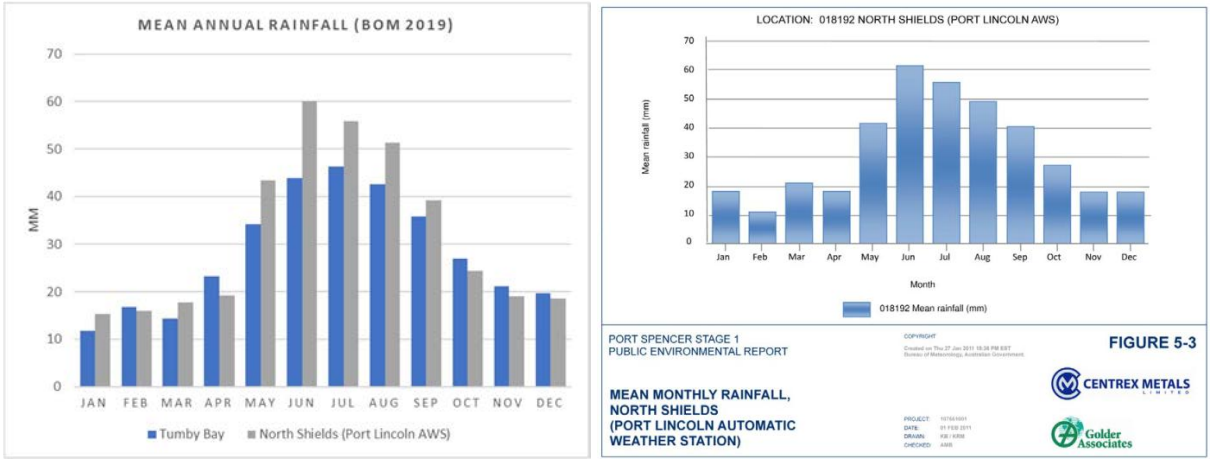


Figure 2-3 Annual Rainfall Comparison (Left: BoM 2019; Right: PER sourced from BoM 2011)

2.1.2 Climate Change

Since the Evaluated Project, SA Climate Ready project[1] has been undertaken to develop a comprehensive set of downscaled climate projection data for South Australia. Downscaling derives local or regional scale information from larger scale information (e.g. national or global scale).

Data is available for six climate variables (rainfall, temperature maximum, temperature minimum, areal potential evapotranspiration, solar radiation and vapour pressure deficit), using two emission scenarios (intermediate and high "representative concentration pathways") through to 2100. It provides a common platform on which Government; business and the community can assess the impacts of climate change and develop adaptation measures.

Projections for the Eyre Peninsula indicate that the future climate of the region will be drier and hotter, though the amount of global action on decreasing greenhouse gas emissions will influence the speed and severity of change (Goyder Institute 2015a). Decreases in rainfall are projected for all seasons, with the greatest decreases in spring. Climate modelling indicates average annual rainfall could decline by 10-20.9% by the end of the twenty-first century. Average temperatures (maximum and minimum) are projected to increase for all seasons. Slightly larger increases in maximum temperature occur for the spring season. Climate modelling suggests that maximum temperatures could increase by 1.8-3.3ºC and minimum temperatures could increase by 1.4-2.8ºC by the end of the twenty-first century.

A summary comparison of climate change predictions presented in the PER with SA Climate Ready projections is shown in Table 2-2, noting there are variances in the baseline. The changes are presented relative to the statistical probability of occurrence (10th and 90th percentile). Table 2-2 uses data from a subset of the 6 "best" Global Climate Change Models. These models were chosen because they were found to perform better at representing climate drivers that are particularly influential on rainfall in South Australia (Goyder Institute 2015a).

Table 2-2 Summary of Climate Change Projections on the Eyre Peninsula (PER and SA Climate Ready)

		PER Projections for 2030 – Medium Emissions Scenario (relative to 1990 baseline)		**SA Climate Ready Projections for 2030 Intermediate Scenario (relative to 1986-2005 baseline)**		**SA Climate Ready Projections for 2070 Intermediate Scenario (relative to 1986-2005 baseline)**	
Variable	**Season**	**10th percentile**	**90th percentile**	**10th percentile**	**90th percentile**	**10th percentile**	**90th percentile**
Temperature (ºC)	Annual	0.5	0.8	Max: 0.7 Min: 0.5	Max: 1.0 Min: 0.8	Max: 1.3 Min: 0.9	Max: 1.7 Min: 1.6
	Summer	0.5	0.8	Max: 0.5 Min:0.4	Max: 1.1 Min:0.9	Max: 1.1 Min: 0.8	Max: 1.8 Min: 1.8
	Autumn	0.5	0.8	Max: 0.8 Min: 0.9	Max: 1.0 Min: 0.6	Max: 1.3 Min: 1.1	Max: 1.7 Min: 1.7
	Winter	0.5	0.8	Max: 0.6 Min: 0.5	Max: 0.8 Min: 0.7	Max: 1.2 Min: 0.8	Max: 1.6 Min: 1.3
	Spring	0.5	0.8	Max: 0.9 Min: 0.6	Max: 1.2 Min: 0.8	Max: 1.5 Min: 1.0	Max: 2.0 Min: 1.6
Rainfall (%)	Annual	-15	0	-13.9	-2.3	-18.5	-5.6
	Summer	-15	7.5	-24.7	10.7	-23.2	5.3
	Autumn	-15	7.5	-17.3	2.9	-20.4	-4.9
	Winter	-15	0	-6.5	6.1	-10.9	2.2

[1] https://data.environment.sa.gov.au/Climate/SA-Climate-Ready/Pages/default.aspx, Accessed 16 August 2019.

		PER Projections for 2030 – Medium Emissions Scenario (relative to 1990 baseline)		SA Climate Ready Projections for 2030 Intermediate Scenario (relative to 1986-2005 baseline)		SA Climate Ready Projections for 2070 Intermediate Scenario (relative to 1986-2005 baseline)	
	Spring	-15	0	-31.9	-9	-40.0	-10.2
Potential Evapotranspiration (%)	Annual	0	3	2	3.3	3.6	4.9
	Summer	0	3	1.4	2.4	2.4	4.0
	Autumn	0	6	1.7	4.3	3.6	5.8
	Winter	0	10	1.8	3.2	3.8	5.8
	Spring	0	3	2.3	4.4	3.7	6.4

2.1.2.1 Sea Level Rise

The PER provides information on projected sea level rise published by DCCEE (2011). In addition, DEWNR (2013) specifies flooding and erosion protection requirements for coastal development which are based on:

An allowance for sea-level rise due to global climate change of 0.3 m between 1991 and 2050.

Development capable of being protected against a further sea-level rise, and associated erosion, of 0.7 m between 2050 and 2100.

Flood mapping of the project area, including sea level rise is shown in Figure 2-4.

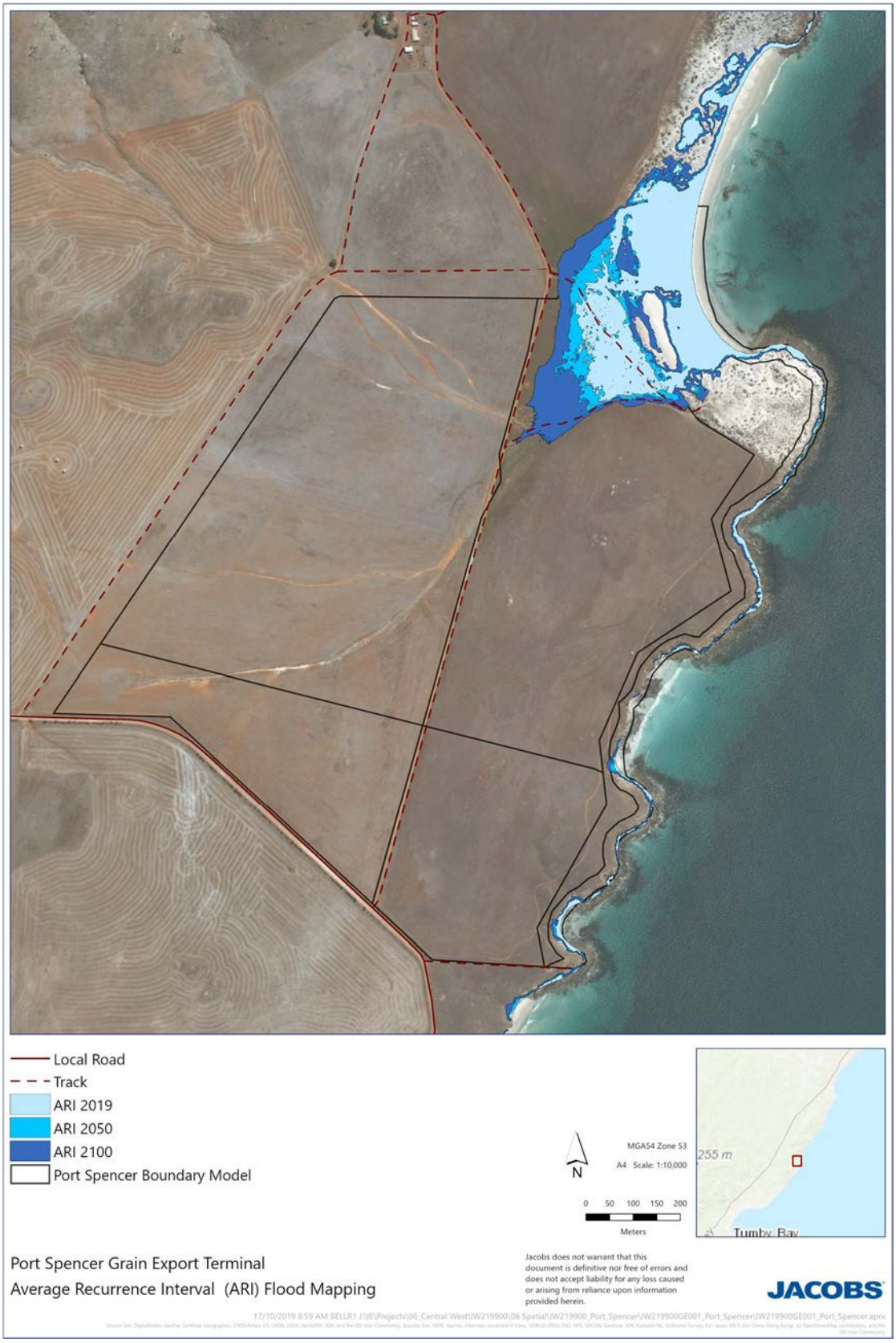


Figure 2-4 Flood maps (Source: Department for Environment and Water)

2.1.2.2 Ocean Wave

The wave climate at the project location is a mix of smaller long period swell that penetrates the gulf from the Southern Ocean and locally-generated wind waves. Th Evaluated Project identified a potential increase of 0.5-1.0 m in wave height at the site based on CSIRO and BoM (2008). Coastal and hydrodynamic modelling for the Proposed Amendment has included modelling of baseline conditions and is included as Appendix D.

2.1.2.3 Storm Surge

The Tumby Bay (DC) Development Plan has been updated since the Evaluated Project. The updated (2018) plan establishes the 100-year average return interval (ARI) flood extreme sea level (tide, stormwater and associated wave effects combined), plus an allowance to accommodate land subsidence until the year 2100 as the standard for coastal development. The 100-year ARI event has a 1 in 100 change of occurring or being exceeded in any year.

2.2 Land Use

The site land tenure details for the Evaluated Project and the Proposed Amendment are summarised in Table 2-3 and shown in Figure 2-5.

One of the changes evident in Table 2-3 occurred during the Evaluated Project assessment process but were not reflected in the PER (refer to Section 3.3 of the PER Response Document):

> A portion of the site (from Allotments 23 and 24) was transferred and forms part of an extended Crown land coastal strip (Allotment 25) on the eastern boundary.

Since the Evaluated Project, the following changes have occurred:

> Ownership of most of the site transferred to Peninsula Ports in 2019.
>
> The zones and zone boundaries at the site have changed. Zoning at the site is now Primary Production and Coastal Conservation. The boundary of the Coastal Conservation zone is further east (closer to the coast) than for the previous Coastal zone.

The site has been leased to a neighbouring farmer and has been used for continued agricultural purposes since the Evaluated Project.

Table 2-3 Comparison of Site Tenure and Land Use Details

Feature	Evaluated Project				Proposed Amendment				
Lot No.	386	387	23	24	386	387	23	24	25
Plan Details	CT6037/404 H511600 Parcel S386	CT6066/698 H511600 Parcel S387	CT6037/404 D78441 A23	CT6066/698 D78441 A 24	CT6037/404 H511600 Parcel S386	CT6066/698 H511600 Parcel S387	CT6037/404 D78441 A23	CT6066/698 D78441 A 24	CR6029/386 D78441 A 25
Tenure	Freehold	Freehold	Freehold	Freehold	Freehold	Freehold	Freehold	Freehold	Crown Land
Current Owner	Centrex Metals Limited	Centrex Metals Limited	Centrex Metals Limited	Centrex Metals Limited	Peninsula Ports	Peninsula Ports	Peninsula Ports	Peninsula Ports	Crown
Approx. Area (ha)	53	16.7	51	17	53	16.7	39	15	22.8
Zone	General Farming	General Farming	Coastal	Coastal	Primary Production	Primary Production	Primary Production/ Coastal Conservation	Primary Production/ Coastal Conservation	Coastal Conservation

Notes: Grey shading indicates changes in land tenure and zoning since the Evaluated Project.

2.2.1 Topography

The topography of the site is described in the PER for the Evaluated Project (Section 5.2.1 of the PER), and is not repeated here.

Lipson Cove Road rises towards the Coast Road intersection. From the intersection, the road falls towards the coast, rising again at the coastline where it deviates south towards Lipson Cove.

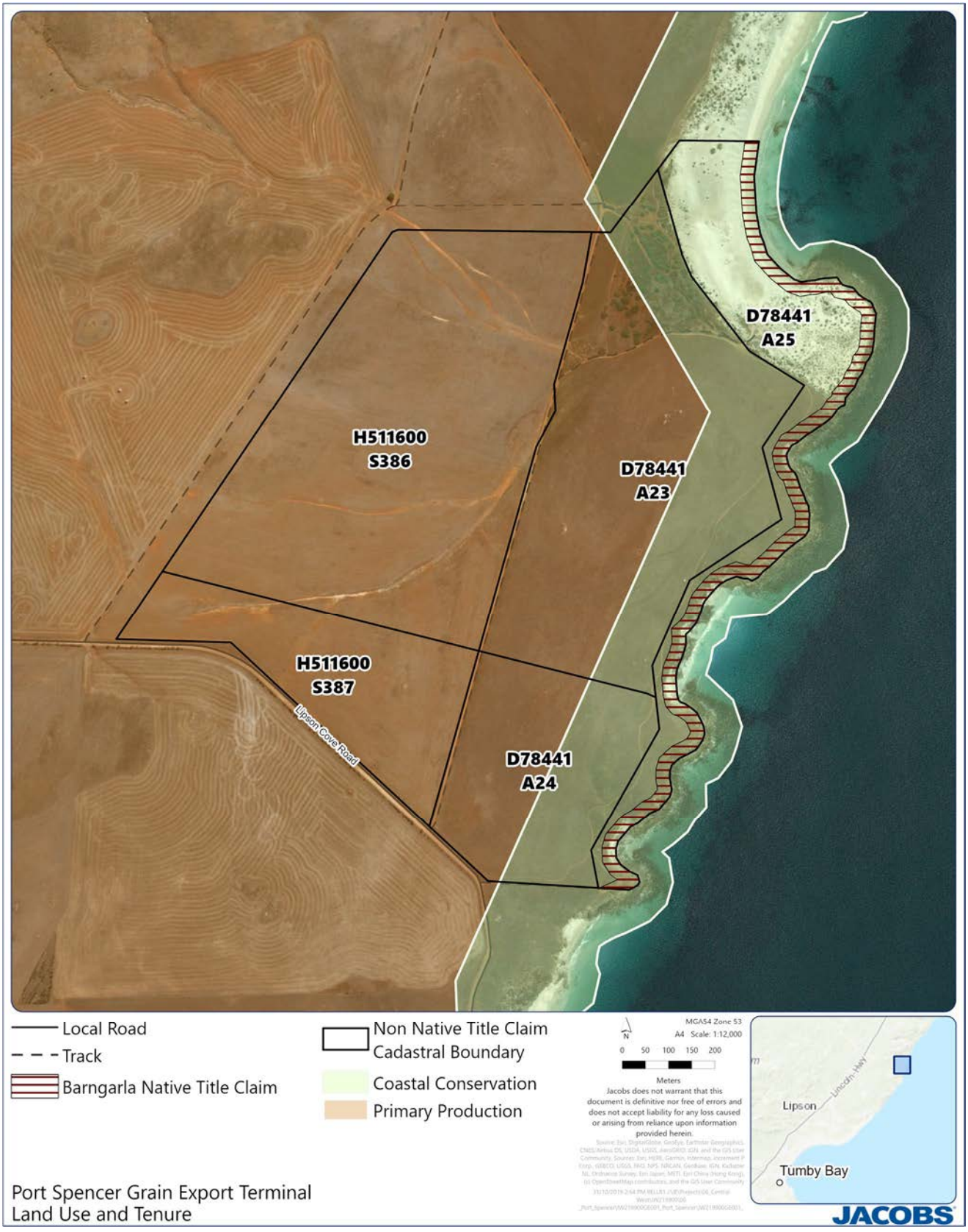


Figure 2-5 Land Use and Tenure

2.3 Geology and Soils

The geological and soil characteristics of the site are described in the PER for the Evaluated Project (Section 5.3 and Appendix D of the PER). No bulk earthworks or change of land use has occurred at the site since the Evaluated Project, as such no significant change is expected to ground surface conditions or the contamination status at the site.

2.4 Surface Water

The existing surface water conditions at the site are described in the PER for the Evaluated Project (Section 5.4.1 of the PER). There have been no significant changes to surface flows in and around the site since the Evaluated Project (i.e. no significant development, earthworks or land use changes). However, estimation of rainfall and runoff is a practice that is continuously subject to review and improvement of techniques, parameters and estimates. Since the Evaluated Project there have been changes in rainfall data and a significant update to the national guideline Australian Rainfall and Runoff (AR&R) that influence the calculation of peak surface water flows.

A review was undertaken to assess the effects of these changes (refer to Appendix A). Key differences identified were:

Rainfall depths for design events at the site have decreased since the Evaluated Project. Decreases are of the scale of 5-20% for 1% Annual Exceedance Probability (AEP) storms and 0-5% for 10% AEP storms.

Storm loss values as recommended by AR&R have increased from 10 mm initial loss and 2 mm/hr continuing loss at the time of the Evaluated Project to revised values of 23 mm initial loss and 2.8 mm/hr continuing loss. This change results in an estimated decrease of surface runoff of 22% for a 1 hour 1% AEP event and a decrease of 71% for a 1 hour 10% AEP event.

Overall, estimated baseline flows decrease by 10-50% due to a decrease in rainfall and increase in losses (refer to Appendix A). Estimated total catchment runoff for existing (undeveloped) conditions at the flat zone adjacent to Rogers Beach for the 1% annual exceedance probability event was modelled to be **68 m^3/s** for the Evaluated Project. However, based on the revised AR&R parameters, it is expected these flows are in the order of **20-40 m^3/s** depending on the method used to estimate flows.

2.5 Groundwater

The groundwater conditions at the site are described in the PER for the Evaluated Project (Section 5.5 and Appendix E of the PER). No bulk earthworks, change of land use or significant change in vegetation cover has occurred at the site since the Evaluated Project, as such no significant change is expected to groundwater conditions at the site.

The site groundwater investigation (Appendix E of the PER) indicated that groundwater levels at the site range between approximately 0.9 m AHD and 2.3 m AHD. The uppermost aquifer is generally brackish to saline water that would be unsuitable for irrigation or potable use.

2.6 Air Quality

The existing air quality environment is described in the PER for the Evaluated Project, based on the closest ambient air quality stations to the site, located at Whyalla (approximately 250 km from the site) and Port Pirie (approximately 280 km from the site). Both sites are situated in urban environments with significant heavy industry located in the respective regions and are considered worst case scenarios compared to Port Spencer. The Air Quality Assessment Report for the PER (Appendix C of the PER) used background data derived from air monitoring undertaken for Centrex Metals' proposed Wilgerup Mine, approximately 70km north-west of the site (between 4 June 2009 and 8 March 2010). This modelling was subsequently updated based on revised assumed background levels following the PER consultation period.

Air emissions modelling undertaken for the Proposed Amendment has conservatively used the highest of the 70th percentile concentrations measured at Whyalla EPA monitoring station between 2015 – 2018 inclusive. A comparison of background air quality parameters used to assess air quality effects at the site are summarised in Table 2-4.

Particulate matter (PM) relates to particles of solid matter suspended in the air. Particulate matter smaller than 10 micrometres in diameter are referred to as PM_{10}. Particulate matter smaller than 2.5 micrometres in diameter are referred to as $PM_{2.5}$. These are the generally accepted measures of particulate material.

Table 2-4 Background air quality for the site

Parameter	Proposed Amendment[1] (Whyalla highest 70th percentile 2015-2018)	PER (Whyalla and Port Pirie)	PER Appendix C	Response to Submission Document
PM_{10} – 24 hour	20 µg/m^3	23 µg/m^3	14 µg/m^3	18 µg/m^3
$PM_{2.5}$ – 24 hour	10 µg/m^3	11 µg/m^3	7 µg/m^3	7.2 µg/m^3
$PM_{2.5}$ – 12 month	7 µg/m^3	11 µg/m^3	7 µg/m^3	7.2 µg/m^3

Note 1: PM_{10} background concentration is based on the highest 70th percentile concentration measured at Whyalla between 2015-2018. $PM_{2.5}$ background concentration is consistent with the background adopted for IRD (2015).

2.7 Noise

The existing noise environment is described in the PER for the Evaluated Project, based on a noise survey completed in November 2008 (refer to Section 5.7 and Appendix G of the PER). The noise survey data collected is considered suitable to describe the baseline conditions at the site given that no significant development, earthworks or land use changes have occurred which are likely to have altered the noise environment in a significant way. In addition, it is not expected that the baseline noise levels will affect the ability of the Proposed Amendment to comply with the Environment Protection (Noise) Policy 2007.

Figure 2-6 Sensitive Receptors

2.8 Traffic

It is expected that significant changes to traffic conditions on the Eyre Peninsula have occurred since the Evaluated Project, due to the passage of time and the closure of the rail line into Port Lincoln. A revised traffic assessment has been completed for the Proposed Amendment (refer to Appendix B).

A summary of the revised baseline conditions is provided in the following sections.

2.8.1 Lincoln Highway

Lincoln Highway is an arterial road under the care and control of the Department of Planning, Transport and Infrastructure (DPTI), that extends some 300 km between the Eyre Highway (approximately 25 km south-west from Port Augusta) and to the town centre of Port Lincoln, generally following the Eyre Peninsula's eastern coastline. In the vicinity of the Port Spencer site, the highway has a posted speed limit of 110 km/h and has an approximate sealed width of 10 m with 3.6 m wide lanes and sealed shoulders in each direction.

Approximately half the highway length between the Lipson Cove Road and Swaffers Road (i.e. near the site) has a single or double barrier line (i.e. no overtaking permitted). The road traverses areas of both cut and fill along its length, with an area of significant fill noted near the Swaffers Road junction with a culvert in place to maintain a natural watercourse which crosses the beneath the highway.

The traffic impact assessment for the Evaluated Project noted the existing traffic volumes along the Lincoln Highway to be in the order of 750 vehicles per day (vpd), with approximately 17 percent commercial vehicle content (according to traffic data provided by DPTI dated October 2006).

More recent DPTI traffic data indicates the Lincoln Highway volumes (along the section between Tumby Bay and Arno Bay) to be in the order of 850 vpd with 17.5 percent (or 150 vpd) commercial vehicles (2014 data (month unknown) sourced from Location SA Viewer). This data does not factor in the impact of the recent railway line closure on the road network. The recent Eyre Peninsula Freight Study (SMEC, 2018) reported the rail network to transport approximately 816,000 tonnes of grain to Port Lincoln in 2017 (and approximately 1.1 million tonnes delivered by road).

As the railway line closure is a recent change to the transport network on the Eyre Peninsula (railway closure occurred 1 June 2019), the impact on the road network is not fully understood as a harvest season has not yet occurred to measure the resultant transport impacts.

The Eyre Peninsula Freight Study forecasted the impact of the railway closure to be an additional 30 (70 tonne) freight vehicle movements (two-way volume) per day on the Lincoln Highway between Wharminda Road and Tumby Bay. In the town centre of Port Lincoln, the impact of the railway line closure was forecast to be 68 freight vpd. This assumes no seasonal variation to the transport of the grain.

In addition to the railway closure, Lucky Bay Grain Terminal commenced grain receivals in early 2019. The terminal is located along the eastern coastline of the Eyre Peninsula approximately 180 km north-east of Port Lincoln and 120 km north-east of Port Spencer. The extent of trip redistribution of freight traffic on both the Lincoln Highway and throughout the wider Eyre Peninsula road freight network to this new export as a result of its trip generation has not yet been determined.

The Lincoln Highway is currently gazetted for use by up to 36.5 m Road Trains or National Heavy Vehicle Performance Based Standards (PBS) Level 3A vehicles, and for Over-Size / Over-Mass (OSM) vehicles up to 4.0 m Wide 93.5 t Low Loader and 6 Axle Cranes.

2.8.2 Lipson Cove Road

Lipson Cove Road is an unsealed road under the care and control of the District Council of Tumby Bay, that extends approximately 8 km east from Lincoln Highway to Lipson Cove on the Eyre Peninsula's eastern coastline. The road's junction from Lincoln Highway is located approximately 17 km north-east from Tumby Bay.

The default rural speed limit of 100 km/h applies to this road because it is unsealed. The road is located within a 20 m wide road corridor reserve, with a formed road width approximately 7 m to 8 m.

Three rural properties have direct access points from Lipson Cove Road. Lipson Cove Road also provides the only direct access to the Lipson Cove reserve area and camping grounds (refer to Figure 2-7).

The traffic impact assessment for the Evaluated Project noted the traffic volumes along Lipson Cove Road to be approximately 50 vpd, with approximately 10 percent commercial vehicle content (according to traffic counts undertaken as part of the assessment between 6 and 8 April 2011). This traffic data was collected during the school holiday period.

Lipson Cove Road is currently gazetted as a Grain Commodity Route for both B-doubles and Road Trains between Lincoln Highway and South Coast Road only.

2.8.3 Swaffers Road

Swaffers Road is an unsealed road under the care and control of the District Council of Tumby Bay, that extends approximately 4 km east from Lincoln Highway towards Lipson Cove (refer to Figure 2-7). The road's junction from Lincoln Highway is located approximately 20 km north-east from Tumby Bay, and a further 3 km north-east from the Lipson Cove Road junction.

The formed road, which is approximately 7 m to 8 m wide within a 20 m wide corridor, terminates approximately 2 km short of the eastern coastline at a rural property access point. However, the road corridor extends beyond this (refer to Figure 2-7 for the formed road extent). Three rural properties have direct access from Swaffers Road (refer to Figure 2-7). The default rural speed limit of 100 km/h applies to this road because it is unsealed.

Traffic volume data for Swaffers Road is not available. No traffic surveys were commissioned as part of the PER for the Evaluated Project. The traffic impact assessment for the Evaluated Project notes that *"given the low volumes on Lipson Cove Road, it is considered conservative to assume the same volumes on Swaffers Road in terms of existing traffic loading".*

Swaffers Road is not gazetted as a part of the Grain Commodity Route, nor does it form part of any of the restricted access vehicle network gazettes.

2.8.4 South Coast Road

South Coast Road (referenced in the PER and supporting studies as both Cove Road or Coast Road) is an unsealed road under the care and control of the District Council of Tumby Bay, that extends approximately 22 km between junctions with the Lincoln Highway. Generally, the road runs parallel to the Lincoln Highway and is located halfway between the highway and the eastern coastline (refer to Figure 2-7).

Traffic volume data for South Coast Road is not available. The traffic impact assessment for the PER did not examine the road in detail, except for a visual assessment at its intersections with Swaffers Road and Lipson Cove Road.) It is considered conservative to assume similar traffic volumes along South Coast Road to Lipson Cove Road (i.e. approximately 50 vpd).

South Coast Road is not gazetted as a part of the Grain Commodity Route, nor does it form part of any of the restricted access vehicle network gazettes.

2.8.5 Existing Restricted Access Vehicle Network

A significant amount of the road network across the Eyre Peninsula forms part of the current approved restricted access vehicle network grain commodity routes for B-doubles and Road Trains (refer to Appendix B for maps of the network). Many of the current grain commodity routes are subject to council-imposed restrictions which limit the speeds on sealed and unsealed roads, and through townships, and restrict specific freight movements.

Most of the Council controlled road network for grain commodity routes are unsealed and operate for local access to main sealed freight routes and grain receival points. The Local Government Association of Eyre Peninsula has identified the potential need for a strategic east-west sealed freight linkage between Todd Highway and Lincoln Highway that would join Lincoln Highway close to Cape Hardy (SMEC 2019; and reflected as Scenario 3 of the Traffic Impact Assessment (TIA) in Appendix B. This need may be triggered by any new port on the east coast of Eyre Peninsula that could reduce grain volumes exported through Port Lincoln, thereby reducing the impacts of the rail line closure. The TIA has calculated the potential traffic volumes along such a route.

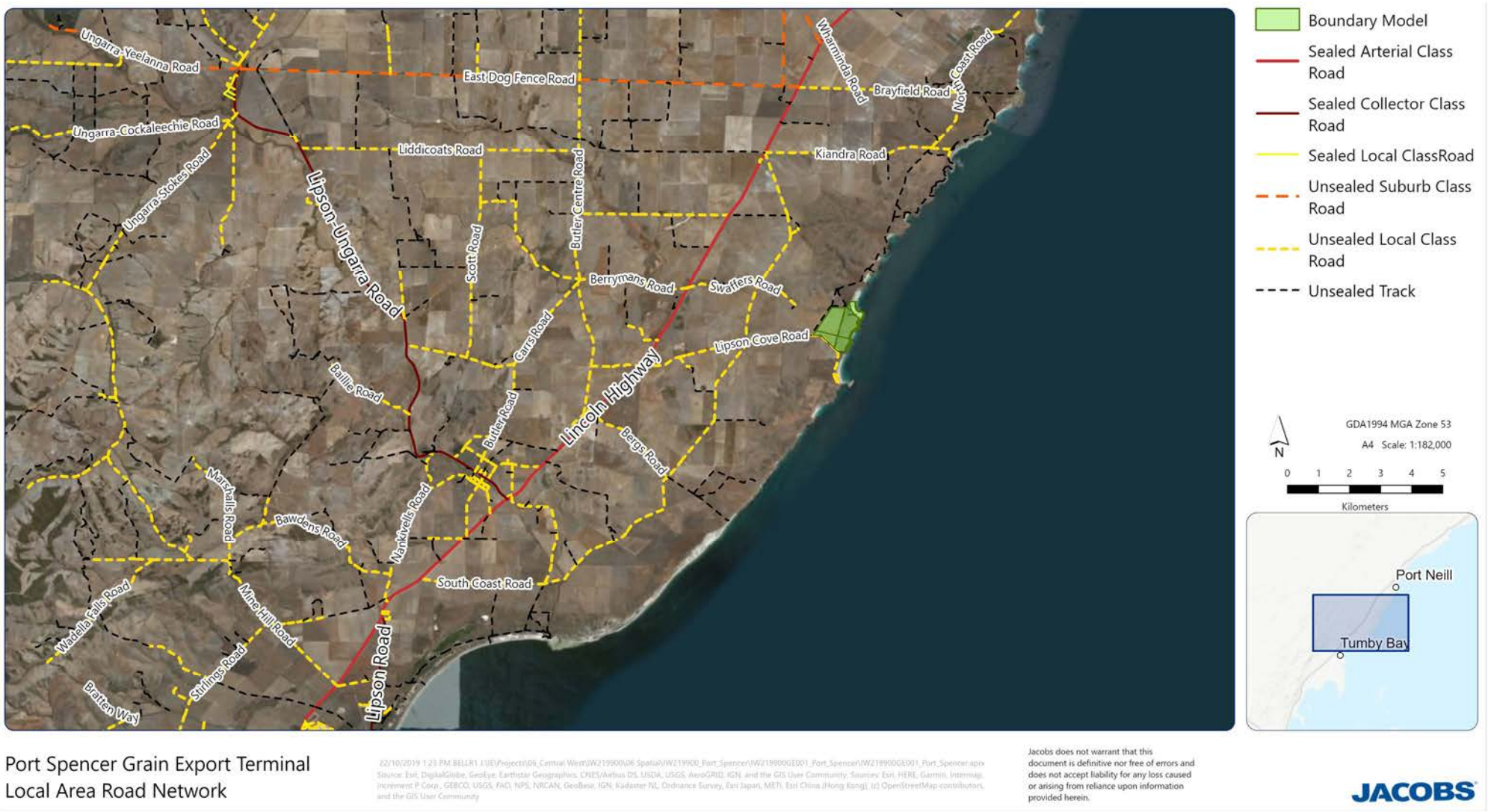


Figure 2-7 Road transport network

2.9 Terrestrial Ecology

Baseline terrestrial ecology conditions are described in the PER for the Evaluated Project, based on a study completed in 2008 (refer to Section 5.9, Appendix I of the PER and Section 5.9 of the Response to PER Submissions). The baseline ecological data collected is considered generally suitable to describe the terrestrial ecology at the site given that no significant development, earthworks or land use changes have occurred which are likely to have altered the ecological environment in a significant way.

Additional data collection has been undertaken in 2019 to enable a revised Significant Environmental Benefit to be calculated for the Proposed Amendment based on the updated *Native Vegetation Regulations 2017* (refer to Appendix C). A summary of the results of the August 2019 survey is provided below, including high level comparison with the Evaluated Project.

2.9.1 Listed Plant and Fauna Species and Threatened Ecological Communities

A search of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters database (with a 5 km buffer) identified:

Six EPBC listed plant species as potentially present within the project area. None of the species identified as potentially present are considered likely to occur at the site.

Nine EPBC listed fauna species identified as potentially present within the search area. Based on the vegetation associations identified at the site, it is considered potentially suitable habitat is present at the project site for only the Rock Parrot (the coastal dunes and slopes may provide non-breeding habitat).

No threatened ecology communities are present in the project area.

2.9.2 Weeds

Two Weeds of National Significance were identified within the project site boundary:

Lycium ferocissimum (African Boxthorn) was widespread within all habitats within the project site, except for the coastal dunes. African Boxthorn is also a Declared Plant under the *Natural Resources Management Act 2004.*

Lycium ferocissimum was sparsely present within rocky outcrop areas.

In addition to African Boxthorn, the Declared plant *Pinus halapensis* (Aleppo pine) was recorded on Swaffers Road. *Asphodelus fistulosus* (Onion Weed) was widespread and common, to locally dominant in the survey area. However, this species is not currently a Declared Plant.

2.9.3 Vegetation Associations present at the Project Site

Distinct vegetation assemblages were surveyed within the project site boundary, using the Bushland Assessment Method (BAM) (NVC 2017). Native vegetation within the project boundary occurs in the following habitats:

Rocky Slopes adjoining the coast (BAM sites 1 and 1a (*Lomandra effusa* sedgeland) and BAM 4 (*Triodia* closed hummock grassland),

Coastal dunes with *Olearia axillaris* +/- *Westringia dampieri* (BAM sites 2 and 2b),

Saline clay flat supporting a *Nitraria billardierei* tall shrubland (BAM site 3), and

Unploughed rocky outcrops within the fallow paddock (BAM site 5 and BAM 6).

The vegetation associations and area (ha) occupied within the project site are shown in Figure 2-8 and summarised in Table 2-5. Areas of the site outside of these BAM sites did not contain native vegetation.

Figure 2-8 Vegetation Association mapping across the Project site

Table 2-5 BAM site vegetation associations and area (ha) occupied within the project site.

BAM Site	Association/habitat	Area (ha)
1	*Lomandra effusa* (Scented Mat-rush) sedgeland on rocky slopes above coast	1.5
1a	*Lomandra effusa* (Scented Mat-rush) very open sedgeland on rocky slopes above coast	0.69
2	*Olearia axillaris* (Coast Daisy-bush) very open shrubland on coastal hind dunes	4.3
2b	*Olearia axillaris* (Coast Daisy-bush) – *Westringia dampieri* (Shore Westringia) open shrubland on coastal fore dunes	1.2
3	*Nitraria billardierei* (Nitre-bush) Tall Open Shrubland	5.6
4	*Triodia scariosa* (Spinifex) closed hummock grassland	0.63
5	*Asphodeuls fistulosus* (Onion Weed) open herbland	5.9
6	*Lomandra effusa* (Scented Mat-rush) +/- *Gahnia lanigera* (Black Grass Saw-sedge) +/- *Lepidosperma* sp. (Rapier Sedge) sedgeland on rocky outcrops in fallow paddock	1.2

2.9.4 Comparison with Terrestrial Vegetation Recorded for the Evaluated Project

The outcomes of the terrestrial vegetation survey undertaken in 2019 were compared with the baseline terrestrial vegetation survey completed by Golder Associates (2009) in November 2008. In general, there has been little apparent change in native species composition and abundance since 2008, except for the rocky slopes adjoining the coast. However, some differences are difficult to assess due to different seasonal timing of surveys and different sized survey sites.

There has been an increase in the reporting of weeds in the rocky slopes and saline shrublands in 2019. It is considered there has been an actual increase in high risk weeds African Boxthorn and Marguerite daisy. However, the increased reporting of weeds other than African Boxthorn in 2019 in the saline shrubland may reflect season of survey (most species were annuals)

Rocky Slopes adjoining the coast

In 2008, *Enchylaena tomentosa* (Ruby Saltbush) was estimated to cover > 25% of the survey site, compared with < 5% cover in 2019. Conversely, the 2019 survey recorded a higher cover of *Triodia scariosa* (Spinifex Grass) (up to 75%) compared with 26 – 50% cover in 2008. The highly invasive Marguerite daisy was recorded from this habitat only in 2019. The abundance of Boxthorn also appears to have increased from 2008 to 2019.

The higher number of native species recorded in 2019 (35 compared with 18 on 2008) is likely a combination of more annual species being evident due to the time of year surveyed, and a greater area surveyed (the two BAM sites, 1 and 1a, were one hectare each, compared with 0.09 ha for the one Biological Survey of SA site in 2008).

Coastal dunes with Olearia axillaris +/- Westringia dampieri

Minimal changes were observed in the coastal dunes habitat between 2008 and 2019. The greatest apparent change is the estimated decline in Marguerite Daisy from 6 – 25% cover in 2008, to < 1% cover in 2019

Saline clay flat supporting a *Nitraria billardierei* tall shrubland

There appears to have been little apparent change between 2008 and 2019. There has possibly been a decline in Samphire (*Tecticornia pergranulata*), and an increase in exotic species. The only weed species recorded in

2008 was Iceplant (*Mesembryanthemum crystallinum*). However, 10 weed species were recorded in 2019, including African Boxthorn. Most weed species present in 2019 were annuals, or seasonally evident, which may explain the relative absence of weeds in 2008.

Unploughed rocky outcrops within the fallow paddock

There appears to have been no significant changes in native vegetation cover on the rocky outcrop areas in the fallow paddocks.

2.9.5 Lipson Cove Road Vegetation Associations

Native plants were absent or not obvious for most of the northern side of the Lipson Cove Road reserve. Two distinct vegetation associations were recognised on the southern side of Lipson Cove Road Reserve (refer to Figure 2-9):

LCR-1: *Acacia pycnantha* (Golden Wattle) – *Allocasuarina verticillata* (Drooping Sheoak) – *Eucalyptus angulosa* (Coast Ridge-fruited Mallee) Low Open Woodland occurred along the eastern half of Lipson Cove Road.

LCR-2: Senna very open shrubland with emergent *Eucalyptus gracilis, E. dumosa, E. peninsular*s) occurred along the western half of Lipson Cove Road. Native shrubs and trees occurred discontinuously, often with large gaps comprised of exotic weeds and grass.

Terrestrial vegetation along Lipson Cove Road was not assessed as part of the Evaluated Project.

Figure 2-9 BAM survey site areas on Lipson Cove Road

2.10 Lipson Island Ecology

Baseline ecological conditions at Lipson Island are described in the PER for the Evaluated Project, based on a study completed in 2011 (refer to Section 5.10, Appendix I of the PER and Section 5.10 of the Response to PER Submissions). The baseline ecological data collected is considered suitable to describe the Lipson Island ecology given that no significant changes have occurred to the nearby environment which are likely to have altered the ecological environment in a significant way.

2.11 Marine Ecology

A series of marine surveys were undertaken by Golder Associates in 2009 and 2011 as part of impact assessment works undertaken for the Evaluated Project PER (refer to Section 5.11, Appendix K and Section 5.11 of the Response to PER Submissions). The investigations comprised three surveys undertaken October 2008, July 2010 and August/September 2011. Benthic habitat mapping covered the previously proposed jetty alignment as well as a broader area of potential impact surrounding the proposed nearshore infrastructure. A comparison of the initial jetty alignment and footprint with the proposed nearshore infrastructure for the Proposed Amendment indicates that the revised footprint falls within the extent of habitat mapped previously.

Given the nature of the benthic habitats noted during the initial surveys (i.e. predominantly bare sand substrate with seagrass and macroalgae) it is anticipated that the benthic habitats and associated marine fauna observed and mapped at the time of the original assessment are similar in composition, distribution and spatial extent to the current habitats and fauna. Therefore, it is determined appropriate to use this existing baseline ecological data for the purposes of this impact assessment review.

2.12 Coastal Environment and Wave Dynamics

The studies undertaken to assess the coastal environment and wave dynamics for the Evaluated Project (refer to Section 5.12 and Appendix L of the PER) are considered valid for the Proposed Amendment, as there has been no development or change at the site since the Evaluated Project was assessed. On this basis, no new data collection has occurred. However, additional coastal and sediment transport modelling has been undertaken as part of an iterative process of jetty design and impact assessment, which has included developing new base case models (refer to Appendix D).

2.13 Cultural Heritage

A Cultural Heritage Assessment was undertaken in 2008 comprising desktop review, site walk over and interviews (refer to Section 5.13 and Appendix M of the PER). An update review of archival information has been undertaken, confirming no new heritage values have been recorded near the site (refer to Appendix E).

The baseline information presented in the PER is considered suitable to describe the heritage values at and near the site given that no significant changes have occurred to the nearby environment which are likely to have altered the heritage values in a significant way and there have been no new archival recordings of heritage values.

2.14 Visual Amenity

A visual impact assessment was undertaken for the Evaluated Project (refer Section 6.14 of the PER), and is considered suitable to describe the baseline conditions for the site given that no significant development, earthworks or land use changes have occurred which are likely to have altered the visual environment or amenity of the area in a significant way.

A visit of the site and of nearby viewing points was undertaken on 30 August 2019. Photographs taken on site formed the basis for photomontages, which were used to illustrate and assess the potential visual impact of the Proposed Amendment from selected viewpoints.

2.15 Socio-Economic Environment

The PER for the Evaluated Project describes the baseline socio-economic environment for the project area based on a baseline investigation completed in 2008 and review of data sources in 2011 (refer to Section 5.15 and Appendix N of the PER). Due to the elapsed time since the Evaluated Project, it is expected that changes to the baseline socio-economic environment have occurred which may affect the assessment of impacts for the Proposed Amendment. A revised Socio-Economic Impact assessment has been undertaken and is included as Appendix F). The revised baseline socio-economic profile for the project area is presented below.

The study area for the revised assessment comprised those communities that have potential to experience changes due to the construction and operation of the proposal (refer to Figure 2-10). This included:

Primary study area comprising the Australian Bureau of Statistics (ABS) defined Tumby Bay (DC) LGA (LGA47910).

Secondary study area comprising regional communities; the Eyre Peninsula and South West Statistical Area Level 3 (SA3)[2].

2.15.1 Regional social context

The Tumby Bay Local Government Area (LGA) is situated on the Spencer Gulf on the eastern coast of Eyre Peninsula. The LGA covers an area of about 2,670 km^2 and had an estimated resident population of about 2,688 people in 2017.

The proposal is located at Lipson Cove, about 20 km north of the town of Tumby Bay. The town of Tumby Bay is the largest town in the LGA and major population and service centre for the surrounding district. The town is a popular retirement location due to its relaxed lifestyle, safe community environment and coastal amenity. Other towns within the Tumby Bay LGA and near the proposal include:

Port Neill, located about 20 km north of the proposal, which is a small coastal town surrounded by mainly agricultural land, and which is a popular tourist destination.

Ungarra, located west of the proposal, which is a small agricultural community surrounded by cropping and grazing uses

Lipson, located south-west of the proposal, which is a small historic farming town based on mixed cropping and sheep farming (District Council of Tumby Bay, undated).

The Tumby Bay LGA's economy is based on agricultural industries such as mixed cropping, sheep and beef grazing. Tourism is also an important industry for the LGA with many visitors attracted to the area for recreational opportunities associated with the coastal location (District Council of Tumby Bay, undated).

The Eyre Peninsula extends from the Spencer Gulf in the east to the Great Australian Bight in the west, and to the Gawler Ranges in the north. Major population centres for the Eyre Peninsula include Whyalla, Port Lincoln and Ceduna. Port Lincoln is located about 45 km south of the town of Tumby Bay and is the major service centre for the Lower Eyre Peninsula communities.

Agriculture (particularly sheep and grain), aquaculture and tourism are key industries for the regional economy. In 2018/2019, the Eyre Peninsula region produced about 2.18 million tonnes of grain from a crop area of about 1.24 million hectares. This represented about 39% of the State's grain production with the main crops being wheat, barley, and canola (PIRSA, 2019). The Eyre Peninsula is a major contributor to the State's aquaculture activity, with activity in tuna, marine finfish, oysters, mussels, abalone and 'other aquaculture' concentrated in the Eyre Peninsula region. In 2017/2018, the Eyre Peninsula contributed about 90% of the State's total aquaculture production, including 100% of the State's southern bluefin tuna, marine finfish and mussels production (BDO EconSearch, 2019).

[2] Socio-economic data for the Evaluated Project was based on the 2006 Census of Population and Housing. Changes have been made to the geographies used by the ABS since the 2006 Census. The primary and secondary study areas represent the closest ABS geographies to the Tumby Bay Statistical Local Area (SLA) and Eyre Statistical Division (SD) used for the Evaluated Project.

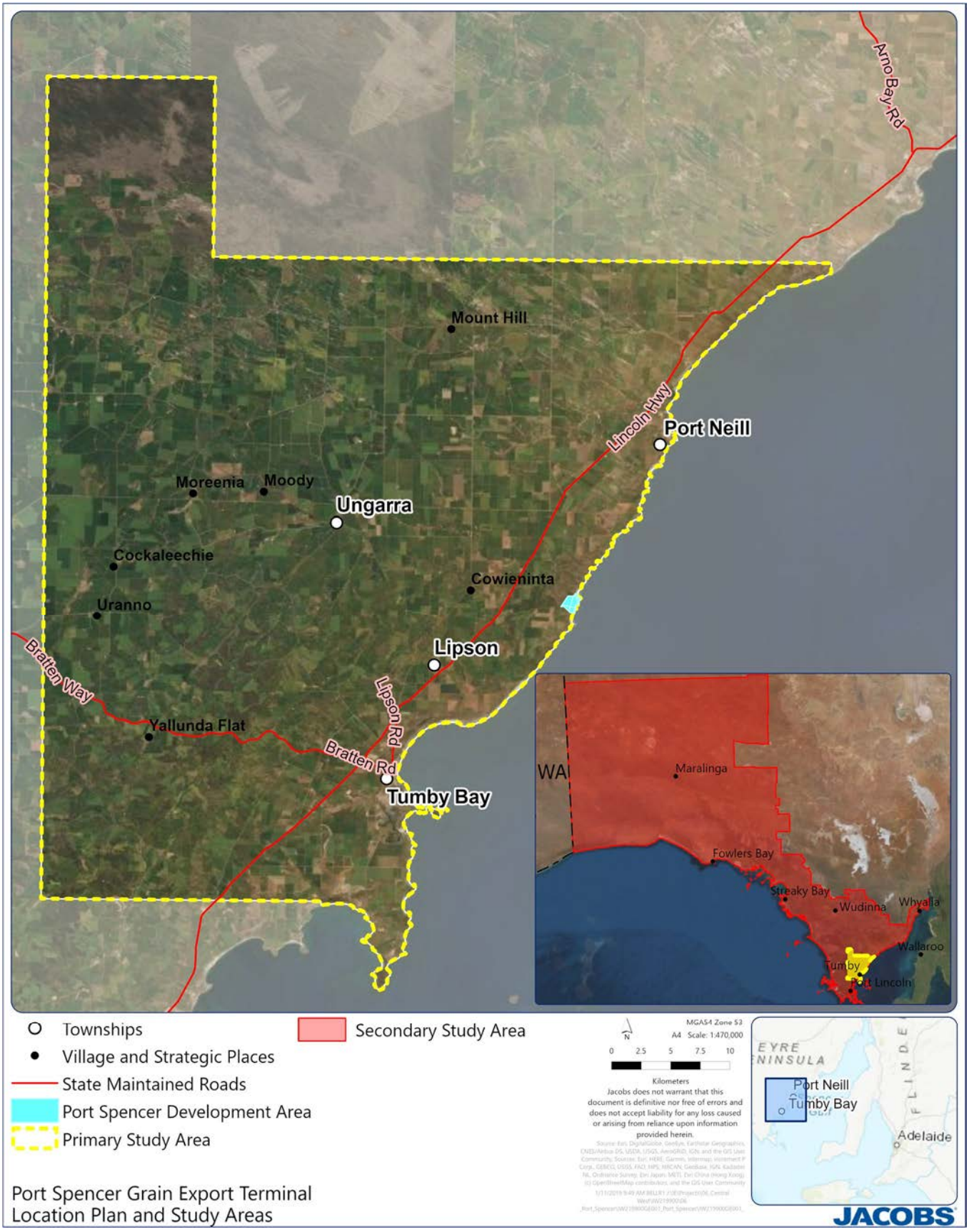


Figure 2-10 Socio-economic study area

Between December 2016 and December 2018, the Eyre Peninsula attracted about 423,000 visitors annually, of which about 95% were domestic visitors and about 70% were 'leisure visitors' (i.e. on holiday or visiting friends and relatives). In 2016/2017, the tourism industry contributed about $227 million to the regional economy of the Eyre Peninsula (Tourism SA, 2017).

The Eyre Peninsula currently has four ports, located at Thevenard, Port Lincoln, Whyalla and Port Bonython. The road network across the Eyre Peninsula includes a National Highway, state roads and local roads. Major regional airports are located at Port Lincoln, Ceduna and Whyalla.

2.15.2 Community profile

2.15.2.1 Population and demography

In 2018 the primary study area had an estimated resident population of 2,688 people (Table 2-6). Over the 10 years to 2018, the primary study area experienced population growth below the South Australian average, with an average annual population growth of 0.29% compared to 0.89%. More recently, population growth in the primary study area between 2013 and 2018 grew at a higher rate than the 10-year average. This is compared to a slowing in the growth rate for South Australia as a whole. At a regional level, the population growth of the secondary study area was about half that of the primary study area, with the secondary study area experiencing a decline in population between 2013 and 2018. Population projections are only available for the secondary study area. The population of the secondary study area is projected to remain relatively stable with no population growth projected over the 25 years to 2041.

The primary study area generally has an older population. Compared to South Australia, the primary study area recorded a higher median age, lower proportions of children and working aged people, and higher proportions of older people aged 65 years or over at the 2016 Census. This is likely to reflect the popularity of Tumby Bay as a retirement location and the trend for younger people to move away from rural and regional areas for education or work. At a regional level, the age profile of the secondary study area was similar to South Australia as a whole.

The primary and secondary study areas generally displayed relatively low levels of cultural diversity compared to South Australia, with levels of overseas born people and non-English speaking people well below the South Australian average at the 2016 Census. The primary study area had proportions of people who reported as Aboriginal and/or Torres Strait Islander similar to South Australia. At a regional level, the secondary study area had relatively high proportions of Aboriginal and/or Torres Strait Islander communities, which reflects the presence of Aboriginal communities across the Eyre Peninsula.

Communities in the primary study area generally display lower levels of population mobility, with higher proportions of people who lived at the same address both 12 months and five years prior to the 2016 Census. This is likely to reflect the older population profile and predominantly rural nature of the primary study area.

Table 2-6: Key population and demographic characteristics

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Population and growth			
Estimated resident population (2018)*	2,688	57,823	1,736,422
Average annual change in ERP (2008-2018)*	0.29%	0.14%	0.89%
Average annual change in ERP (2013-2018)*	0.36%	-0.12%	0.77%
Population projection (2041)**	-	58,448	2,046,747
Average annual change in projected population (2016-2041)**	-	0.00%	0.71%
Age profile* **			
Median age (years)	50	42	40

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
0-14 years	16.6%	19.4%	17.5%
15-64 years	56.4%	62.4%	64.2%
65+ years	27.0%	18.2%	18.3%
Cultural diversity* **			
Aboriginal and/ or Torres Strait Islander people	2.0%	5.6%	2.0%
Overseas born	5.1%	11.2%	22.9%
Speaks language other than English at home	1.3%	4.7%	16.5%
Population mobility* **			
Same address one year previously	83.2%	78.5%	79.2%
Same address five years previously	63.9%	59.6%	57.6%

*Sources: Based on *ABS ERP by LGA (ASGS 2017), 2001 to 2017 dataset and ERP by SA2 and above (ASGS 2016), 2001 onwards. ** Department of Planning, Transport and Infrastructure (2019) Population Projections for South Australia and Regions, 2016-41. ***2016 Census Quickstats and General Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).*

2.15.2.2 Families and housing

There were 705 families in the primary study area at the 2016 Census, of which nearly 56% comprised couple families without children (Table 2-7). Consistent with many rural and regional areas across Australia, this reflects the trend for young people moving out of rural areas to urban locations for education and employment opportunities.

At the 2016 Census, there were 1,452 dwellings in the primary study area of which 74.2% were occupied. The level of occupancy in the primary study area was below the average for South Australia, which is likely due to the presence of holiday houses and visitor accommodation in coastal towns such as Port Neill.

Nearly 90% of houses in the primary study area were separate houses, which was well above the proportion of this dwelling type in South Australia as a whole and is likely to reflect the predominantly rural nature of the primary study area. At a regional level, the proportion of higher density dwellings such as semi-detached houses, townhouses, flats and apartments in the secondary study area is similar to the South Australian average, which is likely to reflect the greater mix of housing types in major regional centres such as Port Lincoln, Whyalla and Ceduna.

Compared to South Australia, the primary study area had higher proportions of houses that were owned outright and lower proportions of houses that were owned with a mortgage or being rented. This is typical of many rural locations and is likely to reflect the primary study area's older population, lower levels of population mobility, lower housing costs and more affordable housing options (refer to Table 2-7).

Table 2-7: Family and housing characteristics, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Families			
Couple family with no children	55.9%	44.6%	40.2%
Couple family with children	33.9%	37.9%	41.6%
Total families	705	14,545	443,733
Housing			
Total private dwellings	1,452	27,703	731,036
Occupancy rate	74.2%	78.8%	87.4%

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Dwelling type			
Separate houses	89.0%	75.0%	77.8%
Semi-detached, townhouse, flat, apartment, etc	8.2%	23.1%	21.4%
Other dwelling type	1.8%	1.3%	0.5%
Housing tenure			
Owned outright	49.7%	32.4%	32.2%
Owned with a mortgage	23.7%	31.0%	35.3%
Rented	23.3%	32.9%	28.5%
Housing costs			
Median monthly mortgage repayments ($)	1,170	1,257	1,491
Median weekly rental costs ($)	170	180	260
Households paying more than 30% of their income on rent costs	6.4%	9.1%	10.2%
Households paying more than 30% of their income on mortgage costs	4.1%	4.5%	6.6%

Sources: Based on 2016 Census Quickstats data and General Community Profiles for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE)

At the 2016 Census, there were 251 dwellings in the primary study area that were being rented (Table 2-8). Compared to South Australia, the primary study area had lower proportions of dwellings that were being rented from real estate agents and State housing authorities, and higher proportions of dwellings that were being rented from a family member or other person; housing co-operative, community or church group; or 'other landlord type' such as caravan park, marina or employer.

About half of rental dwellings in the primary study area were being rented from a parent, relative or other person, almost double the average for South Australia. A further 9.6% of rental dwellings were being rented from a landlord such as a caravan park, marina or employer.

Table 2-8: Rental dwellings, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Real estate agent	21.5	30.7	45.5
State or territory housing authority	3.6	32.5	18.4
Person not in same household	51.0	24.4	26.2
Housing co-operative/community/church group	6.4	2.8	3.7
Other landlord type (including caravan parks, marinas, and employers)	9.6	6.5	4.2
Landlord type not stated	7.6	3.2	1.9
Total	251	7,174	182,180

2.15.2.3 Tourist accommodation

The primary and secondary study areas include a range of accommodation options including holiday houses, caravan parks, hotels, motels and serviced apartments. In 2016, the Eyre Peninsula region had 26 accommodation establishments with 15 or more rooms offering a total of 987 rooms. Average occupancy

rates for the 12 months to June 2016 ranged from a low of 47% in the winter months to a peak of 53% in October (Tourism SA, 2017).

There are 12 accommodation businesses, including caravan parks, holiday flats, motels, hotels and serviced apartments (Tumby Bay District Business Directory, 2019a). A search of accommodation websites such as Stayz (https://www.stayz.com.au/) and AirBNB (https://www.airbnb.com.au/) also identified additional holiday houses and apartments available for short-term rent in Port Neill and Tumby Bay. A range of visitor accommodation options are also available in Port Lincoln, which is about a 50-minute drive from the project site at Lipson Cove.

2.15.2.4 Education and employment

At the 2016 Census, residents in the primary and secondary study areas generally had lower levels of non-school qualifications, with 47.8% of people aged 15 years and over in the primary study area and 51.8% in the secondary study area reporting to have a qualification compared to 56.3% in South Australia (Table 2-9). Compared to South Australia, the primary study area had lower proportions of people with diploma, bachelor and post-graduate level qualifications and proportions of certificate level qualifications similar to the South Australia average.

Table 2-9: Education, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Bachelor Degree level and above	8.9%	9.1%	18.5%
Advanced Diploma and Diploma level	6.4%	6.1%	8.3%
Certificate Level III and IV	16.6%	20.2%	16.7%
Certificate Level (total)	20.5%	23.9%	20.1%
Proportion of people aged 15 years and over with non-school qualification	47.8%	51.8%	56.3%

Source: Based on General Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

2.15.2.5 Employment and income

At the 2016 Census, communities in the primary and secondary study area generally had lower personal and household incomes compared to South Australia as a whole. The primary and secondary study areas also had higher proportions of households on lower incomes and lower proportions of households on higher incomes. This is likely to reflect the older population of the study area and lower proportion of working aged people.

The primary study area recorded a lower level of workforce participation at the 2016 Census, with about 52% of people aged 15 years or over in the primary study area working or looking for work, compared to 58.3% in South Australia. Again, this reflects the older population of the primary study area, with about 27% of the population aged 65 years or over.

At the 2016 Census, the primary study area generally had a relatively low rate of unemployment (at 3.8%) compared to South Australia (at 7.5%).

Table 2-10: Employment and Income, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Income			
Median weekly personal income ($)	570	576	600
Median weekly household income ($)	966	1,073	1,206
Households with income <$650 per week	27.4%	25.5%	21.6%

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Households with income >$2,500 per week	9.1%	12.4%	15.3%
Employment			
Total labour force	1,127	25,854	806,589
Participation rate (%)	51.9	56.7	58.3
Unemployment (%)	3.8	7.7	7.5

Source: 2016 Census Quickstats and Community Profile data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

Agriculture, forestry and fishing were key industries of employment for the primary study area, employing about 28% of residents aged 15 years or over at the 2016 Census. In particular, 'other grain growing' and 'grain – sheep or grain – beef cattle farming' were the top two industries of employment in the primary study area (refer to Table 2-11). Other key industries of employment in the primary study area included supermarket and grocery stores, primary and secondary education, and hospitals (except psychiatric hospitals).

Table 2-11: Industry of employment, 2016

Characteristic	Tumby Bay LGA	Eyre Peninsula and South West SA3	South Australia
Employment Industries			
Main industries of employment (top 5)	Other grain growing (13.4%) Grain-sheep or grain-beef cattle farming (7.4%) Supermarket and grocery stores (4.1%) Combined primary and secondary education (3.7%) Hospitals (except psychiatric hospitals) (3.6%)	Iron smelting and steel manufacturing (4.3%) Other grain growing (3.7%) Hospitals (except psychiatric hospitals) (3.5%) Supermarket and grocery stores (3.5%) Grain-sheep or grain-beef cattle farming (2.9%)	Hospitals (except psychiatric hospitals) (4.1%) Aged care residential services (3.0%) Supermarket and grocery stores (2.9%) Primary education (2.2%) Cafes and restaurants (2.1%)

Source: 2016 Census Quickstats data for Tumby Bay LGA (LGA47910), Eyre Peninsula and South West SA3 (40601) and South Australia (4STE).

2.15.3 Economic profile

2.15.3.1 Business and industry

In June 2018, there were 325 businesses in the primary study area, of which about half comprised agriculture, forestry or fishing businesses. Construction related businesses were the next largest group of businesses in the primary study area, comprising about 10% of total businesses, followed by rental, hiring and real estate services (9.8%) and retail trade and professional, scientific and technical services, both at 4.3% (ABS,2019).

Retail, services, accommodation and eatery businesses are mainly concentrated in Tumby Bay. These generally serve the day-to-day needs of residents within Tumby Bay and surrounding areas and include such things as a supermarket, food and grocery outlets (e.g. butcher, bakery, takeaway shops and cafes), pharmacy, post office, hardware and farming and garden supplies, services businesses (e.g. hairdresser, banks, post office, real estate, and car repairs), and tourist accommodation businesses. Businesses in Port Neill generally include a service station, post office and tourist accommodation businesses.

2.15.3.2 Agriculture

Agriculture (particularly sheep and grain) is a key industry for the regional economy. In 2018/2019, the Eyre Peninsula region produced about 2.18 million tonnes of grain from a crop area of about 1.24 million hectares (Table 2-12). This represented about 39% of the State's grain production with the main crops being wheat

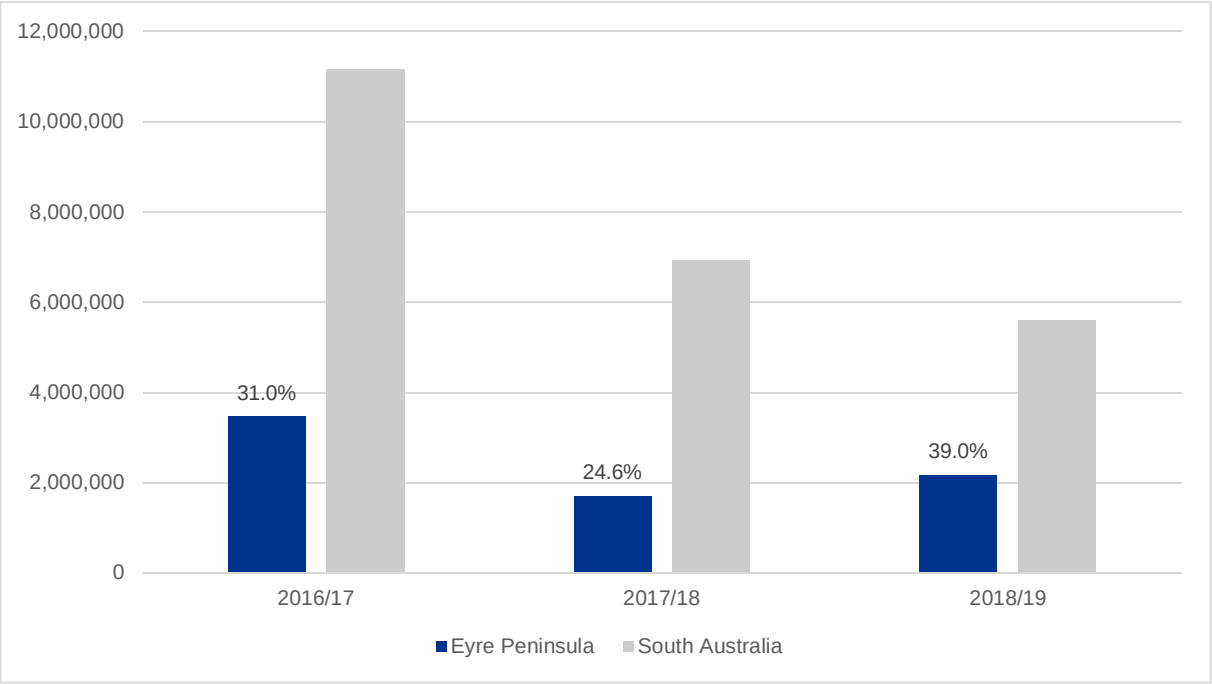
(1.45 million tonnes), barley (468,000 tonnes), and canola (126,620 tonnes). In relation to the total South Australia production, the Eyre Peninsula produces 58% of the State's lupin, about 49% of the State's wheat and 45.4% of South Australia's canola (PIRSA, 2019).

Table 2-12: Crop production, 2018/2019

Commodity	Measure	Eyre Peninsula	South Australia	Proportion of South Australian production
Wheat	Hectares	879,000	1,943,200	45.2
	Tonnes	1,469,000	2,993,700	49.1
Barley	Hectares	191,000	807,800	23.6
	Tonnes	468,000	1,687,300	27.7
Oats	Hectares	22,000	74,700	29.5
	Tonnes	23,500	118,500	19.8
Triticale	Hectares	1,400	29,400	4.8
	Tonnes	2,320	32,970	7.0
Peas	Hectares	9,900	65,700	15.1
	Tonnes	9,650	53,120	18.2
Lupins	Hectares	29,000	61,000	47.5
	Tonnes	34,750	59,950	58.0
Beans	Hectares	5,900	63,100	9.4
	Tonnes	10,200	79,680	12.8
Chickpeas	Hectares	600	33,600	1.8
	Tonnes	670	23,870	2.8
Lentils	Hectares	6,100	149,800	4.1
	Tonnes	7,550	177,870	4.2
Vetch	Hectares	6,400	28,400	22.5
	Tonnes	1,450	5,760	25.2
Canola	Hectares	83,600	200,100	41.8
	Tonnes	126,620	278,900	45.4
Hay (not in total)	Hectares	39,000	436,000	8.9
	Tonnes	111,000	1,297,000	8.6
TOTAL (excluding hay)	Hectares	1,239,800	3,503,300	35.4
	Tonnes	2,176,140	5,583,690	39.0

Source: Based on PIRSA, 2019

Figure 2-11 shows total grain production for the Eyre Peninsula between 2016/2017 and 2018/2019. Total grain production over the three years ranged from 1.70 million tonnes in 2017/2018 to about 3.46 million tonnes in 2016/2017 (PIRSA, 2017, 2018, 2019).



Source: PIRSA, 2017, 2018, 2019

Figure 2-11: Grain production, 2016/17 to 2018/19

2.15.3.3 Fishing and aquaculture

The Eyre Peninsula is a major contributor to the State's aquaculture sector, with activity in tuna, marine finfish, oysters, mussels, abalone and 'other aquaculture' concentrated in the Eyre Peninsula region. In 2017/2018, the Eyre Peninsula contributed about 90% of the State's total aquaculture production, including 100% of the State's Southern Bluefin Tuna, marine finfish and mussels production. The value of aquaculture value from the Eyre Peninsula in 2017/2018 was $184.36 million, of which $126 million was from Southern Bluefin Tuna and $29.87 million from marine finfish (BDO EconSearch, 2019).

In 2017/2018, the aquaculture industry directly and indirectly generated about 1,157 full-time equivalent (FTE) jobs in the Eyre Peninsula, contributing about $78.9 million to household income (BDO EconSearch, 2019).

Tumby Bay and the surrounding district well known by locals and visitors for its recreational fishing opportunities, with key fishing locations including:

Sir Joseph Banks Group of Islands

Inshore boating at Tumby Bay and Port Neill.

Second Creek tidal estuary south of Tumby Bay

Ski Beach and Back Beach located at the southern end of Tumby Bay

Beach and rock fishing from variety of locations along the coastline

Tumby Bay Marina

Lipson Cove located approximately 15 kilometres north of Tumby Bay

Port Neill beaches

Jetties at Port Neill and Tumby Bay (https://www.tumbybay.sa.gov.au/page.aspx?u=319).

2.15.3.4 Tourism

Tourism is a key contributor to the local and regional economy with tourists attracted to the region by several unique and diverse nature-based visitor experiences related to coastal recreation, adventure tourism, ecotourism and the area's scenic landscapes (DPTI, 2012).

Between December 2016 and December 2018, the Eyre Peninsula attracted about 423,000 visitors annually who stayed for a total of about 1.82 million nights. About 95% of visitors were domestic visitors, of which about 74% were from South Australia and 26% from interstate. The average length of stay for all visitors was four nights, with international visitors staying for an average of seven days. Accommodation options such as 'Hotel/resort/motel or motor inn' and 'caravan park or commercial camping ground' were used by about 39% of domestic visitors and 40% of international visitors (Tourism SA, 2017).

About 70% of visitors to the Eyre Peninsula visit for holiday or to see family and relatives. Business travellers comprise about 25% of total visitors. The most popular activities undertaken by visitors included eating out or visiting friends or relatives, although going to the beach, sightseeing and fishing were also key activities undertaken by visitors (Tourism SA, 2017).

Within the primary study area, visitors are attracted to natural and recreational features associated with the local environment including Rogers Beach, Lipson Cove and the Lipson Island Conservation Park. Rogers Beach is located approximately 1,500-2000 m north of Lipson Cove and is popular for swimming, beach and rock fishing, boating and occasionally surfing (Beachsafe, 2019). Lipson Cove is an isolated sandy beach which is valued for fishing and swimming activities, and its topographic and natural features, tranquillity and picturesque views (Eye on Eyre Tumby Bay, 2018; Caravan on Tour, 2019; Beachsafe, 2019). The Lipson Cove campground is located on the foreshore, with visitors undertaking recreational activities such as swimming, dolphin watching, nature trails, boating and fishing (Without a Hitch, 2017, Beachsafe, 2019). The Lipson Island Conservation Park contains Lipson Island and its surrounding waters. Lipson island is located approximately 170 m from the mainland, can be walked to a low tide and is known for its wildlife and topographic features (Eye on Eyre Tumby Bay, 2018).

2.15.4 Social infrastructure

The primary study area has a range of social infrastructure that caters for the needs of local communities, including education facilities; health, medical and emergency services; sport, recreation and leisure facilities; and community facilities (refer to Table 2-13). Communities in the study area also access higher order community services and facilities in regional centres such as Port Lincoln and Whyalla.

Table 2-13: Social infrastructure in the primary study area

Facility	Tumby Bay	Port Neill	Ungarra
Hospital			
Community health centre			
General practice			
Police			
Ambulance			
Fire and rescue			
Country Fire Service (CFS)			
Kindergarten			
Primary school			
Area school			
Tertiary education			

2.15.4.1 Health, medical and emergency services

A range of health and medical services are located at Tumby Bay, including a hospital with 24-hour emergency department, a community health centre and a general practice. The Tumby Bay hospital offers a range of allied health services, primary health care services, residential aged care, and outpatient services. Port Lincoln Hospital is a larger hospital offering 50 beds with obstetrics, renal dialysis, operating facilities and 24-hour accident and emergency department.

There are no medical facilities available in the smaller townships of Port Neill and Ungarra.

Emergency services in the primary study area include ambulance stations at Tumby Bay and Port Neill and fire and police services at Tumby Bay. Country Fire Service (CFS) brigades are located at Lipson, Port Neill, Tumby Bay and Ungarra, providing volunteer fire and rescue services.

2.15.4.2 Recreation and community facilities

There are a number of recreation and community facilities and organisations provided in the primary study area, with these mainly focused on Tumby Bay and Port Neill including netball, football, cricket, bowling, tennis basketball, croquet, darts and yachting.

Lipson Cove Campground is located on Lipson Cove Road at Lipson Cove south of the project area. The campground has several camp sites and offers basic facilities and beach access. Lipson Cove is also a popular location for swimming and rock and beach fishing, which is used by local and travellers during the summer months. The beach is one of only a few publicly accessible beaches between Port Neill and Tumby Bay and offers access for boat launching (https://beachsafe.org.au/beach/sa/tumby-bay/lipson/lipson-cove).

2.15.4.3 Education

Primary schools in the primary study area are located at Ungarra, Port Neill and Tumby Bay (Tumby Bay Area School). The Tumby Bay Area School also offers secondary education to Year 12. A kindergarten is also located at Tumby Bay.

2.15.5 Community values

Community values are those things held as important to communities for quality of life and wellbeing. They include physical elements that contribute to such things as amenity and character, and intangible qualities such as sense of place and community cohesion.

2.15.5.1 Amenity and lifestyle

The amenity and lifestyle values of the primary study area reflect the area's rural and coastal landscapes and towns and localities that support the area's traditional agricultural and rural pursuits and tourism activities.

The town of Tumby Bay is the largest town in the LGA and major population and service centre for the surrounding district. The town is a popular retirement and holiday location and is valued for its relaxed lifestyle, safe community environment and coastal location. Port Neill is also a popular tourist destination and is valued by residents and visitors for its access to coastal environments (District Council of Tumby Bay, undated).

Communities in the primary study area value the quality of the coastal and marine environment and natural landscapes, with these offering a range of landscape, ecological, scenic amenity, recreational and cultural values. The study area's coastal and marine environment are also important to the region's economy with many visitors attracted to the region's beaches, rocky shores, sheltered bays and offshore islands as well as recreational opportunities such as fishing, diving, and bird watching (Department of Environment and Natural Resources, 2010).

Consultation undertaken for the Evaluated Project identified the 'quietness of the area' and 'small-town lifestyle' as being important to local communities, with the area's rural character, overall geographic beauty, Lipson

Island Conservation Park and unspoilt beaches (including Roger's Beach) identified as key features (Golder Associates, 2009). Preservation of the primary study area's unique natural heritage and environment for current and future generations and ensuring growth does not compromise the lifestyle and amenity that residents enjoy and value are important to local communities (District Council of Tumby Bay, undated).

2.15.5.2 Community cohesion and sense of community

Communities in the primary study area value a community where residents are safe and an inclusive community, with 'a safe and welcoming community', 'well-staffed medical centre and hospital', emergency services and high standard of community facilities identified as key advantages (District Council of Tumby Bay, undated).

The primary study area demonstrates a strong sense of community, with a high standard of community services and facilities, high volunteer participation and 'a community that works well together' identified as key strengths for communities in the study area (District Council of Tumby Bay, undated). The primary study area also has a broad range of community clubs and organisations such as sporting clubs, environmental groups, cultural organisations, and residents associations, that also foster community interaction and provide the sense that community is an important aspect of the primary study area.

Previous consultation undertaken for the Evaluated project identified that local communities value the community spirit of the area and the 'interaction and kinship that comes with living in a small community' (Golder Associates, 2009).

Industries such as agriculture and aquaculture are important to local communities and contribute to the identity of local communities. Many people across the primary study area are employed in agricultural and aquaculture industries and similar to many rural areas across Australia, it is likely that many farming families have farmed the area over many generations. Sustaining and enhancing success of the Tumby Bay LGA's existing industries is important to communities in the primary study area (District Council of Tumby Bay, undated).

2.15.5.3 Community health and safety

Local residents in the primary study area value the safe and welcoming community environment, relaxed lifestyle and affordable property. Having a safe and crime free community was identified as 'extremely important' by community members during consultation for the District Council of Tumby Bay Strategic Plan (District Council of Tumby Bay, 2019b). These characteristics are further supported by previous community consultation undertaken for the Evaluated Project, with community members indicating they valued the low levels of crime and high levels of safety; and clean, relaxed and stress-free environment (Golder and Associates, 2009).

2.15.5.4 Access and connectivity

The primary and secondary study areas are serviced by a range of transport infrastructure, including roads, ports and airports.

Key roads servicing the primary and secondary study areas include:

- Eyre Highway, which forms part of the National Highway and connects from Norseman in Western Australia to Port Augusta at the top of Spencer Gulf
- Lincoln Highway, which connects Whyalla and Port Lincoln along the east coast of Eyre Peninsula
- Flinders Highway, which connects Ceduna and Port Lincoln along the west coast of Eyre Peninsula
- Tod Highway, which connects the Eyre and Flinders Highways
- Birdseye Highway, which connects Elliston on the west coast of Eyre Peninsula to Cowell on the east coast of Eyre Peninsula (SMEC, 2019).

The primary study area also includes a number of local roads that provide connections to major highways, local centres and rural areas. These include Lipson Cove Road, which is an unsealed road connecting Lincoln Highway to Lipson Cove.

There are four ports located across the Eyre Peninsula including:

Thevenard, located approximately three kilometres from Ceduna on the west coast of Eyre Peninsula, which mainly provides for gypsum, grains and seeds, salt and mineral sands (https://www.flindersports.com.au/ports-facilities/thevenard/)

Port Lincoln, located on the south-east coast of Eyre Peninsula, which generally provides for grains and seeds, petroleum products and fertilisers (https://www.flindersports.com.au/ports-facilities/port-lincoln/)

Whyalla, which caters for iron ore products from SIMEC's mining operations

Port Bonython, located near Whyalla on the east cost of Eyre Peninsula, which is used for the export of naphtha, crude oil, propane and butane (https://www.santos.com/what-we-do/activities/south-australia/port-bonython/port-bonython-processing-facility/).

The primary and secondary study areas are serviced by three regional airports at Port Lincoln, Whyalla and Ceduna. The airports cater for daily air services to and from Adelaide by Regional Express and Qantaslink (http://www.eyrepeninsula.com/getting-here). The District Council of Tumby Bay also owns and maintains the Tumby Bay Aerodrome.

3. Impact Assessment

This section provides an assessment of the potential effects of the Proposed Amendment on the existing environment and surrounds, and a comparison with the potential effects identified for the Evaluated Project in the PER.

Key inputs and assumptions for both the Evaluated Project and Proposed Amendment are identified and contrasted to demonstrate key similarities and points of difference between the proposals. For clarity, the Evaluated Project impacts have been taken direct from the original PER document and represent the level of effect that has been approved to date.

The following definitions were adopted for the comparison for effects:

No change – The effect described in the PER was qualitative in nature and the Proposed Amendment will not significantly alter the nature and scale of the effect.

Similar level of effect – The effect has been described in quantitative terms in the PER. Some differences in effect have been identified, but the overall risk profile remains the same.

Reduced effect – The effect has been described in quantitative terms in the PER and the effect (impact or benefit) of the Proposed Amendment is expected to be less (for example in terms of intensity or temporal or geographic scale).

Increased effect – The effect has been described in quantitative terms in the PER and the effect (impact or benefit) of the Proposed Amendment is expected to be greater in terms of intensity or temporal or geographic scale.

No longer applicable / No impact – the effect will not occur for the Proposed Amendment.

Altered effect – the nature of the effect has changed (for example due to differences in timing, intensity, location, which make it difficult to directly compare effects).

Increased / reduced potential for effect – The issue is not expected to occur as part of standard project activities, but there is a risk of it occurring in some circumstances. Changes as a result of the Proposed Amendment increase or decrease the likelihood of the risk eventuating.

3.1 Climate Change and Greenhouse Gas Emissions

3.1.1 Climate Change

Table 3-1 compares the minimum site and floor levels recommended by the Coast Protection Board for the Evaluated Project (refer to Section 5.12.3 of the Response to Submissions) with the concept design for the Proposed Amendment. The existing site levels are generally high, with the existing minimum site level approximately 10 metres AHD. The minimum developed site level for the Proposed Amendment will be 7 metres AHD associated with grain bunkers and truck marshalling yards. The jetty will have a minimum floor level of 8.5 metres AHD. The approach causeway crest level is proposed to be greater than or equal to 5m AHD. All levels comply with the recommended site levels nominated by the Coast Protection Board for the Evaluated Project.

Table 3-1 Minimum site and floor levels compared to recommendations of the Coast Protection Board

Level	Coast Protection Board Recommendations	Proposed Amendment Concept Design
Development on Land (to the year 2050)		
Site levels (metres AHD)	2.95	7
Floor levels (metres AHD)	3.2	8.5
Development over water (to the year 2100)		
Site levels (metres AHD)	3.65	5.0

Level	Coast Protection Board Recommendations	Proposed Amendment Concept Design
Floor levels (metres AHD)	3.9	8.5

3.1.1.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and subsequently both require similar types of infrastructure. Design of the Proposed Amendment accords with the Evaluated Project as follows to reduce the effect of climate change:

Any revegetation or rehabilitation works proposed as part of the development will be monitored for planting success and maintenance.

Site location and design complies with the 100-year ARI risk from both a jetty and surface water design perspective (refer to Section 3.3) and recommended site levels nominated by the Coast Protection Board for the Evaluated Project in response to the PER (refer to Table 3-1 and Section 5.12.3 of the Response to Submissions).

The project is designed for zero surface water discharge off site with a 100-year ARI storm (refer to Section 3.3).

The jetty and conveyors are located on a raised portion of the coast that is not likely to be inundated associated with sea level rise or storm surge from climate change contributions.

However, a review of the sediment transport modelling regarding the Proposed Amendment indicates slightly differing effects on beaches in the local area due to the project's presence. Refer to Section 2.12 and Appendix D.

3.1.1.2 Amended Impact Assessment Summary for Climate Change

Potential impacts of climate change on the amended project (relating to temperature, rainfall, sea level and ocean wave changes) are expected to be the mostly the same as for the Evaluated Project. Table 3-2 identifies the impacts identified and highlights differences in impact due to the Proposed Amendment.

Table 3-2 Summary of potential impacts of climate change on the Evaluated Project (PER Section 6.1) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Temperature increases could stress or change the ecology at the Port site.	No change.
Variability of rainfall may cause flooding, vegetative stress or reduction in captured rainwater volumes for on-site use should rainfall decrease.	No change. Water demand for the Proposed Amendment is expected to be less than Evaluated Project.
Potential inundation during severe storm events through the combined effects of sea level rise, storm surge and ocean waves.	No change.
Potential seabed disturbance, coastal erosion, recession and vulnerability brought about by variations in offshore wave climate such as large wave events or changes in wave events. *Sediment transport modelling undertaken for the Evaluated Project predicted minimal effects on beaches in the local area due to the project's presence.*	Similar level of effect. Sediment transport modelling indicated increased effect immediately south of the wharf, with no significant change at Rogers Beach, Lipson Cove and Lipson Island, where minimal effects on beaches are predicted.
During construction and operational phases, working conditions may become increasingly hostile due to temperature increases.	No change.

3.1.1.3 Mitigation and management carried forward by the amended project

Key mitigations identified in Section 6.1 of the PER carried forward by the Proposed Amendment:

Any revegetation or rehabilitation works proposed as part of the development will be monitored for planting success and maintenance.

Should rainfall decrease, operational water demands will be met through other sources.

Key mitigations identified in Section 6.1 of the PER not carried forward by the Proposed Amendment:

Nil.

3.1.2 Greenhouse Gases

Greenhouse gas (GHG) emission estimates for the Proposed Amendment were calculated in accordance with the *National Greenhouse and Energy Reporting Act 2007* and Guidelines to provide a direct comparison with the Evaluated Project (refer to Appendix G).

3.1.2.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels construction plant and machinery over an 18-month period. During operations, key differences relate to the size of diesel generator (5 MW for the Evaluated Project compared to 2x1.5 MW) and vessel type.

3.1.2.2 Amended Impact Assessment Summary for Greenhouse Gas Emissions

The Evaluated Project and Proposed Amendment both result in an increase in GHG emissions to the environment. However, the Proposed Amendment reduces the level of expected emissions compared to the Evaluated Project (refer to Table 3-3 and Appendix G for detailed calculations). The removal of iron ore from the scope of the project also means that associated GHG emissions from mining and subsequent sale and processing of the ore will not eventuate, although this is not reflected in the calculations for the Port Spencer Facility alone.

Table 3-3 Comparison of key GHG calculation outputs for the Evaluated Project and Proposed Amendment

Aspect	Evaluated Project	Proposed Amendment
Construction Phase Direct Greenhouse Gas Emissions (kt CO_{2-e})	33.5	24.3
Operational Phase Direct Greenhouse Gas Emissions (kt CO_{2-e})	7.34	7.3
Greenhouse Gas Emissions for transport of exported commodities (shipping from Port Spencer to international markets) (kt CO_{2-e})	Ore: 64 -111 (Cape class/ Panamax) Grain: 28 (Panamax)	Ore: Nil Grain: 28 (Mixture of Handymax and Panamax) Note; grain freight task is the same and negligible change in emissions occurs
Approximate Energy Demand (MW)	5 MW 10 for hours a week 0.5 MW for 158 hours a week	1.5MW for 10 hours per week 0.5MW for 75 hours per week 0.1MW for 83 hours per week BASED ON 10-hour average operational day throughout the year, 250kW operating load (2 weigh bridges, 2 sample stands @ 11kW each, 2 hoppers @ 50kW each, one conveyor loading system (CLS) conveyor @100kW, the reclaim and transfer

Aspect	Evaluated Project	Proposed Amendment
		@100kW each plus general site power at 60KW)
Annual Fuel Consumption (kL)	1,990	1,080 Based on a single 1.5kW taking the duty datasheet is a Kohler KD1500-UF

Table 3-4 identifies the impacts considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Table 3-4 Summary of GHG impacts for the Evaluated Project and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Greenhouse gas emissions during construction	Similar level of effect.
Greenhouse gas emissions during operations	Similar level of effect.

3.1.2.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigations identified in Section 6.1 of the PER carried forward by the Proposed Amendment:

Fuel use during construction works would be tracked to enable the calculation of GHG emissions in accordance with NGERS. GHG and energy consumption would be reported to the relevant authority if required under legislation.

Fuel use during the operational phase would be recorded to allow for annual assessment of GHG emissions and impacts.

Key mitigations identified in Section 6.1 of the PER not carried forward by the Proposed Amendment:

Nil.

3.2 Soils

A qualitative assessment of soil impacts has been undertaken for the Proposed Amendment to enable a comparison with the Evaluated Project (Section 6.2 of the PER).

3.2.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels of soil disturbance, including blasting, removal of vegetation cover and exposure of soils during construction.

3.2.2 Amended Impact Assessment Summary for Soil Impacts

Table 3-5 identifies the potential impacts considered for the Evaluated Project and highlights differences in impact arising from the Proposed Amendment.

Table 3-5 Summary of potential soil impacts for the Evaluated Project (PER Section 6.2) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Potential impacts from blasting (low impact)	No change. The Proposed Amendment will use a smaller but deeper blast area.

Evaluated Project Impact	Proposed Amendment Impact
Soil impacts (wind and water erosion) from removal of vegetation cover and exposure of soils – 48 ha disturbance footprint for Stage 1, 18-month construction duration (moderate impact)	No change. Noting there will be an increased overall disturbance area – Approximately 68 ha disturbance footprint, 18-month construction period (moderate impact).
Impacts to Rogers Beach by project personnel and unauthorised access (insignificant impact)	No change.
Contamination of soils during construction (low impact)	No change.
Operations	
Inadequate rehabilitation and revegetation leading to areas exposed to wind and water erosion (insignificant impact)	No change.
Pollution from spills of fuel and other substances (insignificant impact)	No change.
Inadequate treatment of sewage and waste water generated from project facilities, with untreated water escaping to land (insignificant impact)	No change.
Spill of hematite ores and dust from the storage shed and ship loading, which may result in elevated levels of iron in the surrounding soils (insignificant impact)	No longer applicable / No impact – iron ore excluded from Proposed Amendment
Impacts on Rogers Beach from berthed ships (addressed in Section 6.12 of PER)	Similar level of effect. Addressed in Section 3.12 of this document. The modelling for the Proposed Amendment indicates that Rogers Beach to the north will experience a small increase in post-development erosion of up to 0.005 m/annum (0.25 m over 50 years).
Decommissioning	
Similar potential impacts to construction (no significant impacts)	No change.

3.2.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigations identified in Section 6.2 of the PER carried forward by the Proposed Amendment:

Blasting undertaken by personnel certified to design and execute blasting operations.

Blasting carried out in accordance with all relevant government codes and regulatory requirements.

Private access to Rogers Beach maintained. Noting that this is assumed to be provided by the gazetted public roadway to the west of the subject land.

Soil erosion and sediment drainage will be managed and monitored during the project (especially construction and decommissioning).

Key mitigations identified in Section 6.2 not carried forward by the Proposed Amendment:

Nil

3.3 Surface Water

A review of the Evaluated Project surface water assessment was undertaken to assess the effect of more recent changes in rainfall data and AR&R parameters to surface water at the site (refer to Appendix A). This review has also informed the surface water concept design developed for the Proposed Amendment.

3.3.1 Comparison of Key Inputs and Assumptions

The key principles in the stormwater management of the site remain the same from the Evaluated Project to the Proposed Amendment. These are:

- Zero discharge of the site runoff to the marine environment
- Low velocity design where possible
- Offsite runoff continues to discharge to Rogers Beach, but quantity is not increased by the project
- Tributary flows are diverted around the site towards Rogers Beach
- Similar total impervious area to the Evaluated Project.
- Detained site runoff is to be reused on site.

The conceptual stormwater design to achieve the stormwater management principals is shown in Figure 3-1.

Key features of the Proposed Amendment concept design include:

- Three detention basins for site stormwater runoff of a combined size of 65ML (41, 15 and 9 ML), sized to the 1% AEP event, to contain all site runoff and prevent discharge to the marine environment. The volume of storage is significantly smaller than for the Evaluated Project storage because the Evaluated Project was designed to store water from a much greater catchment area, which included a sub-catchment outside of the project site and site area that was undisturbed.
- A decrease in total catchment discharging to Rogers beach of 7%
- The construction of a 28 ML flow attenuation basin on the major creek upstream of the site to reduce the 1% AEP event storm flow from 31 m^3/s to 10 m^3/s. This will reduce the peak flow that eventually discharges to Roger's Beach

The concept design also assumes that the export conveyor will match the level of the silo pad.

Key differences between the conceptual stormwater design for the Evaluated Project and the Proposed Amendment are:

- The major flow path through the site still flows through the site instead of being diverted around the site. However, a portion of the flow path is shifted from its natural path.
- A decrease in site runoff extended detention storage from 136 ML to 65 ML. This is due to the decrease in contributing catchment from 169 ha to 61ha. This is shown in Figure 3-2.
- Energy dissipation basin upstream of discharge to Rogers Beach is maintained but a flow spreader is incorporated to minimise the impact on Rogers Beach from the discharge of the constructed channels.

Key features of the Proposed Amendment concept design that are retained from the Evaluated Project are:

- Culverts are sized for the 10-year flow
- Storages / separating development and non-development areas / sizing swales

3.3.1.1 Water Sensitive Urban Design

Water sensitive urban design (WSUD) measures have been carried over from the Evaluated Project to the Proposed Amendment as outlined in Table 3-6. As for the Evaluated Project, the Proposed Amendment achieves the desired outcomes of WSUD including:

- Maintaining natural water balance
- Reducing flood risk
- Reducing erosion of waterways
- Efficient use of water resources

Reducing cost of providing and maintaining water infrastructure.

Table 3-6 Comparison of WSUD measures between the Evaluated Project and the Proposed Amendment

Evaluated Project WSUD	Proposed Amendment WSUD
Water supply demand reduction via the collection of non-potable water through the on-site drainage network (including infrastructure guttering and downpipes) for wash down of plant and equipment and fire suppression systems.	No change.
Water storage for future use via 136 ML onsite extended detention pond and an onsite stormwater retention pond.	Reduction in water storage to 65ML.
Wastewater management measures as follows: Use of stormwater as an alternative non-potable water source to reduce potable demand. Site design which includes zero stormwater discharge off site to the marine environment from the Project area.	No change.
Urban water harvesting or stormwater retention and drainage as follows: Site design which includes zero stormwater discharge off site, with all stormwater to be collected and re-used. Rainwater from infrastructure surfaces will be piped to stormwater retention ponds for storage and reuse.	No change
Measures to reduce flow velocities and assist uniform deposition of sediment. Conceptual stormwater management infrastructure including: use of culverts; channel drop structures; an energy dissipation basin; on-site stormwater retention pond; 136 ML onsite extended detention pond; and low velocity earthen vegetated channel around the Project.	No change to drainage philosophy, conceptual stormwater management measures have been amended to suit new development. Major flow path follows natural flow path more closely

Figure 3-1 - Total Detention Catchment Area

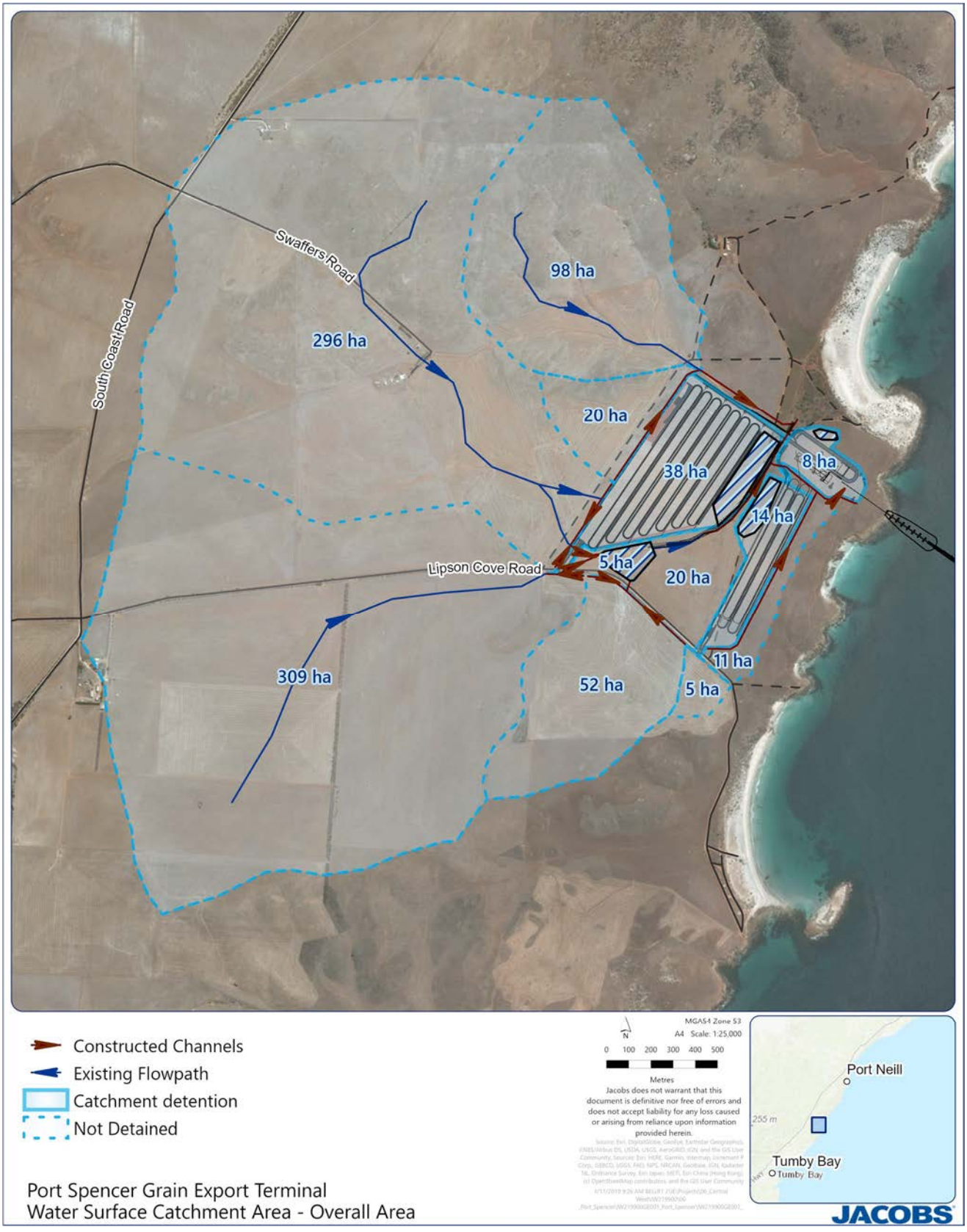


Figure 3-2 - Surface Water Catchments

3.3.2 Amended Impact Assessment Summary for Surface Water

Table 3-7 identifies the potential impacts to surface water controls considered for the Evaluated Project and confirms that no change in effect is expected due to the Proposed Amendment.

Table 3-7 Summary of potential impacts to surface water controls for the Evaluated Project (PER Section 6.3) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Build-up of sediment in channels	No change.
Exposed soils on cut slope and earthen channel	No change.
Erosion	No change.
Non-stormwater discharge to surface water	No change.
Flood control	No change.
Spills to surface water	No change.
Stormwater runoff	No change.

3.3.3 Mitigation and management carried forward by the Proposed Amendment

The key principles in the stormwater management of the site remain the same from the Evaluated Project to the Proposed Amendment.

Key mitigations identified in Section 6.3 of the PER carried forward by the Proposed Amendment:

Zero discharge of the site runoff to the marine environment

Offsite runoff continues to discharge to Rogers Beach, but quantity is not increased by the project. Outfall maintains design to distribute flow and decrease velocity.

Detained site runoff is to be reused on site.

Low velocity design to minimise erosion through channel drop structures and an energy dissipation basin.

Key mitigations identified in Section 6.3 of the PER not carried forward by the Proposed Amendment:

Nil

3.4 Groundwater

A qualitative assessment of groundwater impacts has been undertaken for the Proposed Amendment to enable a comparison with the Evaluated Project (Section 6.4 of the PER).

3.4.1 Comparison of Key Inputs and Assumptions

The Evaluated Project did not propose to use groundwater as a source. Design development of the Proposed Amendment has identified a potential requirement to use groundwater for construction, including dust suppression.

The site groundwater investigation (Appendix E of the PER) indicated that groundwater levels at the site range between approximately 0.9 m AHD and 2.3 m AHD.

3.4.2 Amended Impact Assessment Summary for Groundwater

As identified in the groundwater investigation (Appendix E of the PER), the uppermost aquifer is generally brackish to saline water that would be unsuitable for irrigation or potable use. The site is not located within a

Prescribed Water Resource Area and a well construction permit will be sought if the bore is to be drilled more than 2.5 m below ground level. Use of saline water will be limited to the construction phase and will be contained within the site boundary. Retained areas of native vegetation will be avoided. The risks to soil and groundwater from the use of saline groundwater during construction is considered low (unlikely x minor), consistent with other groundwater risks identified for the Evaluated Project (refer to Table 4-4).

As for the Evaluated Project, a key risk to groundwater is considered to be contamination risk from possible chemical and fuel spills at site. The pathways through which contaminants could reach the groundwater from construction and operational activities remain unchanged, being:

Through direct transmission of liquids through the underlying soils to the groundwater

Through the leaching of contaminants from contaminated soils as water passes through it.

Table 3-8 identifies the potential impacts to groundwater considered for the Evaluated Project and provides a comparison with the impacts expected for the Proposed Amendment. Due to the site groundwater conditions, potential impacts are expected to be minor and limited to potential contamination from project sources for both the Evaluated Project and the Proposed Amendment (refer to the risk assessment in Section 4).

Table 3-8 Summary of potential groundwater impacts for the Evaluated Project (PER Section 6.4) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Mobilisation of existing contaminants present on-site due to earthworks and the potential for the creation of preferential pathways to groundwater.	No change.
Migration of hydrocarbons to groundwater through spills or leakage due to the presence of earthmoving and construction plant and equipment, including vehicles, compressors and diesel generators.	No change.
Migration of chemicals and hydrocarbons to groundwater due to spills or leakage due to the storage and use of chemicals on-site including fuels, oils, greases and solvents.	No change.
Migration to groundwater of wastewater or treated wastewater through failure of waste water treatment systems or designated irrigation disposal area.	No change, noting the Proposed Amendment does not propose to use treated wastewater for irrigation purposes.
Off-site surface water impacted by agricultural land use (such as fertiliser, herbicides or pesticides) that is captured, stored and re-used on-site may permeate to groundwater.	No change, noting that water coming from off-site sources will be diverted back to the natural channel. Only surface water generated on-site will be captured.
Operations	
Migration of hydrocarbons to groundwater through spills or leakage due to the presence of site, earthmoving and construction plant and equipment, including vehicles, compressors and diesel generators.	No change.
Migration of chemicals and hydrocarbons to groundwater due to spills or leakage due to the storage and use of chemicals on-site, including fuels, oils, greases and solvents.	No change.
Migration to groundwater of wastewater or treated wastewater through failure of waste water treatment systems or designated irrigation disposal area.	No change.
Off-site surface water impacted by agricultural land use (such as fertiliser, herbicides or pesticides) that is captured, stored and re-used on-site may permeate to groundwater.	No change.

Evaluated Project Impact	Proposed Amendment Impact
Reduction in groundwater recharge due to the presence of low permeability surfaces and pavements on the site (and corresponding benefit in reducing the mobilisation of any contaminants underlying the soil).	No change.

3.4.3 Mitigation and management carried forward by the Proposed Amendment

Section 6.4 of the PER did not specify any mitigation or management as part of the groundwater impact assessment chapter due to the nature of site groundwater conditions and limited potential for contamination of groundwater from project sources. Additional mitigation or management approaches to be implemented for construction of the Proposed Amendment are as follows:

A well construction permit will be sought if the bore is to be drilled more than 2.5 m below ground level.

Use of saline water will be limited to the construction phase and will be contained within the site boundary. Use of groundwater will avoid retained areas of native vegetation.

Key mitigations identified in Section 6.4 of the PER not carried forward by the Proposed Amendment:

Nil

3.5 Air Quality

Air emissions for the Proposed Amendment were identified as likely to differ from the Evaluated Project, due to both the removal of iron ore from the development scope and the reconfiguration of the site to provide significant bunker storage (and corresponding increase in in-loading activities). As such, a revised Air Quality Assessment has been undertaken for the Proposed Amendment (refer to Appendix H).

The Evaluated Project Air Quality Assessment (Appendix C of the PER) was able to demonstrate compliance with the air quality criteria at all sensitive receptors located near the site, based on conservative assumptions of simultaneous grain and ore in-loading and simultaneous grain and ore ship-loading.

The air quality criteria, known as Design Ground Level Concentrations (DGLC), adopted for the assessments are shown in Table 3-9.

Table 3-9 Air quality Assessment Criteria for Port Spencer

Parameter	Evaluated Project	Proposed Amendment
Particulate Matter	**DGLC (µg/m^3)**	**DGLC (µg/m^3)**
PM_{10} – 24 hours	50	50
$PM_{2.5}$ – 24 hours	25	25
$PM_{2.5}$ – 1 year	8	8
Dust Deposition		**NSW EPA level (g/m^2/month)**
Dust Deposition – Annual maximum increase in deposited dust level	Not assessed.	2
Dust Deposition – Annual maximum total deposited dust level	Not assessed.	4

3.5.1 Comparison of Key Inputs and Assumptions

The removal of iron ore from the development scope and the reconfiguration of the site to provide significant bunker storage (and corresponding increase in in-loading points) has resulted in changes to the Evaluated

Project. The key differences in assumptions between the Evaluated Project and Proposed Amendment for the purposes of air quality impacts is summarised in Table 3-10.

Table 3-10 Comparison of assumptions regarding sources of particulate matter emissions during operations

Feature	Evaluated Project		Proposed Amendment
Product:	**Hematite (2MT/yr.)**	**Grain (0.5 MT/yr.)**	**Grain (1 MT/yr.)**
Vehicles accessing the site	Negligible – sealed road		Negligible – sealed road
Material receivals	06:00 – 22:00 All year		06:00-22:00 Peak harvest period (October – December with seasonal variations)
In-loading	40 t payload	11.6 t payload	70 t payload (average)
	Simultaneous unloading of grain and ore		Up to 8 trucks in-loading at a time (at peak times only).
Unloading rate	Payload unloaded over 10 minutes	Payload unloaded over 10 minutes	Payload unloaded over 10 minutes
Material receiving dust control infrastructure	Covered gantry (two sides and a roof).	Covered gantry – 2 sides and a roof	No gantry. There will be wind break walls each side of the truck un-loading bay.
	Payload tipped into a hopper through Burnley Baffles.	Payload tipped into a hopper through Burnley Baffles.	Payload tipped into a hopper through Burnley Baffles.
	Reverse air fabric filter 70% emissions control	Reverse air fabric filter 70% emissions control	Nil
Storage of materials	Shed	Shed	Approximately 9 bunkers (800 kT). Maximum of eight operational at a time.
Storage dust control infrastructure	Ventilation system and reverse air fabric filters – 24 hrs/day	Sealed shed with dust collectors on all grain handling processes in the shed.	5 sealed silos with dust collectors on all grain handling processes and conveyors.
	10 mg/m^3 particulate matter passing the filter	Not specified for grain	-
	Fabric filter exhaust discharge 3 m above the roof line, vertical exit velocity 16 m/s.	Not specified for grain	-
Bunker storage dust control	NA	Not considered	Bunker fitted with either traditional tarpaulin cover arrangement or lightweight semi-mobile roof system to weather proof the grain.
Covered conveyors	Serviced by ventilation systems with pulsed jet fabric filters at each of the conveyor transfer points		Yard conveyors – uncovered conveyor loading system, covered reclaim conveyor. No dust collection at transfer points.

Feature	Evaluated Project		Proposed Amendment
			Silo conveyors - Serviced by ventilation systems with pulsed jet fabric filters at each of the conveyor transfer points
	10 mg/m^3 particulate matter passing the filter		10 mg/m^3 particulate matter passing the filter
Number of conveyor transfer points	4		3
	1. Out-loading from shed	1. Out-loading from shed	1. Out loading from Silo
	2. Land to wharf	2. Land to wharf	2. Wharf conveyor to shiploader
	3. Wharf to wharf	3. Wharf to wharf	3. Shiploader to ship
	4. Wharf to ship	4. Wharf to ship	-
Ship-loading	Ship loaded over 24-hour period	Ship loaded over 24-hour period	Ship loaded over a 24-hour period.
	Simultaneous loading of grain and ore		Grain only
Ship-loading rate	5,000 tonnes/hr	1,400 tonnes/hr	Design capacity – 2400 tonnes/hr Effective capacity – 2000 tonnes/hr
Ship-loading dust control infrastructure	No dust control infrastructure in place (assumption for modelling).		Covered conveyors, dust capture at all transfer points, telescopic chute.
Generator	5 MW		2 x 1.5 MW

Based on the concept design and key assumptions, emission rates for the Proposed Amendment have been calculated (refer to Table 3-11). The emission rates calculated for the Proposed Amendment were compared with the total dust emission rates for gain adopted for the Evaluated Project and are shown in Table 3-12.

Table 3-11 Summary of dust emission rates for the Proposed Amendment

Dust emission source	Mass emission rates (g/sec) [Note 1]		
	TSP	PM_{10}	$PM_{2.5}$
Grain unloading			
Harvest	17.7	5.79	0.98
Non-harvest	8.84	2.90	0.49
Grain handling and transfers	1.53	0.85	0.15
Ship loading	6.68	1.67	0.31
Wind erosion	0.022	0.011	0.002
Diesel generator	0.179	0.179	0.175
Bagfilter exhaust stack emissions (total) [Note 2]	5.24	1.16	1.16
Total of all sources			
Harvest	31.3	9.67	2.77
Non-harvest	22.5	6.77	2.28

Notes

1. The emission rates shown incorporate the dust control factors adopted for the Proposed Amendment.

2. The emission rates for each of the 19 bagfilters are reported in Appendix H.

Table 3-12: Summary of Evaluated Project (Centrex, 2011) total grain handling dust emissions

Dust emission source	Mass emission rates (g/sec)	
	PM_{10}	$PM_{2.5}$
Volume sources	1.083	0.186
Point sources	0.322	0.261
Total	1.405	0.447

The PM_{10} and $PM_{2.5}$ dust emissions applied in the Evaluated Project air quality assessment are significantly lower than those calculated for the Proposed Amendment. There are several causes of the differences between the two inventories; the key contributing factors are:

There are several more dust collectors for the Proposed Amendment compared to the Evaluated Project, some with significantly higher particulate mass emission rates, e.g. the silo vents.

The Evaluated Project assumes a single 11.6 tonne payload of material will be unloaded over a period of 10 minutes, resulting in approximately 70 tonnes of grain unloaded every hour for the site. This is significantly less than the Evaluated Project which has up to a total of 3,360 tonnes of grain unloaded every hour at peak during the harvest period.

3.5.2 Amended Impact Assessment Summary for Air Quality

Port Lincoln BoM meteorological data for 2012-2018 was analysed for the selection of a suitable model year. Low wind speeds are important as they typically represent low atmospheric turbulence and hence poor dispersion of pollutants. High wind speeds can also be important if there are emission sources which are influenced by wind speed, such as wind erosion. For the Proposed Amendment, the focus of the selection year was based on assessment of the low wind speeds as the mass emission rates for wind erosion are relatively minor compared to the total emissions for the site. 2017 was selected as the model year on the basis that it had the highest frequency of low wind speeds in the direction which is most likely to impact sensitive receptor sites around the Port Spencer Grain Export facility boundary.

The air quality assessment for the Proposed Amendment was undertaken as follows:

The TAPM prognostic meteorological and dispersion model developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was used to generate an 'initial guess' three-dimensional meteorological field for the project site region.

TAPM generated meteorological data was output for a location near to the Port Lincoln AWS site (North Shields) and the Port Spencer grain facility site and compared to the Port Lincoln AWS data for the model year.

Using the gridded prognostic meteorological data from TAPM as the initial guess wind field in combination with terrain and land use data, refined wind fields were then generated using CALMET v6.5.0.

The CALPUFF (Version 7.3.1) model was used to predict ground level concentrations (GLCs) for the Proposed Amendment.

The TAPM-CALMET-CALPUFF combination is expected to provide higher quality results for the project's coastal location.

The dispersion modelling outputs for the dust emissions at the Port Spencer Grain Export Facility were compared with the EPP ambient concentration criteria (EPA, 2016a) for PM_{10} and $PM_{2.5}$, and the NSW EPA criteria for TSP dust deposition. Each of the model outputs incorporates the respective background concentrations. A summary of the plots is shown in Figure 3-3 to Figure 3-6. In each output plot, the site boundary is depicted by the red line and the sensitive receptor sites are shown by the pink triangles.

The modelling indicates:

Maximum 24-hour average $PM_{2.5}$ GLCs (µg/m^3):

- Under maximum proposed operations during harvest (6 am to 10 pm), the results show exceedances of the 50 µg/m^3 EPP criterion at SR#1 to the north of the site boundary. At this receptor, exceedances of the PM_{10} 24hr average criterion are expected for 13 separate days in the year, each during the harvest season (November and December).
- Under modified (6 am to 6 pm) operations during harvest the model predicts no exceedances of the PM_{10} 24-hour criterion at any of the sensitive receptor sites (refer to Figure 3-3).

Maximum 24-hour average $PM_{2.5}$ GLC

- Under maximum proposed operations during harvest (6 am to 10 pm), the results indicate exceedances of the 25 µg/m^3 EPP criterion at the closest sensitive receptor, SR#1, to the north of the site boundary. At this receptor location, exceedances of the $PM_{2.5}$ 24-hour criterion are predicted to occur for 7 days in the model year, with all exceedances occurring during the harvest season.
- Under modified (6 am to 6 pm) operations during harvest the model predicts no exceedances of the $PM_{2.5}$ 24-hour criterion at any of the sensitive receptor sites (refer to Figure 3-4).

Annual average $PM_{2.5}$ GLC

- Under maximum proposed operations during harvest (6 am to 10 pm), the results indicate exceedances of the 8 µg/m^3 EPP criterion at the closest sensitive receptor, SR#1, to the north of the site boundary.
- Under operations representative of typical annual operation, a contracton of the deposition contours occurs and compliance with the EPP criterion at the closest sensitive receptor, SR#1 is predicted (refer Figure 3-5).

Annual average dust deposition (g/m^2/month)

- Under maximum proposed operations during harvest (6 am to 10 pm), the results predict conformance with the 8 µg/m^3 NSW EPA criterion at all sensitive receptor sites. However, the result at SR#1 of 3.95 µg/m^3 is very close to the criterion (refer to Figure 3-6).
- Under modified (6 am to 6 pm) operations during harvest the model output indicates a contraction of the dust deposition contours as seen in Figure 3-7.

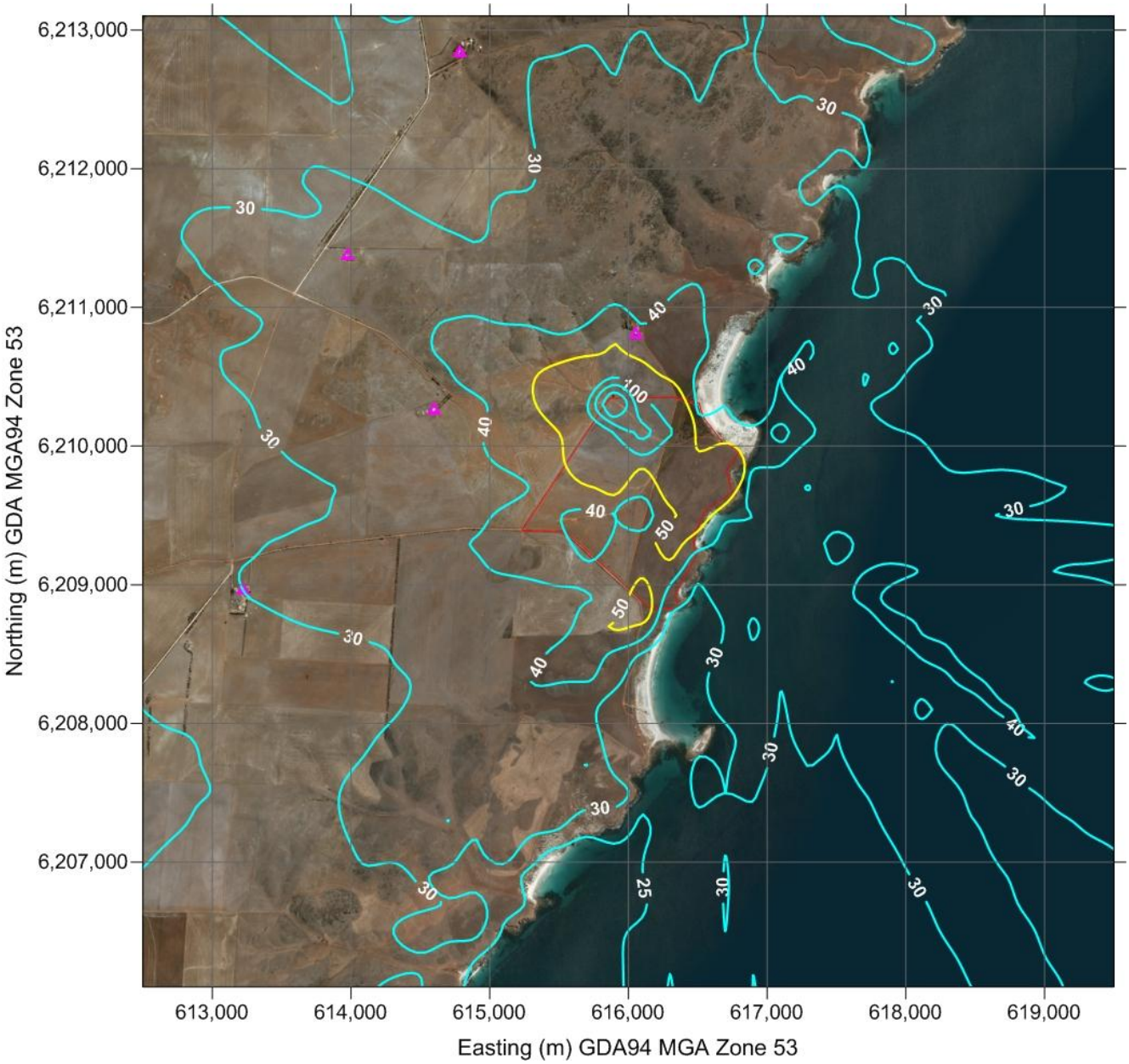


Figure 3-3: Maximum 24-hour average PM_{10} GLC (µg/m^3) – restricted operating hours during harvest

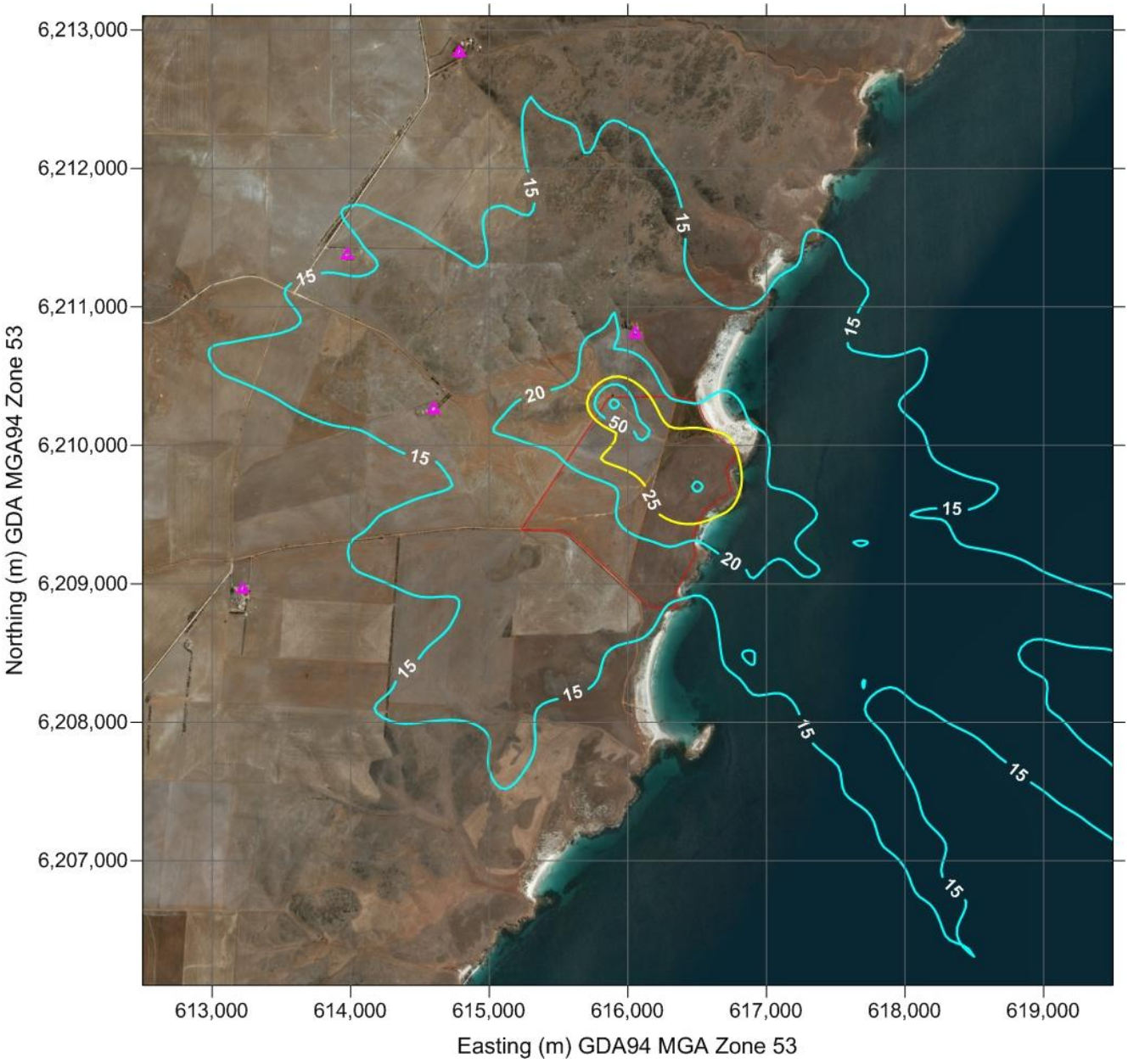


Figure 3-4: Maximum 24-hour average $PM_{2.5}$ GLC (µg/m^3) – restricted operating hours during harvest

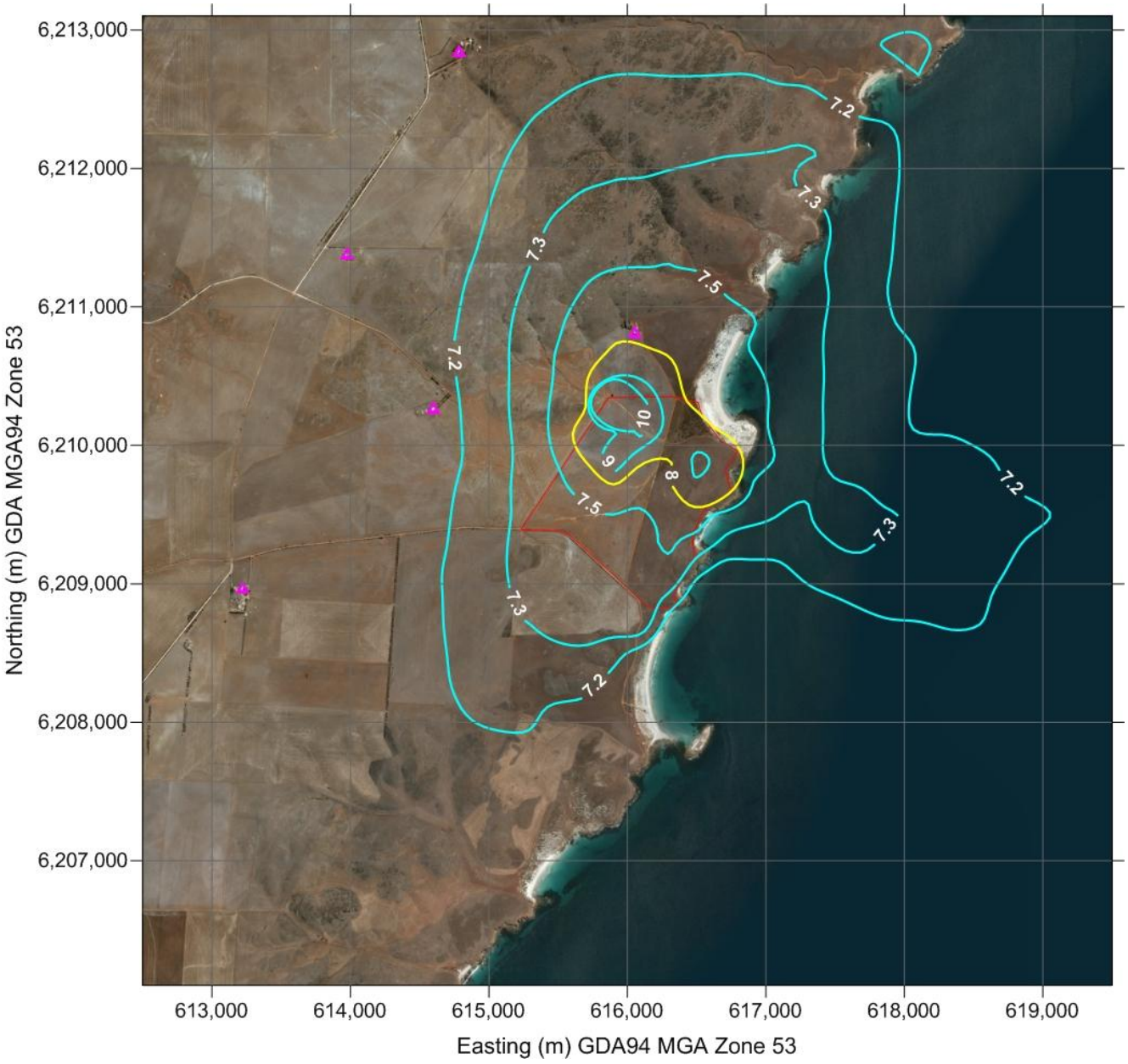


Figure 3-5: Annual average $PM_{2.5}$ GLC (µg/m^3) – adjusted annual average emissions to represent typical operation

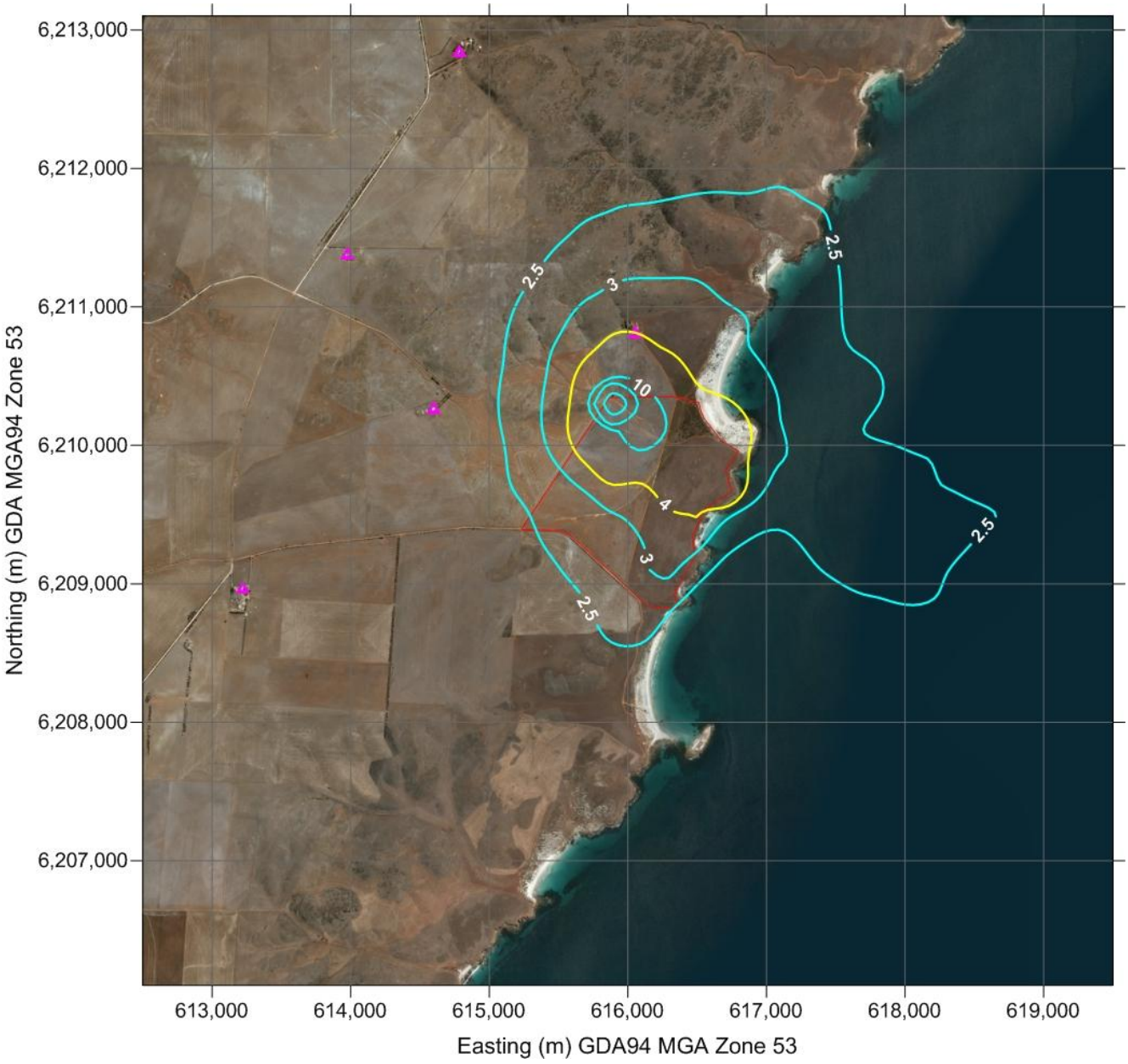


Figure 3-6: Annual average TSP deposition (g/m^2/month), including background concentration

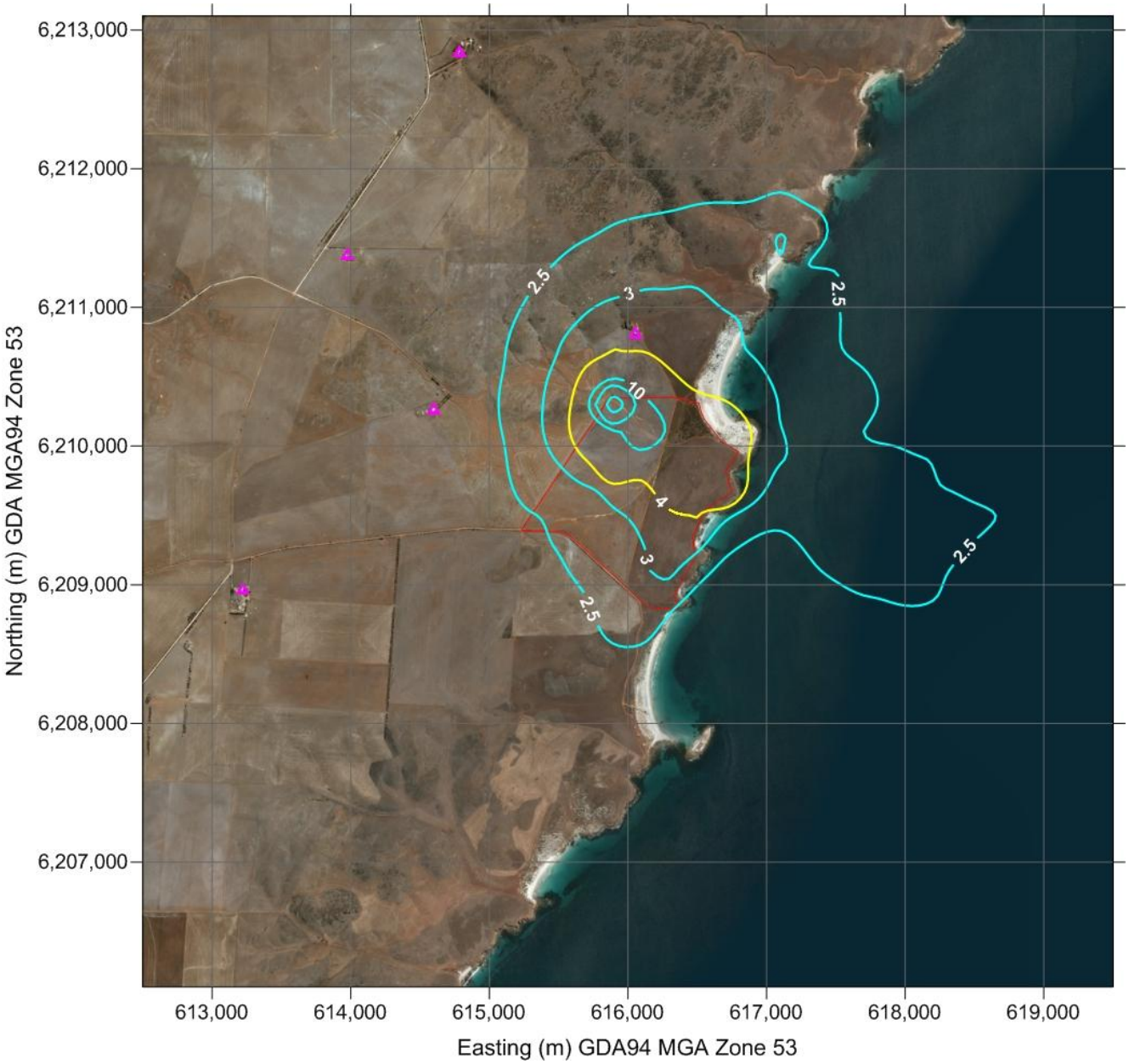


Figure 3-7: Annual average TSP deposition (g/m^2/month), restricted operating hours during harvest

Table 3-13 identifies the potential impacts to air quality considered for the Evaluated Project and highlights differences in impact arising from the Proposed Amendment.

Table 3-13 Summary of potential air quality impacts for the Evaluated Project (PER Section 6.5) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Dust generated from construction activities including wind-borne dust from exposed surfaces, vehicle movements, earthworks, crushing, blasting of rock material.	No change.
Operations	
Dust emissions associated with the transport and handling of materials. *Modelling demonstrated PM_{10} and $PM_{2.5}$ concentrations complied with the assessment criteria.*	Similar level of effect. Modelling has demonstrated that the site can achieve compliance with project air quality criteria. It is noted that under certain wind conditions (low wind conditions in the evening hours, typically between 6 pm and 10 pm, and when blowing from the south of the site towards SR#1), there may be a requirement to reduce the intensity of grain in-loading operations between 6pm and 10pm during harvest.
Products of combustion from fuel use in vehicles and mobile plant. *Qualitative assessment determined emissions from diesel fuel generators rarely exceed assessment criteria 1 km from sensitive receptors in areas with low background.*	No change. The Proposed Amendment has a smaller power demand than the Evaluated Project.
Decommissioning	
Dust and products of combustion generated from decommissioning activities.	No change.

3.5.3 Mitigation and management carried forward by the Proposed Amendment

Due to the altered site configuration of the Proposed Amendment to include significant bunker storage and no iron ore storage, the nature of dust control infrastructure proposed for the Proposed Amendment differs from the Evaluated Project. These differences are highlighted in Table 3-10, and have been included in the revised Air Quality Assessment (refer to Appendix H).

Additional management approach to be implemented for the operational phase of the Proposed Amendment are as follows:

A meteorological station at the site will be installed. During the harvest period, forecasting of meteorological conditions at the site will be used to assist in decisions to temporarily restrict truck in-loading operations, thereby reducing the likelihood of dust impact at any of the sensitive receptor sites.

3.6 Noise

Operational and traffic generated noise emissions for the Proposed Amendment were identified as likely to differ from the Evaluated Project, due to the removal of iron ore from the development scope, the reconfiguration of the site to provide significant bunker storage (and corresponding increase in in-loading activities), and the seasonal delivery of grain. A revised Noise Assessment has been undertaken for the Proposed Amendment (refer to Appendix I). As the level of automation able to be accommodated in the final design was not confirmed at the time of modelling, the revised noise modelling was undertaken for two scenarios so that the worst-case conditions could be identified and assessed:

Manual Grain Handling Scenario comprising: grain in-loading via eight mobile drive over stackers; transfer to silos (reclaim) via front end loaders and trucks; silo transfer conveyor, bucket elevator and silo loading conveyors; silo reclaim conveyors, bucket elevator, screens, weigher, export conveyor and ship loading.

Automated Scenario comprising: in-loading via trucks tipping concurrently at eight hoppers with four stacking/reclaiming bunker conveyors and four twin-boom stackers between the bunker conveyors and bunkers; reclaim via eight reclaimers (one located in each bunker) four stacking/reclaiming bunker conveyors, silo transfer conveyor, bucket elevator and silo loading conveyors; silo reclaim conveyors, bucket elevator, screens, weigher, export conveyor and ship loading.

Once grain is transferred (by either scenario) to silos, the downstream operation (silo loading, reclaim and export) is identical for both options.

The noise criteria adopted for the assessments, as derived from the Environment Protection (Noise) Policy 2007 and the relevant Road Traffic Noise Guidelines, are shown in Table 3-14.

It is noted that the operational noise criteria include a 5 dB(A) penalty, due to a modulating characteristic associated with the dominance of truck movements in comparison to other sources. Automated grain reclamation and ship-loading will be dominated by constant mechanical equipment and will therefore not attract a penalty. Nonetheless, a 5 dB(A) penalty has been applied to the assessment for all scenarios in the interests of consistency, simplicity and conservatism. This effectively reduces the goal noise levels to 47 dB(A) (day) and 40 dB(A) (night).

Table 3-14 Operational and Traffic Noise Assessment Criteria for Port Spencer

Parameter	Evaluated Project dB(A)	Proposed Amendment dB(A)
Operational – day (7.00am – 10.00pm)	47	47
Operational – night (10.00pm – 7.00am)	40	40
Road traffic noise – day (7.00am – 10.00pm)	55[1]	50[2]
Road traffic noise – night (10.00pm – 7.00am)	50[1]	42[2]

Notes:[1.] Department of Transport, Energy and Infrastructure (DTEI) Road Traffic Noise Guidelines 2007; [2.] Department of Planning Transport and Infrastructure (DPTI) Road Traffic Noise Guidelines 2016 (relative increase criteria applicable to a low background noise environment).

3.6.1 Comparison of Key Inputs and Assumptions

The Evaluated Project Noise Assessment (Appendix G of the PER) was able to demonstrate compliance with the operational noise criteria at all sensitive receptors located near the site, with specific acoustic treatments around the generators required. The assessment of traffic noise predicted that the relevant noise criterion would be exceeded at one sensitive receptor located along Swaffers Road.

The reconfiguration of the site to provide significant grain storage capacity will enable direct transport of grain from farm to site during harvest. The altered layout and seasonal nature of grain deliveries associated with the Proposed Amendment results in differences in operational and traffic noise impacts from the Evaluated Project. The key differences in assumptions between the Evaluated Project and Proposed Amendment for the purposes of noise impacts is summarised in Table 3-15. The Proposed Amendment will result in an increase in the number of locations where grain in-loading and reclamation activities occur and also in the number of trucks circulating the site at a given time; however, some of these noise generating activities will be primarily limited to the 8-week harvest period.

Table 3-15 Comparison of assumptions regarding noise emission sources during construction (15-minute period)

Noise Sources	Evaluated Project	Proposed Amendment
Operational		
Road train movements around the project area	2 B-Triple trucks moving continuously around the project area	8 truck movements through the site
Material in-loading	Within fully enclosed buildings for grain and ore One truck in-loading at the grain-unloading shed	At bunkers for grain only. Manual Grain Handling Scenario: 8 mobile drive over stackers (including engine drive). Automated Scenario: Trucks tipping at four double hoppers with four stacking/reclaiming bunker conveyors and four twin-boom stackers between the bunker conveyors and bunkers
Ventilation and dust control equipment	Two exhaust fans and associated filters on the grain storage shed. Two exhaust fans and associated filters on the grain storage shed.	No grain storage shed.
Materials handling (reclaiming)	Operation of one front-end loader within grain storage shed and one front-end loader in the ore storage shed.	Manual Scenario: Four front-end loaders. Automated Scenario: Eight reclaimers (one located in each bunker) four stacking/reclaiming bunker conveyors, silo transfer conveyor and silo loading conveyors, bucket elevator
Out-loading Conveyors	Continuous operation of an enclosed conveyor belts and associated drives. Conveyor drive at sampling station and a conveyor drive at the end of the jetty.	Manual Grain Handling Scenario: Silo loading conveyors, bucket elevator Automated Scenario: One silo transfer conveyor and drives. Silo in-loading conveyors, bucket elevator and drives.
Ships	One ship at berth	One ship at berth
Ship-loader	Continuous operation of one ship-loader	Continuous operation of one ship-loader
On-site power generators	Three 1 MW generators at the switchyard and generator location.	Two 1.5 MW generators located near the silos.
Traffic		
Heavy vehicle access road	Swaffers Road	Lipson Cove Road
Heavy vehicle access road traffic movements	280 road train movements per day (140 hematite trucks and 140 for grain)	429 heavy vehicles per day (peak day) 262 vehicles per day assuming uniform distribution during harvest.
Distribution of heavy vehicle traffic movements	Equal distribution over a 24-hour period	Occurs within an 8-week harvest period, over a 17-hour day
Passenger vehicle access	Lipson Cove Road	Lipson Cove Road
Light vehicle access road traffic movements	30 passenger vehicle movements per day (Refer to Appendix G of the PER)	120 passenger vehicle movements per day (two-way movements with allowance for shift changeover)
Access road speed limits	100 kmph	100 kmph

3.6.2 Amended Impact Assessment Summary for Noise

The Amended Impact Assessment for Noise references sensitive receptors 1-8 as shown in Figure 2-6.

3.6.2.1 Operational Noise

Environmental noise predictions for operations have been made using the CONCAWE noise propagation model in the SoundPLAN three-dimensional noise modelling software. In accordance with the recommendations of the Guidelines for the Use of the Environment Protection (Noise) Policy 2007 (Noise Policy Guidelines), predictions for day and night time activities have been generated for the worst-case weather conditions (corresponding to CONCAWE Category 5 and 6 respectively), resulting in the highest noise level at nearby residences for a given operational scenario.

Predictions were generated for each of the two potential concepts to be established at the site, comprising either:

Manual Grain Handling Scenario

Automated Scenario.

For each of the above, the following three scenarios were considered:

Grain receival (day-time operations)

Grain receival (Prior to 7am and after 10pm)

Bunker reclamation and simultaneous ship loading (both day-time and night-time).

Results of the assessment of operational noise are shown in Table 3-16.

Table 3-16 Predicted worst-case operational noise levels

Scenario	Criteria (dB(A))	Weather Category	Predicted worst-case noise levels (L_{eq}, dB(A))			
			Manual Scenario		Automated Scenario	
			Dwelling 1	Dwelling 2	Dwelling 1	Dwelling 2
Receival – Day Operations	47[1]	Category 5	45[1]	40[1]	44[1]	41[1]
Receival – Night Operations	40[1]	Category 6	40[1]	37[1]	40[1]	37[1]
Reclamation and ship-loading	40[1]	Category 6	39	34	39	34

Notes: [1]Includes a 5 dB(A) penalty for modulating characteristic associated with dominant vehicle movements

3.6.2.2 Road Traffic Noise

The noise from truck movements along Lipson Cove Road has been predicted using the Federal Highway Administration “Traffic Noise Model” traffic noise modelling software (TNM). TNM has been widely used and accepted by DPTI for modelling road traffic noise within South Australia.

The predictions are based on:

Lipson Cove Road being sealed, with a posted speed limit of 100km/h;

An average of 26 vehicle movements per hour in each direction between 7am and 10pm, with remaining vehicle movements (a total of approximately 40 vehicle movements) occurring between 10pm and 7am.

Results of the assessment of road traffic noise are shown in Table 3-17.

Table 3-17 Predicted road traffic noise levels on Lipson Cove Road

Scenario	Descriptor	Criteria (dB(A))	Predicted road traffic noise levels (L_{eq}, dB(A))		
			Dwelling 7	Dwelling 8	Dwelling 4
Day (7am to 10 pm)	$L_{eq, 15\ hr}$	50	47	43	48
Night (10pm to 7am)	$L_{eq, 9\ hr}$	42	37	33	38

3.6.2.3 Summary of Effects

Table 3-18 identifies the potential impacts of noise emissions considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Table 3-18 Summary of potential noise impacts for the Evaluated Project (PER Section 6.6) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Noise emissions from project construction impacting nearby noise sensitive receptors. *Short-term adverse noise and vibration impacts. Reasonable and practicable noise measures identified through a Construction Noise and Vibration Management Plan.*	No change.
Operations	
Noise emissions from site operations impacting nearby noise sensitive receptors. *Night-time noise criterion exceeded at one residence with no acoustic treatment in place. Upon application of acoustic treatments, modelling demonstrated compliance with acoustic treatments,*	Similar level of effect. The Proposed Amendment will be designed and operated to meet the relevant noise criteria from the Environment Protection (Noise) Policy.
Traffic	
Noise emissions from operational traffic impacting nearby noise sensitive receptors. *Predicted noise levels indicated exceedance of criteria at one residential dwelling along Swaffers Road. Acoustics treatments proposed at the dwelling.*	Similar level of effect. Modelling indicated compliance with the criteria for all receptors on Lipson Cove Road, with no requirement for acoustic treatment.

3.6.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigations identified in Section 6.6 of the PER carried forward by the Proposed Amendment:

Providing significant distances between most noise sources and noise-sensitive receivers.

Ensuring conveyor belts are fully enclosed where possible noting that the conveyor loading system is not able to be covered.

Key mitigations identified in Section 6.6 of the PER not carried forward by the Proposed Amendment:

Locating all in-loading facilities in full enclosed buildings. Consistent with normal national industry practice at bunker receival sites the truck unloading hoppers at this site are proposed to be open, but with baffles).

Acoustic treatment of dwellings on heavy vehicle route.

Enclosure of generators – noting the proposed generator type is containerised and therefore has inherent acoustic treatment.

In order to ensure that the predicted noise levels are maintained, the following acoustic measures will be adopted for the Proposed Amendment:

Ensure that all pumps, fans, motors and conveyor drives are designed/selected to meet the maximum sound pressure levels required by the Design Requirements;

Ensure that the generators are selected with a maximum sound power level of 108dB(A) per unit, with a barrier constructed around the generator area which blocks line-of-sight to Dwelling 1 and extends a minimum of 1-metre above the top of the generator casing or exhaust outlet (whichever is higher);

Front End Loaders (FELs) to be selected having a maximum rated sound power level of 102dB(A);

Ensure that bunker conveyors are designed or selected to meet a maximum sound power of 74 dB(A) per metre. Subject to the design of the conveyors, this may require:

- Selecting “low noise” idlers;
- Enclosing the conveyors within a gantry or similar structure, or installing within a channel or trench such that line-of-sight to nearby dwellings is blocked at all times; In practice, this is achieved through the haul road and bunker walls.
- Ensuring that any gantry, enclosure or screen is resiliently mounted to the conveyor structure;

Extend the northern dust barriers adjacent the fixed receival hoppers to a minimum height of 2.5 metres for an extent sufficient to block line-of-sight to Dwelling 1;

The following additional controls will be implemented for night-time operations (i.e. prior to 7am and after 10pm):

Limit site throughput prior to 7am or after 10pm to the following:

Operation of up to four sampling stations, and three weighbridges;

Operation of up to four fixed hoppers (i.e. any two pairs of hoppers, or four single hoppers);

Operation of up to four mobile drive-over hopper stackers;

For the manual scenario, all mobile tipping points to be selected such that ‘line of sight’ to Dwellings 1 and 2 is blocked by a full or partially full bunker;

No stopping/idling in the secondary marshalling area (i.e. drivers proceed directly to the designated tipping point).

It is noted that the Evaluated Project assumed that product deliveries to site would occur over a 24 hours per day throughout the year. By contrast, grain receivals for the Proposed Amendment will mostly occur during the eight-week harvest period and during daylight hours, with a relatively small number of peak days where a 17-hour pattern is envisaged based on actual harvest demands.

3.7 Traffic

Traffic impacts associated with the Proposed Amendment were identified as likely to differ from the Evaluated Project, due to the removal of iron ore from the development scope and the reconfiguration of the site to provide significant bunker storage which will allow for peak seasonal delivery of grain.

A revised Traffic Impact Assessment (TIA) has been undertaken for the Proposed Amendment to identify the impacts of the Proposed Amendment and comparison of effects with the Evaluated Project (refer to Appendix B).

3.7.1 Comparison of Key Inputs and Assumptions

The Evaluated Project was based on steady and continuous delivery of iron ore and grain throughout the year. By contrast, the Proposed Amendment will result in a higher peak volume of traffic travelling to the site, with most impacts limited to the eight-week harvest period. Heavy vehicle access to the site also differs between the Evaluated Project (Swaffers Road) and the Proposed Amendment (Lipson Cove Road). The key differences

between the Evaluated Project and Proposed Amendment for the purposes of traffic impact is summarised in Table 3-19.

Table 3-19 Comparison of inputs and assumptions regarding traffic generation

Feature	Evaluated Project	Proposed Amendment
Export commodity	Hematite and grain	Grain
Export volume per annum	1 million tonnes of grain 2 million tonnes of hematite	1 million tonnes of grain
On-site storage	60,000 tonne grain storage Bulk minerals storage.	860,000 tonne grain storage [1]
Vessel size	Vessels up to Cape class	Vessels up to Panamax, including the emerging larger (wider) Panamax. Cape size not catered for.
Road upgrade recommendations	Swaffers Road / Lincoln Highway junction Lipson Cove Road / Lincoln Highway junction Swaffers Road (heavy vehicle route) Lipson Cove Road (light vehicle route)	Lipson Cove Road / Lincoln Highway junction Lipson Cove Road
Freight vehicle size	Road Train = 80% (79 tonne) B-Double combinations = 20% (45 tonnes)	70 tonne freight vehicles – Considered to be representative of an average freight fleet of: AB Triple Road Train = 80% (79 tonne) B-Double combinations = 20% (45 tonnes) This aligns with the assumptions made in the recent DPTI endorsed Eyre Peninsula Freight Study (SMEC 2019).
Site receivals during operations	365 days per year	Assumes site receivals occur over an 8-week harvest season operating up to 17-hour days (peak days only) / 7 days a week.
Heavy vehicle traffic generation during operations	Grain – 40 Heavy Vehicles (HVs) per day (i.e. 80 in and out vehicle movements per day) Hematite – 70 HVs per day (i.e. 140 in and out vehicle movements per day)	Grain – up to 430 HVs per day (assumes a peak receivals day of up to 30,000 tonne) (i.e. peak of 860 in and out vehicle movements per day) ***OR*** an average of 230 HVs per day (uniform over an 8-week harvest season) (i.e. average of 460 in and out vehicle movements per day) Hematite – N/A
Light vehicle traffic generation during operations	Staff – 30 passenger vehicles per day (assumes 1 passenger vehicle per staff) (i.e. 60 in and out vehicle movements per day)	Staff – during harvest season up to 60 passenger vehicles per day (assumes 1 passenger vehicle per staff, and two shifts per day) (*i.e. peak of 120 in and out vehicle movements per day).* Outside harvest season, up to 10 passenger vehicles per day (assumes 1 passenger vehicle per staff, and one shift per day) (*i.e. peak of 20 in and out vehicle movements per day).*
Construction duration	24 months	12-13 months[1]
Construction traffic generations	Construction workforce – 50 to 250 people on site at any one time	Construction workforce:

Feature	Evaluated Project	Proposed Amendment
	Expected – up to 20 trucks, 3 buses and 10 light vehicles per day (undertaking one trip in and one trip out per day) Worst case – maximum 250 vehicle movements per hour (i.e. entire workforce drives individual vehicles) Material transport – not clearly defined	Construction workforce – 150 personnel peak workforce on site at any one time Expected worst case peak (Months 10 & 11) – up to 5 heavy vehicles (5 24-seater buses), and 149 light vehicle (7 12-seater buses, 3 light trucks, and 139 light vehicles) movements per day Material transport: Expected worst case peak (Month 2) – up to 25 heavy vehicles (19 commercial vehicles and 6 over-dimensional vehicles), and 68 light vehicles movements per day Current design development envisages all bulk earthworks and rock being site won, significantly reducing the bulk materials haul task and therefore construction traffic impact. The scale of the development is significantly lower in terms of oversized and heavy materials deliveries comparative to the previous Evaluated Project.

Notes: [1]. It is noted grain storage capacity and construction duration differ from the final concept proposed (i.e. 860,000 t storage and 18-month construction period; however, this is not considered to materially affect the TIA. The overall construction traffic generated remains a valid assumption.

3.7.2 Amended Impact Assessment Summary for Traffic

The TIA assessed the potential of the Proposed Amendment to impact to the operation of the existing road network as a result of both the construction and operation phases. The total generated traffic was been divided into three categories:

Light Vehicle traffic (e.g. 4WDs and cars) associated with staff movements to and from the site.

Heavy Commercial Vehicles (e.g. >2-tonne trucks, semi-trailers, dump trucks etc.) associated with deliveries to site during construction and operation that will travel on roads according to the current gazettal's.

Over Dimensional and Over Mass Vehicles associated with transportation of construction materials to site that may only travel under National Heavy Vehicle Regulator and DPTI permit.

Three scenarios were considered to help assess the operation impact of the Proposed Amendment, noting the following significant changes have recently occurred within the wider Eyre Peninsula road network:

Closure of railway line in June 2019, which has resulted in significant increases of freight vehicles on the road network transporting grain to existing export ports (predominately to Port Lincoln)

New export port at Lucky Bay expected to receive first harvest revivals for the 2019/2020 harvest season.

Port Spencer is expected to remove a proportion of the forecast traffic congestion from Port Lincoln (in conjunction with Lucky Bay) by offering an alternate grain receivals site and an alternate export port for the Eyre Peninsula, which would disperse the traffic impact on the existing road freight network (i.e. reduce the freight volumes to Port Lincoln) by adding competition to an otherwise monopolistic market and offer a more cost effective viable alternative for many farmers (i.e. by reducing the vehicle kilometres travelled).

The three post-development scenarios considered were:

Scenario 1 – Trip Redistribution from Port Lincoln to Port Spencer (and Lucky Bay) via sealed road network with **Uniform** Trip Generation (during the 8-week harvest).

Scenario 2 – Trip Redistribution from Port Lincoln to Port Spencer (and Lucky Bay) via sealed road network with **Peak** Trip Generation (during the 8-week harvest).

Scenario 3 – Trip Redistribution from Port Lincoln to Port Spencer (and Lucky Bay) with **Peak** Trip Generation (during the 8-week harvest), **and** east-west trip redistribution via other unsealed council routes, such that:

- A) 100% via other east-west unsealed council routes
- B) 50% via other unsealed council routes, 50% via Bratten Way.

Based on the TIA undertaken for this Project, road upgrades are not required from a capacity viewpoint, however a number of turning and other road improvements to improve road safety would be considered should the Proposed Amendment be approved. Further discussion would be undertaken with the Department of Planning, Transport and Infrastructure through the detailed design phase to reach agreement on the scope of potential improvements, particularly as it relates to providing acceleration lanes for heavy vehicles on Lincoln Highway.

Table 3-20 identifies the potential impacts due to changed traffic conditions considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Table 3-20 Summary of potential traffic impacts for the Evaluated Project (PER Section 6.7) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Construction vehicle access has the potential to impede local traffic or cause congestion. *No capacity impacts anticipated to the Lincoln Highway or Lipson Cove Road.*	Similar level of effect. The TIA identified that from a traffic capacity viewpoint, the peak construction traffic impact of the proposal is considered to be minimal. With total daily traffic volumes of up to 204 trips per day on Lipson Cove Road and up to 1,088 trips per day on Lincoln Highway during construction, the adjoining access roads will continue to operate at Level of Service (LOS) “A” (i.e. uncongested) with construction traffic. The OD vehicles will operate under pilot and may be pulled over when necessary to minimise traffic delay.
Operations	
Significant increase in heavy vehicle turning movements at the Swaffers Road / Lincoln Highway Junction. *Traffic analysis indicated no need for an upgrade from a traffic efficiency perspective (13 second delay).*	No impact. The Proposed Amendment does not propose to use Swaffers Road.
Lipson Cove Road - Light vehicle access has the potential to impede local traffic or cause congestion. *Traffic movements not expected to impede or congest or impede local, commercial or tourist use of Lipson Cove or access to Lipson Cove (10 second delay).*	Increased effect due to the use of Lipson Cove Road for heavy vehicle grain deliveries. Redirection of heavy vehicle traffic to Lipson Cove Road will result in an increased impact for approximately 8 weeks of the year during peak harvest times. However, based on the estimated increase in freight volumes converging to Lincoln Highway and Lipson Cove Road of up to 980 total two-way movements at the Lincoln Highway / Lipson Cove Road intersection (or up to 860 two-way CV movements) per day during the seasonal peak harvest period, the roads will still operate under capacity. Outside this period, traffic movements are not expected to impede or congest local, commercial or tourist use of Lipson Cove Road.

Evaluated Project Impact	Proposed Amendment Impact
Traffic impacts to the regional road network. *A Road Transport Study – Wilgerup to Port Spencer (Parsons Brinkerhoff 2012) which was provided as part of the Response to PER Submissions identified likely upgrades of roads and intersections required due to haulage of iron ore from the Wilgerup Mine. Grain transport was not considered by the assessment.*	Impact not specifically compared as grain deliveries were not assessed. However, it is acknowledged that the nature of effects will change due to the seasonal delivery of grain and absence of a specified haul route. In addition, Port Spencer is expected to remove a proportion of the forecast traffic congestion from Port Lincoln (in conjunction with Lucky Bay) by offering an alternate grain receivals site and an alternate export port for the Eyre Peninsula, which would disperse the traffic impact on the existing road freight network due to the closure of the railway line (i.e. reduce the freight volumes to Port Lincoln). SMEC (2019) identified the potential need for a strategic east-west freight link joining Tod Highway and Lincoln highway, approximately along Dog Fence Road and joining Lincoln Highway near Cape Hardy. Scenario 3A confirms that such a link would be required to service either Proposed Amendment or the proposed Cape Hardy, both of which would be expected to reduce north-south transfer of grain to Port Lincoln.

3.7.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigations identified in Section 6.7 of the PER carried forward by the Proposed Amendment:

Majority of the construction workforce is to be transported to and from the site by bus.

Additional mitigations proposed are as follows:

The site is proposed to operate with separate entry and exit access points from Lipson Cove Road, with provision for heavy vehicle queueing areas (waiting bays) on-site.

The site access arrangement has been developed to eliminate the number of vehicle conflict points (opposing turn movements) and contains all internal vehicle circulation movements on-site.

Separate Traffic Management Plans (TMP) will be developed for the construction and operation of the site, once more details are known about the construction and operational phases.

It is noted that junction and road upgrades will be required for the Proposed Amendment but will differ from the evaluated Project due to the use of Lipson Cove Road for site access. The recommended upgrades and improvements are as follows:

New Intersections:

- **Entry Access Point (T1):** Basic left turn treatment from major road (Lipson Cove Road).
- **Exit Access Point (T2):** Basic right turn treatment from minor road (site access road).

Intersection Upgrades:

- **Lipson Cove Road / Lincoln Highway intersection:** Full channelised turn treatment. Channelised right turn treatment from major road (Lincoln Highway) to be provided to allow for two queued Road Trains. Channelised left turn treatment from major road (Lincoln Highway) to be provided. Channelised left turn treatment from minor road (Lipson Cove Road) to merge into an appropriate acceleration or slip lane on Lincoln Highway exit to allow for slow moving vehicles to come up to speed.

Road Upgrades:

- **Lipson Cove Road:** Between Lincoln Highway and 50 m beyond Exit Access Point (T2), provide full sealed pavement (noting increased heavy vehicle loading) (also benefit in dust suppression) and localised vegetation trimming (to improve sight lines). Maintain existing priority controls for junction with South Coast Road (located along road section).

3.8 Waste and Materials

A qualitative assessment of impacts due to the generation and management of waste and materials has been undertaken for the Proposed Amendment to enable a comparison with the Evaluated Project (Section 6.8 of the PER), and to determine whether additional management strategies are required.

3.8.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels of soil disturbance, including blasting, and construction of similar types of infrastructure (road upgrades, internal roads, storage facilities, conveyors, jetty structure).

A comparison of the types of waste expected from the Evaluated Project and the Proposed Amendment is summarised in Table 3-21.

Table 3-21 Comparison of expected types of waste to be generated

Evaluated Project	Proposed Amendment
Construction	
Topsoil	No change.
Excavated subsoil and rock	No change.
Packaging and off cuts from construction materials	No change.
Mixed waste comprising kitchen and general waste from temporary buildings	No change.
Oil and air filters from maintenance of plant and equipment	No change.
Sewage from ablutions blocks	No change.
Stormwater captured from the catchment	No change.
Operations	
Packaging from warehouses	No change.
Mixed waste comprising kitchen and general waste from office buildings and maintenance sheds	No change.
Minor volumes of chemical and fuel waste	No change.
Oil and air filters from maintenance of plant, equipment, the switchyard and generator	No change, other than food-grade lubricants to be used on export conveyor and ship loader).
Sewage from ablutions blocks	No change.
Ballast water from ships	No change
Stormwater captured from the site catchment	No change.
Shipping activities involving the docking and loading of cargo vessels which sail in foreign waters: Material used to pack or stabilise cargo Galley and food waste Human, animal or plant waste Refuse or sweepings from the holds or decks of vessels	No cargo, waste or material to be accepted from vessels.
Decommissioning	
Fuels, oils and other chemicals stored on-site	No change.
General waste from workers	No change.

3.8.2 Amended Impact Assessment Summary for Waste and Materials

Table 3-22 identifies the potential impacts due to the generation of waste considered for the Evaluated Project and provides a comparison with the expected impacts from the Proposed Amendment.

Table 3-22 Summary of potential waste impacts for the Evaluated Project (PER Section 6.8) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Generation of waste and materials and consumption of resources. *Strategies identified for the project to 'avoid and reduce waste' and 'to maximise the value of our resources'.*	No change.
Uncontrolled (accidental) release of waste from the project. *The PER risk assessment (Section 7 of the PER) assigned a low residual risk for potential hazards associated with the management of waste (including contamination).*	No change.
Operations	
Generation of waste and materials and consumption of resources from site operations. *Strategies identified for the project to 'avoid and reduce waste' and 'to maximise the value of our resources'.*	No change.
Generation of waste and materials from shipping activities. *Waste from ships (solid waste, black water or grey water) will not be accepted by the project.*	No change.
Uncontrolled (accidental) release of waste from the project. *The PER risk assessment (Section 7 of the PER) assigned a low residual risk for potential hazards associated with the management of waste (including contamination).*	No change.
Decommissioning	
Generation of waste and materials and consumption of resources. *Strategies identified for the project to 'avoid and reduce waste' and 'to maximise the value of our resources'.*	No change.
Uncontrolled (accidental) release of waste from the project. *The PER risk assessment (Section 7 of the PER) assigned a low residual risk for potential hazards associated with the management of waste (including contamination).*	No change.

3.8.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigation and management strategies identified in Section 6.8 of the PER carried forward by the Proposed Amendment:

Development of a procurement policy to encourage purchase and use of materials with recycled content, minimise packaging and materials and use materials that can be recycled at the end of their life.

Contractors and suppliers expected to reflect the policy requirements in their procurement activities.

Reuse options considered in the design:

- Spoil generated from site earthworks would be reused during construction.
- Infrastructure primarily composed of steel material which can be recycled at the end of its life and typically contains recycled content.

Key mitigation and management strategies identified in Section 6.8 not carried forward by the Proposed Amendment:

Nil

3.9 Terrestrial Ecology

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels of soil disturbance, including blasting, removal of vegetation cover and exposure of soils during construction. These activities have the potential to impact terrestrial ecology values present at the site. The comparison of impacts presented in this section is based on the PER (Section 6.9 and Appendix I) and the updated terrestrial ecology assessment undertaken in August 2019 (Appendix C).

3.9.1 Comparison of Key Inputs and Assumptions

A comparison of inputs and assumptions relevant to assessing terrestrial ecology impacts for the Evaluated Project and Proposed Amendment is shown in Table 3-23. The comparison shows no material changes to the baseline ecological conditions of the site since the Evaluated Project and a similar disturbance footprint.

Table 3-23 Comparison of assumptions and inputs for assessment of potential terrestrial ecology impacts

Input / Assumption	Evaluated Project	Proposed Amendment
Baseline Conditions		
Vegetation overview	Most vegetation in the project area is highly modified and does not possess substantially intact strata of native vegetation. Paddocks dominated by agricultural plants or weed species, with no significant trees.	No change. It is noted that an increase in weed species was recorded in 2019.
Protected flora	No rare and/or threatened flora species identified within the project development footprint and are considered unlikely to occur. The Shore Westringia Tall Open Shubland is protected by a development exclusion zone.	No change.
Conservation values	The remnant Low Shrubland association confined to the coastal cliff top is of regional conservation importance due to the extent of historical vegetation clearance in the region.	No change.
Fauna values	No significant native fauna species. Concentration of fauna species in areas of the site that native vegetation remains.	No change.
Development conditions		
Project disturbance footprint (terrestrial)	6.67 ha (2.78 ha on the site and 3.89 ha along Swaffers Road)	3.01 ha on the site and localised trimming along Lipson Cove Road to improve sight lines.
Location of project infrastructure	Primarily within the area that has historically been cleared of native vegetation (the paddocks).	Primarily within the area that has historically been cleared of native vegetation (the paddocks).
Native vegetation clearance	Restricted to: The construction of the conveyor and jetty structure across the clifftop coastal zone. Construction of the haul road across tall open shrubland within the claypan immediately west of Rogers Beach.	Restricted to: The construction of the conveyor and jetty structure across the clifftop coastal zone. Trimming of vegetation along Lipson Cove Road to improve sight lines.

Input / Assumption	Evaluated Project	Proposed Amendment
	Narrow corridor of highly degraded native vegetation due to widening of Swaffers Road.	No native vegetation clearance required along Swaffers Road or immediately adjoining Rogers Beach.
Proposed exclusion zones	The Shore Westringia Tall Open Shubland is protected by a development exclusion zone.	No change.
Significant Environmental Benefit		
Applicable legislation	Native Vegetation Regulations 2003	Native Vegetation Regulations 2017
Type of SEB offset proposed	Native Vegetation Management Plan comprised of rehabilitation, revegetation, weed and pest management planning.	Payment into native vegetation fund. The proponent has committed to rehabilitating an area of the site to the south of Rogers Beach and along the ridgeline between the silos, Eastern bunkers, sea and Lipson Cove Road. This may be suitable as part of an SEB offset.

3.9.2 Amended Impact Assessment Summary for Terrestrial Ecology

The expected native vegetation disturbance footprint due to the Proposed Amendment is show in Figure 3-8. The Proposed Amendment will result in 3.01 ha disturbance to native vegetation on the site comprising:

BAM 1: *Lomandra effusa* (Scented Iron-grass) grassland – 0.007 ha.

BAM 1a: *Lomandra effusa* (Scented Mat-rush) very open sedgeland on rocky slopes above coast – 0.13 ha.

BAM 3: *Nitraria billardierei* (Nitre Bush) tall open shrubland – 0.44 ha.

BAM 4: *Triodia scariosa* (Spinifex) hummock grassland – 0.28 ha.

BAM 5: *Asphodeuls fistulosus* (Onion Weed) open herbland – 2.15 ha.

Table 3-18 identifies the potential impacts to terrestrial ecology values considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

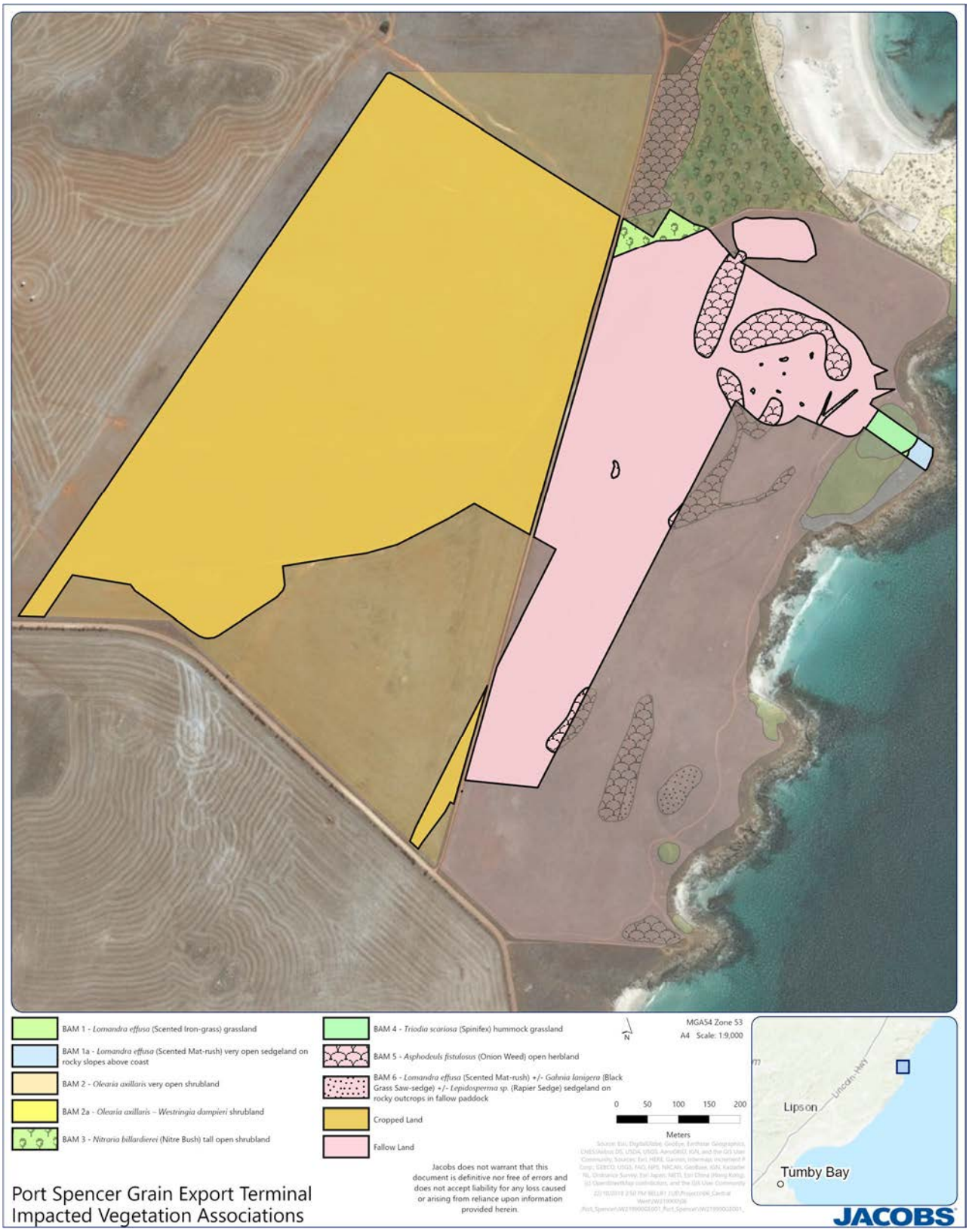


Figure 3-8 Area of terrestrial vegetation subject to clearance

Table 3-24 Summary of potential terrestrial ecology impacts for the Evaluated Project (PER Section 6.9) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Native vegetation clearance *Low significance impact due to limited area of clearance and limited biodiversity value of the site vegetation.* *The area of terrestrial disturbance was calculated to be 6.67 ha, with a corresponding SEB area of 15.66 ha.* *0.77 ha* Enchylaena tomentosa *(ruby saltbush),* Maireana brevifolia *(yanga bush) Low Shrubland over* Triodia irritans *(Porcupine grass) on the coastal strip.* *2.01 ha of* Nitraria billardierei *(dillon bush) Tall Open Shrubland over* Tecticornia *sp. (samphire).* *3.89 ha of roadside vegetation (Swaffers Road).*	Similar level of effect. The area of terrestrial disturbance has been calculated at 3.01 ha, with most of the clearance associated with BAM 5, containing sparse native plants of low diversity. These rocky outcrops were dominated by Onion Weed (*Asphodelus fistulosus*) and Soursob (*Oxalis pes-caprae*) and contained a very sparse cover of natives, mainly *Maireana brevifolia.* Areas of native vegetation disturbance 0.007 ha *Lomandra effusa* (Scented Iron-grass) grassland. 0.13 ha *Lomandra effusa* (Scented Mat-rush) very open sedgeland on rocky slopes above coast. 0.44 ha *Nitraria billardierei* (Nitre Bush) tall open shrubland. 0.28 ha *Triodia scariosa* (Spinifex) hummock grassland. 2.15 ha *Asphodeuls fistulosus* (Onion Weed) open herbland. Bushland Assessment Datasheets for the proposed clearance are included as part of Appendix C.
Impacts to rare and/or threatened species and communities *No impacts anticipated.*	No change.
Direct mortality of individuals during clearing and earthworks *Assessed as low significance impact despite potential moderate magnitude effects (likely loss of a significant number of individuals from the local population). This is due to: limited geographic extent; limited duration (construction); rare likelihood of occurrence (effects most likely during early construction); and partially reversible.*	No change. No species of conservation significance present.
Habitat fragmentation, edge effects and isolation due to clearance of habitat. *Assessed as a low significance impact. This is due to: limited geographic extent and quantity of clearance (6.67 ha); limited duration (construction); and provision of an SEB to offset native vegetation clearance.* *Proposed clearance of 2.01 ha of highly degraded Tall Open Shrubland habitat. The habitat provides refuge for rabbits and other pest animals including feral cats. Combined with pest animal control measures, removal of habitat assessed as a benefit.* *Proposed clearance of 0.77 ha and potential to isolate a patch of this vegetation.*	No change.
Potential for an increase in already established weed species or the introduction of new weed species via the importation of soil and rock or soil attached to earth moving plant. *Assessed to be of moderate significance. This is due to: potential for the geographic extent of impact to go beyond the immediate site; the duration would last beyond the decommissioning phase of the project; rare to infrequent occurrence; and reversibility of impacts.*	No change. There is already significant weed coverage at the site.

Evaluated Project Impact	Proposed Amendment Impact
Impacts to terrestrial flora and fauna due to dust, noise and light. *Assessed to be of low significance. Due to: the distance of the project from Lipson Island; the potential for species to move away from the site; lack of significant fauna habitat; noise and air modelling has shown significant impacts outside project footprint are unlikely.* *Potential impacts of construction generated dust on vegetation limited due to effects of wind and rain and absence of rare and/or threatened species.* *Potential impacts to birds breeding on Lipson Island from construction noise (including blasting) not expected due to distance of Lipson Island from the project area and outcomes of noise modelling.* *Potential for light overflow from construction to impact Lipson Island not expected due to distance and topography.*	No Change
Operations	
Potential for an increase in already established weed species or the introduction of new weed species. *Assessed as a moderate significance impact. This is due to: potential for the geographic extent of impact to go beyond the immediate site; the duration would last beyond the decommissioning phase of the project; rare to infrequent occurrence; and reversibility of impacts.*	No change.
Attraction of new or increased number of pest animal species (or for normally benign species to become pests through over-abundance) due to the storage and shipment of grain. *Assessed as a moderate significance impact. This is due to: potential for the geographic extent of impact to go beyond the immediate site; the duration would last beyond the decommissioning phase of the project; rare to infrequent occurrence; and reversibility of impacts.*	No change.
Altered habitat and landscape functioning from the construction of the public access road and the conveyor and jetty infrastructure due to altered overland surface flows. *Assessed as a moderate significance impact. This is due to: potential for the geographic extent of impact to go beyond the immediate site (i.e. Rogers Beach); the duration would last beyond the decommissioning phase of the project; likely continuous occurrence of effects; and partially reversible impacts.* *Assessed layout allows for a water diversion channel to direct surface water flows to the north of the Tall Open Shrubland community (north-east of project site). Potential long-term impacts to vegetation structure and function of the community. Potential for less water to flow from the catchment due to rainwater harvesting.* *Potential for the jetty structure to subtly alter wave and wind movements that drive the dynamics of Rogers Beach vegetation community and habitat.* *Potential for long term toxic effect to plants in the Tall Open Shrubland community due to iron ore spillage along haul route.*	No change – primarily due to the altered hydrodynamics expected at Rogers Beach which may affect Rogers Beach vegetation community and habitat and potential.

Evaluated Project Impact	Proposed Amendment Impact
Potential for the isolated vegetation community that would be created by construction of the conveyor and jetty to be impacted by landscape function.	
Impacts to rare and/or threatened species and communities *No impacts anticipated.* It is noted that following submission of the PER, Centrex referred the project to the Commonwealth Department for Sustainability, Environment, Water, Population and Communities, which was subsequently assessed and approved as a controlled action and subject to conditions.	No change. Peninsula Ports is currently seeking to transfer the EPBC Act Approval and will undertake the project in accordance with the conditions of approval.
Direct mortality of individuals due to increased traffic movements along Swaffers Road.	Altered effect – the potential for impact would occur along Lipson Cove Road.
Revegetation, habitat enhancement and compensation *A moderately significant positive impact from the project anticipated through provision of a SEB offset provided via rehabilitation and revegetation works and implementation of a Weed and Pest Management Plan.*	No change – An appropriate SEB will be provided for the clearance proposed as part of the Proposed Amendment, noting significant area targeted for revegetation both south of Rogers Beach and along the ridgeline between the silos, Eastern bunkers, sea and Lipson Cove Road.
Attraction of fauna due to presence of artificial water sources and increase in population size. *Assessed as low significance impact due to expected variability in water presence.*	No change. Reduced potential for impact due to reduced storage capacity of water storages.
Impacts to terrestrial flora and fauna due to dust, noise and light. *Assessed to be insignificant.*	No change.
Project infrastructure creates barriers to fauna movement *Assessed to be an insignificant impact due to lack of highly mobile or terrestrial migratory species in the project area.*	No change.
Decommissioning	
Expected to be like the construction phase. *No significant impacts identified.*	No change.

3.9.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigation and management strategies identified in Section 6.9 of the PER carried forward by the Proposed Amendment:

Siting of infrastructure primarily within the area that has historically been cleared of native vegetation (the paddocks).

An SEB offset for native vegetation clearance will be delivered in accordance with the Native Vegetation Act and associated regulations.

A Weed and Pest Management Plan will be developed and implemented during all phases.

Key mitigation and management strategies identified in Section 6.9 of the PER not carried forward by the project:

The nature of the SEB is likely to differ from the rehabilitation and revegetation proposed from the Evaluated Project (in part due to a change in the Native Vegetation Regulations since the Evaluated Project).

3.10 Lipson Cove

The Evaluated Project and the Proposed Amendment both propose to construct and operate a bulk shipping facility approximately 1.5 km north of the Lipson Island Conservation Park. The PER process identified Lipson Island as an ecological value requiring specific consideration and assessment due to its proximity to the site and conservation significance. Lipson Island supports populations of breeding birds, including the Little Penguin.

The comparison of impacts presented in this section is based on the PER (Section 6.10 and Appendix C).

3.10.1 Comparison of Key Inputs and Assumptions

A comparison of inputs and assumptions relevant to assessing impacts to Lipson Island ecological values for the Evaluated Project and Proposed Amendment is shown in Table 3-25.

Table 3-25 Comparison of assumptions and inputs for assessment of Lipson Island impacts

Input / Assumption	Evaluated Project	Proposed Amendment
General		
Assumed noise level of seabird rookeries	Frequent episodes above 70 dB recorded.	No change.
Lighting	Domed, focussed low level lights, with the primary source on the jetty.	No change.
Distance from Lipson Cove to jetty	1.5 km	No change.
Sediment transport	The sediment transport assessment demonstrated that suspended material in the marine environment is unlikely to reach Lipson Island.	No change. The sediment transport assessment predicted that changes in hydrodynamics, waves and consequently the sediment transport regime, decrease with distance from the development and are expected to be negligible around Lipson Cove and Lipson Island.
Construction		
Noise sources	Pile drilling, driving and general construction	Significant reduction in pile driving and drilling due to reduction from 184 to 18 piles. Underwater noise associated with rock dumping to construct the causeway is considered to be at a relatively low level and does not have characteristics like piling that could significantly affect fauna. Overall earthworks volumes, drilling and blasting equal or lesser than the Evaluated Project.
Duration	18 months	18 months
Siltation and turbidity controls	Pile fabric filtering would be used around each pile.	No change.
Operational		
Noise sources	Mainly mechanical sources. Noise levels at Lipson Cove predicted to be less than 33 dB(A)	Mainly mechanical sources and truck movements. Noise levels at Lipson Cove predicted to be less than 41 dB(A)

3.10.2 Amended Impact Assessment Summary for Lipson Island

Table 3-18 identifies the potential impacts to Lipson Island ecological values considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Table 3-26 Summary of potential noise impacts for the Evaluated Project (PER Section 6.10) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Noise disturbance to seabird rookeries and roots. *Disturbance associated with project noise is not expected.*	No change. Disturbance associated with project noise is not expected. Duration of peak operations is limited to two months for the Proposed Amendment.
Light disturbance to seabird rookeries and roots during construction. *Illumination from the project site and jetty is not likely to cause disturbance. Project conditions for significant bird strike are not evident or likely.*	No change.
Soil erosion and siltation of adjacent coastal marine environments. *Negative impacts not expected – soil erosion would be controlled, and modelling showed suspended material in the marine environment is unlikely to reach Lipson Island.*	No change. Revised coastal modelling for the Proposed Amendment has been undertaken and confirms negligible impacts to sediment transport at Lipson Island.
Weed proliferation on Lipson Island. *Impacts assessed as unlikely. Weed establishment would be difficult due to the large numbers of breeding and roosting birds (i.e. the effects of trampling, guano concentration and use of vegetative matter for nesting material).*	No change.
Siltation and turbidity pollution of Lipson Island marine environment. *Negative impacts not expected – turbidity effects would be controlled, and modelling showed suspended material in the marine environment is unlikely to reach Lipson Island.*	No change. Revised coastal modelling for the Proposed Amendment has been undertaken and confirms negligible impacts to sediment transport at Lipson Island.
Smothering of terrestrial vegetation on Lipson Island due to dust generation from the project. *Lipson Island is not expected to be impacted by dust generated from the project. Air quality modelling indicated air quality impacts are not expected at Lipson Island.*	No change.
Impacts to wildlife through exposure to dust containing metals. *Lipson Island is not expected to be impacted by dust generated from the project. Air quality modelling indicated air quality impacts are not expected at Lipson Island.*	No potential for impact due to the removal of iron ore from the project scope.
Impact of feral animals on seashore foraging seabirds. *Assessed as not expected to pose a negative impact to Lipson Island due to the nature of the port development, lack of on-site accommodation and provision of appropriate waste disposal facilities.*	No change.
Release of invasive marine species from ballast water. Refer to Section 6.11 of the PER.	No change – Refer to Section 3.11.
Uncontrolled spill of wastewater containing oils, solvents, metals and other contaminants *Assessed as not expected to pose a negative impact to Lipson Island due to:* *Well-developed management practices for hydrocarbons and chemicals throughout industry* *Visiting vessels not anchoring in or around the immediate area of Lipson Island*	No change.

Evaluated Project Impact	Proposed Amendment Impact
No fuel or hazardous material loading or unloading proposed as part of port operations.	
Wildlife entanglement from uncontrolled release of hard waste. *Impacts assessed as unlikely as project would contain all hard waste on site.*	No change.
Disturbance to Lipson Island from increased visitation due to interest in the project. *Assessed as unlikely as the project area would not be open to recreational fishing and therefore an increase in recreational and angler boats is unlikely.*	No change.
Increased habitat for terrestrial invasive species (e.g. silver gull). *The PER identified that inappropriate and increased provision of food resources may increase local Silver Gull populations. If not managed, Silver Gull could increase in numbers at Lipson Island to the detriment of other seabird species by direct predation. The risk of impacts at Lipson Island were assessed as low (Table 7-4 of the PER).*	No change.

3.10.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigation and management strategies identified in Section 6.10 of the PER carried forward by the Proposed Amendment:

Soil erosion and sediment controls measures (Section 6.2, 6.3 and 7.3.9 PER).

Development and implementation of a Waste Management Plan for the project.

Silver Gull Management Plan for the project (incorporated into the Weed and Pest Management Plan).

Dome focussed low level lights.

Key mitigation and management strategies identified in Section 6.10 of the PER not carried forward by the project:

Pile fabric filtering used around each pile (refer to Section 3.11.3 for marine management measures).

3.11 Marine Ecology

The Evaluated Project and the Proposed Amendment differ in terms of the footprint, construction method and type of maritime structure proposed. The comparison of impacts presented in this section is based on the impact assessment presented in the PER (Section 6.11 and Appendix K) but considering the revised project footprint, as well as revised coastal processes and sediment transport modelling undertaken for the Proposed Amendment.

3.11.1 Comparison of Key Inputs and Assumptions

A comparison of inputs and assumptions relevant to assessing impacts to marine ecology values for the Evaluated Project and Proposed Amendment is shown in Table 3-25.

The key differences between with the Evaluated Project and the Proposed Amendment from a marine ecological perspective are associated with the proposed revised design for the nearshore marine infrastructure. The construction of a solid 240 m causeway (crest length) and amended jetty structure for the Proposed Amendment will, in some cases, result in differing impact assessment outcomes from the Evaluated Project.

Table 3-27 Comparison of assumptions and inputs for assessment of marine ecology impacts

Input / Assumption	Evaluated Project	Proposed Amendment
Proposed maritime structures	25 m wide by 515 m long approach jetty 55 m wide and 345 m long berthing jetty	240 m (crest length) causeway 336 m long wharf
Construction timeframe	18 months	18 months
Construction method	End over end construction methodology, commencing at the foreshore and proceeding seaward	Launched construction with piling from launch span.
Estimated number of piles (subject to final design)	184 (64 for approach jetty and 120 for berthing jetty)	18
Piling method	Jack up barge	Piles installed from launched span; no marine plant.
Assumed construction footprint	Benthic disturbance associated with the Evaluated Project jetty and berthing jetty, plus a buffer of approximately 5.5 m either side of the jetty Intertidal Rocky Reef: 429 m^2 Subtidal Rocky Reef: 1,930 m^2 Seagrass: 4,702 m^2 Sandy Substrate: 47,480 m^2 Total footprint (including buffer) – 54,541 m^2	Area under proposed causeway and revised jetty design, plus a buffer of approximately 5.5 m either side of the infrastructure Intertidal Rocky Reef: 728 m^2 Subtidal Rocky Reef: 3,378 m^2 Seagrass: 11,108 m^2 Sandy Substrate: 9,468 m^2 Total footprint (including buffer) - 24,682 m^2

3.11.2 Amended Impact Assessment Summary for Marine Ecology

As for the Evaluated Project, it is anticipated that disturbance to seagrass species during construction will be restricted to the footprint of the proposed jetty and to those areas which may be disturbed resulting from construction methods (i.e. for the jack-up barge for the Evaluated Project and from rock placement for the Proposed Amendment; assumed to be up to 5.5 m either side of the jetty).

The footprint of the marine infrastructure for the Proposed Amendment (including 5.5 m buffer) was overlaid with benthic habitat mapping completed for the Evaluated Project to support the assessment of impacts (refer to Figure 3-11 Benthic Habitat Disturbance).

Table 3-18 identifies the potential impacts to marine ecological values considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment. In addition to these potential effects, the following additional considerations have arisen due to the Proposed Amendment, and are addressed in the sections below:

- Water quality effects due to the construction of the causeway
- Potential for seagrass wrack accumulation on the proposed causeway
- Potential seagrass disturbance due to altered coastal processes
- The cumulative effect of seagrass loss in the Spencer Gulf.

Important to the assessment of these impacts is the requirement to avoid environmental harm to the extent that is reasonable and practicable.

A key change associated with the Proposed Amendment is the construction of a 240 m (crest length) causeway as part of the wharf structure. The presence of the causeway infrastructure will have a greater direct disturbance footprint within the intertidal rocky reef and seagrass habitats. Clearance of seagrass is identified in Table 3-28 as an impact that will need to be offset with an appropriate SEB to comply with the *Native Vegetation Act* and associated guidelines. Consistent with the Evaluated Project, total clearance has been assumed in areas where it is known it will not be the case (e.g. under the jetty structure and assuming a 5.5 m

buffer). An SEB would be confirmed as part of the next phase of the Proposed Amendment. Peninsula Ports will work with relevant government agencies to identify an appropriate offset.

Construction of the causeway will adopt accepted mitigations for minimising turbidity effects as detailed in Section 3.11.2.1. Any effects of sedimentation will be short term and localised.

While the construction of the causeway is an element of the Proposed Amendment with a higher degree of impact to seagrasses, the adoption of an incremental launch method for the jetty component of the wharf brings corresponding benefits when compared to the Evaluated Project:

- A significant reduction in piling (184 to 18 piles) resulting in significantly less underwater noise pollution and associated reduced effects on marine fauna.
- Significantly lower biosecurity risks during construction as marine based plant will not be required.
- The causeway will be constructed from site won rock generated as part of bulk earthworks required for the launching area and silo construction. The use these materials in the causeway will alleviate the need to dispose of surplus materials off site and is consistent with the waste management hierarchy.

In balancing the competing effects due to the introduction of the cause, an assessment of what is reasonable also requires consideration of financial implications of various measures that might be taken. The construction of a causeway for the Proposed Amendment provides a significant economic saving compared to a full jetty structure, because the material to be used will be generated on site. This was not an option for the Evaluated Project, as the waste rock was required as part of the landside development. Further background for the selection of the causeway option is provided in the PER Amendment Document.

3.11.2.1 Water Quality Effects due to Construction of the Causeway

Short term and localised turbidity and sedimentation is expected to occur as a result of causeway construction and piling activities. The level of effect associated with piling will be significantly reduced compared to the Evaluated Project due to the reduction in the total number of piles required (184 compared to 18). It is acknowledged that sedimentation and turbidity effects due the placement of fill and rock armour was not contemplated by the Evaluated Project; however, this type and scale of construction is consistent with other approved developments of similar scale and environmental conditions, and the level of turbidity effects for the Proposed Amendment are expected to be localised and short term.

The nearshore construction of the causeway will be managed in a manner to minimise indirect impacts (i.e. increased turbidity or sediment deposition) on surrounding benthic habitats. Key management measures to achieve this will include the following:

- Where appropriate (in relation to water depths and wave action) sediment curtains will be used to manage the dispersion of suspended sediments (Figure 3-9).
- Material selection will be a key component of the management of sediment dispersion. The material will be selected and collected in a manner that fines and smaller rocks are screened out to minimise the dispersion of fines within the marine environment.
- The placement of the rock armouring material will be undertaken in a controlled manner through placement with an excavator (Figure 3-10) as opposed to the uncontrolled tipping of materials.

Figure 3-9 Example of the installation of sediment curtains for the control of suspended sediments for nearshore construction in the marine environment (Image source from: Advanteering Engineering; https://www.advanteering.com.au/deepwater-point-point-walter-boatramps/)

Figure 3-10 Example of the use of excavators to place rock armouring on a groyne structure (Image source from: Advanteering Engineering; https://www.advanteering.com.au/bunbury-causeway-revetments/)

A construction methodology for the causeway construction has also been provided as part of the Amendment to PER document.

3.11.2.2 Seagrass Wrack Accumulation on the Proposed Causeway

It is known that seagrass wrack suspended in the water column can be transported in surface waters and washed up on to the shore by waves, tides and winds. Build-up is expected to occur when currents have an onshore component, or in the context of Port Spencer, during periods of southerly winds. Therefore there is the potential for seagrass wrack to accumulate on the southern side of the causeway (Greer & O'Neill 2019). It should be noted that beach-cast seagrass wrack is a natural process within an important ecological function, providing food and habitat to beach communities along shorelines (birds and invertebrates) (Oldham et al. 2014). Seagrass wrack can also negatively impact beachside communities as a result of visual amenity and odour impacts as the wrack accumulates and subsequently degrades. However, due to the remote location of the proposed causeway (approximately 20 km from the nearest town centre) and subsequent low population of the surrounding area, direct impacts on the local community beach access or tourism are not predicted. Furthermore, it is proposed that any seagrass wrack is monitored as part of the proposed coastal processes/beach monitoring programme to be implemented during operations. If seagrass wrack accumulation is seen to be an issue, then management measures such as the removal and disposal of the wrack may be implemented.

Studies have demonstrated that seagrass wrack is not likely to smother intertidal benthic communities, with Oldham et al. (2014) demonstrating that seagrass washed back into marine waters gets rewetted and stays positively buoyant for a number of hours, circulating back to the beach. It has been noted that as seagrass wrack decomposes on the beach it releases nutrients, altering sediment chemistry. Under anoxic conditions, the main by-product of decomposition is carbon dioxide (CO2), an odourless gas and under anoxic conditions, a range of gaseous by-products occur, including methane and hydrogen sulfide (H_2S) (Oldham et al. 2014).

3.11.2.3 Potential Seagrass Disturbance due to Altered Coastal Processes

The coastal assessment (Appendix D) demonstrated limited localised impacts on local hydrodynamic conditions and sediment transport adjacent to the proposed marine infrastructure. Significant impacts are not predicted to the seagrass meadows mapped offshore from the project area; however, there is the potential for some smothering of seagrass beds within the nearshore, adjacent to the southern side of the infrastructure. Sedimentation and resuspension of sediments is a natural function of local hydrodynamics within seagrass meadows, due to the meadows ability to trap suspended sediments. Given that the project area is within a moderately high energy coastline area, it is likely that the existing habitat will absorb any additional input sediment movement. As such, the slight alteration in local hydrodynamic conditions and sediment transport at the project site is not considered likely to significantly affect adjacent seagrass beds.

3.11.2.4 Cumulative Loss of Seagrasses in the Spencer Gulf

It is acknowledged that the proposed design of the nearshore project infrastructure (i.e. a rock causeway and a jetty structure) is likely to result in the loss of 11,108 m^2 (0.011km^2) of native vegetation (i.e. seagrass) as well as potential disturbance of sparse seagrass within the sandy substrate (an estimated area of 9,467 m^2 or 0.0095 km^2). This impact represents the loss of seagrass associated with the physical presence of the marine structures as well as the indirect impact of the resuspension of sediments during the construction phase. For the purposes of this assessment, an area of 20,547 m^2 (0.0205 km^2) is assumed, which is considered conservative.

South Australia is reported to host 9,620 km^2 (EPA 2009) with Spencer Gulf, particularly the Northern Spencer Gulf bioregion, thought to host 5,512 km^2 of seagrass (Warwick et al. 2012). The South Australian EPA has identified that seagrass communities within the Northern Spencer Gulf are under pressure from numerous heavy industries, coastal discharges and development (Warwick et al. 2012).

The predicted loss of seagrass associated with the project infrastructure represents less than 0.00214% and 0.00373% of the total seagrass area within South Australian and the Spencer Gulf respectively. As such the predicted loss is not deemed to be significant given the wider context of existing seagrass communities within the region (i.e. Spencer Gulf) and more broadly within the state.

Figure 3-11 Benthic Habitat Disturbance

Table 3-28 Summary of potential marine ecological impacts for the Evaluated Project (Section 6.11) and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Native vegetation (i.e. seagrass) and other benthic habitat loss due to disturbance of the seabed. *Scale and intensity of impacts may be relatively insignificant in terms of the wider Spencer Gulf ecosystems.* *Conservative estimates of potential area of disturbance were approximately 1,930 m^2 for the rocky reef habitat and 4,702 m^2 for the seagrass meadows. However, considered unlikely that the whole construction footprint would be impacted.* *Estimated areas for impacts to each seagrass association:* *Mixed meadows of A. antarctica, P. sinuosa and P. angustifolia (moderate cover of 50% seagrass and 50% sandy substrate: 1,317 m^2.* *Mixed meadows of P. sinuosa and P. angustifolia (cover of 90% seagrass and 10% bare sand: 3,385 m^2.* *H. nigricaulis and H. australis (sparse cover of 5-10% and recovery expected soon after construction): 6,520 m^2* *Approximately 430 m^2 potential impact area for the intertidal rocky shore (expected to be an overestimate of native vegetation clearance as only a small portion of clearance supports algal assemblages).*	Similar level of effect. An assessment of the revised nearshore infrastructure footprint (including the proposed causeway and jetty) and proposed construction methodology indicates that the predicted area of impact on the benthic environment (24,682 m^2) is significantly smaller than initially predicted for the Evaluated Project (54,541 m^2), primarily as a result of the significant reduction in the jetty footprint within the sandy substrate. Revised estimates of the area of disturbance/impact area outlined in Table 3-27. It is acknowledged that the revised design will likely result in a higher level of seagrass loss than the Evaluated Project (estimated to be 11,108 m^2 compared with 4,702 m^2 for the seagrass meadows). As outlined within the PER for the Evaluated Project, the environmental risk associated with the marine infrastructure footprint was determined to be Moderate. The application of the same qualitative risk assessment framework (matrix) in the context of the Proposed Amendment also results in residual risk rating of 'Moderate'. This rating is primarily based on the consequence determination of 'minor', which takes into consideration the broader extent of similar habitats within the wider Spencer Gulf and thus it has been determined that the Proposed Amendment does not result in a significant impact to benthic habitats and native marine vegetation. Refer to Section 5.11.1.1 of the PER Response to PER Submissions for further context.
Impacts to rare and/or threatened species and communities *No impacts anticipated.* *Although it has been described as rare, the Crested Threefin fish (endemic to South Australia) not considered to be rare within its known range.* *Unlikely to be detrimental impact to Leucosiid crab, Cryptocnemus vincentianus, due to localised nature of habitat loss under the proposed jetty.*	No change. One rare and one endemic marine species were noted during the marine baseline studies (a Leucosiid crab and the Crested Threefin fish respectively). Due to the relatively small area of impact associated with the project nearshore infrastructure, in the context of the wider habitats within the Spencer Gulf, it is not expected that there will be any significant impacts to these species.
Direct mortality of individuals of (primarily sessile or slow moving) species directly beneath where piles are installed *Potential for impacts at the population level assessed as negligible due to low numbers of individuals expected to be impacted and the high spatially and temporally variability of the populations.*	Increase potential for effect. Whilst the significant reduction in the number of piles required for the revised nearshore infrastructure (18 compared to 184), reduces the risk of direct mortality due to this aspect, the addition of a causeway to the project increases the area subject to physical disturbance and resultant mortality of sessile or slow-moving fauna.
Direct mortality of individuals smothered by sediment generated from construction. *Potential for impacts at the population level assessed as negligible as the disturbance area is small and duration is limited to construction.*	Similar level of effect. The construction of the proposed causeway is likely to result in a greater generation of suspended sediments than the initially proposed 'jetty only' design within the Evaluated Project. However, the implementation of the mitigation and management strategies outlined within the Evaluated Project (e.g. silt curtains) is likely to reduce the potential impacts to negligible, particularly in the context of the extent of the wider habitats within the Spencer Gulf and the short duration of causeway construction

Evaluated Project Impact	Proposed Amendment Impact
	(approximately four months). The Evaluated Project anticipated a total marine construction period of 18 months (and 184 piles).
Impacts to marine biota (direct mortality or behavioural impacts) due to noise pollution. *No effects at the population level are anticipated.* *Assessed as unlikely that underwater noise generated by vibration pile driving and drilling will exceed levels known to cause injury to marine biota (fish, marine mammals).* *During impact pile driving activities, the cumulative sound exposure level could exceed the threshold for injury to marine mammals at very close distances from the source.* *Noise impacts will not be continuous and will be short.*	Reduced effect. The Proposed Amendment will result in a significant reduction in the number of piles required for the revised nearshore infrastructure (18 as opposed to 184) resulting in significant reduction in potential vibration and noise impacts. In addition, underwater noise from shore-based rock dumping associated with the causeway construction is considered relatively low in comparison to noise levels associated with piling. Therefore, it is predicted that the risk of mortality or behavioural impacts on marine fauna associated with the proposed piling and nearshore construction activities will be significantly reduced.
Habitat fragmentation due to vegetation loss *Extent of vegetation loss limited (jetty construction footprint and predominantly associated with pile installation) and expected that most habitats would remain intact.*	Increased effect. An assessment of the revised nearshore infrastructure footprint (including the proposed causeway and jetty) and construction methodology indicates that while the overall area of impact associated with the Proposed Amendment is significantly smaller than initially predicted for the Evaluated Project, the presence of a solid causeway is likely to result in a greater level of habitat fragmentation than the previous trestle jetty design. Nevertheless, the significance of the habitat fragmentation is determined to be low in the context of the extent of the wider seagrass and algal habitats within the Spencer Gulf.
Introduction of additional marine pests via marine vessels / construction equipment. *Possible means for the introduction of non-indigenous marine species at the Project include organisms present in ballast water or as hull biofouling being translocated via construction equipment (i.e., dredges and barges) during the construction phase.*	Reduced potential for impact. Due to the revised construction methodology, with the bulk of the marine works being shore based, the presence of marine vessels during construction will likely be limited to a small workboat to support the installation and management of a silt curtain during the causeway construction. This vessel will likely be locally sourced from the region, with inter-state or international marine vessels unlikely to be present. Therefore, the potential for introduction of non-indigenous marine species is associated with the Proposed Amendment is significantly reduced.
Operations	
Habitat fragmentation and native vegetation loss due to vegetation loss from shading or sedimentation *Predicted that where seagrass loss occurs, species composition of macro-infauna assemblages would change to reflect assemblages more typically found in sandy substrates.* *The potential effects of habitat fragment were assessed to by predominantly limited to the area beneath the jetty with some additional losses up to 500 m either side of the jetty.* *Assessed as a relatively small scale of marine fauna displacement compared to regional extent of seagrass meadows and macroalgal assemblages.*	Similar level of effect. An assessment of the revised nearshore infrastructure footprint (including the proposed causeway and jetty) and construction methodology indicates that while the overall area of impact associated with the Proposed Amendment is smaller than initially predicted for the Evaluated Project, the presence of a solid causeway is likely to result in a greater level of habitat fragmentation and native vegetation loss associated with direct disturbance and shading than the previous trestle jetty design. Nevertheless, the significance of the habitat fragmentation is determined to be low in the context of the extent of the wider seagrass and algal habitats within the Spencer Gulf. Refer to Section 5.11.1.1 of the PER Response to PER Submissions for further context.
Shading causes loss of species which are dependent on high light levels	Similar level of effect. The proposed solid causeway design will result in direct disturbance of seagrass habitat beneath its footprint and shading

Evaluated Project Impact	Proposed Amendment Impact
The east-west orientation of main jetty approaches the maximum shading effect possible due to the east-west movement of the sun. *Conservative estimates of potential area of disturbance were approximately 1,930 m^2 for the rocky reef habitat and 4,702 m^2 for the seagrass meadows (i.e. like construction).* *Estimated areas for impacts to each seagrass association:* *Mixed meadows of A. antarctica, P. sinuosa and P. angustifolia (moderate cover of 50% seagrass and 50% sandy substrate: 1,317 m^2.* *Mixed meadows of P. sinuosa and P. angustifolia (cover of 90% seagrass and 10% bare sand: 3,385 m^2.* *H. nigricaulis and H. australis (sparse cover of only 5-10%): 6,520 m^2* *Approximately 430 m^2 potential impact area for the intertidal rocky shore (expected to be an overestimate of native vegetation clearance as only a small portion of clearance supports algal assemblages.* *Likely extent of species loss assessed as:* *Macroalgal assemblages: likely over a small spatial scale for the life of the port, with recovery expected post decommissioning.* *Seagrasses: shading from jetty likely to result in some changes to composition and abundance of seagrass meadows with immediate effects of shading anticipated immediately under jetty. Localised changes to sediment stability and faunal assemblages may subsequently occur.*	effects beneath the wharf structure. However, the significance of this shading and potential indirect impact on light dependent benthic habitats (i.e. seagrass and macroalgae) is determined to be low in the context of the extent of the wider seagrass and algal habitats within the Spencer Gulf and therefore there is no change in the overall residual risk associated with this aspect of the Proposed Amendment. Refer to Section 5.11.1.1 of the PER Response to PER Submissions for further context.
Potential impacts on marine communities due to sedimentation *Upper estimates of potential disturbance areas:* *Macroalgae: upper extent of 52,463 m^2* *Seagrasses: upper extent 113,406 m^2* *Assessed impacts from sedimentation based on project modelling:* *Minimal impacts on rocky reef areas with relatively short timeframes for recovery after decommissioning.* *Estimate for seagrass loss is considered an overestimate as extensive loss of seagrasses unlikely. Seagrass is expected to recover following decommissioning (removal of infrastructure).* *Interference with filter feeding of sessile invertebrates in both the rocky reef and seagrass meadows.* *Potential increases in the extent of blow outs or sand-patches within seagrass meadows. However, this disturbance area is likely to be the same as that impacted by more general sedimentation impacts.* *Scour holes around individual jetty pylons predicted (0.3 to 1.4 m in depth with long-shore length of 0.6 m to 2.0 m). However, this disturbance area is likely to be the same as that impacted by shading...*	Similar level of effect. The construction of the proposed solid causeway is likely to result in a change in the nearshore sediment transport adjacent to the structure. A sediment transport and coastal processes modelling study (Appendix D) has indicated that the footprint of the Proposed Amendment will result in a broad level of sediment accretion (0.15 km^2 or 150,000 m^2) on the southern side of the coastal infrastructure and erosion (0.08 km^2 or 80,000 m^2) on the northern side. As outlined in the PER for the Evaluated Project, the nearshore coastal habitat north and south of the proposed infrastructure is dominated by rocky reef (with macroalgae) and intertidal rocky shore habitat. While the change in sediment transport and coastal processes is likely to impact these nearshore benthic habitats, the significance of these impacts are determined to be moderate in the context of the extent of the wider benthic habitats within the Spencer Gulf. In addition, the modelling has demonstrated that any changes in the nearshore sediment transport regime are not expected to impact Lipson Cove and Lipson Island to the south of the proposed development.

Evaluated Project Impact	Proposed Amendment Impact
Revegetation, habitat enhancement and compensation *Terrestrial SEB proposed to offset seagrass and macroalgal habitat clearance. Focus on mitigation and management practices to minimise overall loss of habitat.*	No change. An appropriate SEB will be established for the Proposed Amendment in accordance with the *Native Vegetation Act 1991* and regulations (2017).
Impacts to marine biota (direct mortality or behavioural) due to noise pollution (vessel traffic). *Assessed as unlikely that underwater noise generated by vessel traffic will exceed levels known to cause injury to marine mammals. Noise impacts will not be continuous and will be short.*	No change. There are no predicted additional impacts associated with underwater noise as a result of the Proposed Amendment. In fact, given the predicted lower shipping frequencies, vessel port visits and smaller ship sizes, it is likely that any operational underwater noise impacts will be reduced.
Establishment and spread of marine pest species *Potential introduction through ballast water or as hull biofouling. Jetty structure provides opportunity for colonisation by marine pests on newly formed artificial substrates or in disturbed marine habitats.* *Biosecurity risks associated with the operation of the Evaluated Project could be reduced through the biofouling and ballast water management, surveillance and monitoring to detect marine pest introductions, and emergency response planning in the event that a pest species is discovered.*	No change. There are no predicted additional impacts associated with the introduction and establishment of the Proposed Amendment. In fact, given the predicted lower shipping frequencies and vessel port visits, it is likely that the risk of potential impacts associated with marine pests will be reduced.
Impacts to fauna behaviour due to light from operations *Potential for negative impacts to the marine environment assessed as low due to the area being influenced by artificial lighting being localised around the jetty area.*	No change. There are no predicted additional impacts associated with light spill within the marine environment as a result of the Proposed Amendment. Due to the reduced distance of the amended causeway and jetty structure, it is likely that any operational light spill impacts will be reduced.
Impacts to fishing activities and the sustainability of fishing stocks *Minimal effects on fisheries and aquaculture due to:* *The location of trawling, line fishing and netting activities away from the Evaluated Project* *No noteworthy fish populations occurring in the project area (except for Syngnathids, as discussed in the relation to seagrass habitats).* *The project area is not noted as an area for intense recreational fishing.*	No Change. There are no predicted additional impacts associated with fishing activities and the sustainability of fishing stocks as a result of the Proposed Amendment.
Impacts associated with increased fishing pressure by foreign crews accompanying vessels (abalone and reef-associated fish species). *Consideration of this issue was based on concerns raised in consultation undertaken in 2011. The PER identifies the potential for localised impacts in the immediate vicinity of berthed vessels and around the proposed jetty infrastructure if increased fishing was to occur. However, the port will not allow fishing in or around the port.*	No change. There are no predicted impacts associated with increased fishing pressure from foreign crews on international vessels. Similar rules around the port operations whilst vessels are berthed will apply.
Creation of artificial substrates altering the marine ecosystem *The PER addressed the risk/benefit associated with the creation of artificial substrates within the marine environment associated with Evaluated Project. It was determined that the physical presence of artificial hard structures would provide a beneficial impact for sessile marine invertebrates and marine flora, while*	No change. The construction of the proposed solid causeway and jetty structure associated with the Proposed Amendment will result in the creation of significant artificial substrate (representing rocky reef habitat) within the marine environment. As stated in the PER for the Evaluated Project, such substrates are likely to have a net beneficial impact on the marine environment, through the creation

Evaluated Project Impact	Proposed Amendment Impact
potentially increasing the risk of colonisation of non-indigenous marine organisms.	of significant available substrate and niches for benthic habitats and marine fauna. While, the risk of the establishment of non-indigenous marine organisms remains, the likelihood is thought to have decreased due to the predicted lower shipping frequencies and vessel port visits as well as the reduction in pile and jetty structures.
Disturbance to sandy substrates from propeller wash. *To minimise turbidity and disturbance to sediments, operational measures have been proposed which would ensure that cargo vessels are not under their own power within 1.5 km of the jetty. Such measures would minimise the potential effects on the sandy substrate habitat*.	No change. There is likely to be reduced impact associated with the effects of turbidity generated by propeller wash from vessels due to the predicted lower shipping frequencies and vessel port visits.
Increased sedimentation from port operations. *Hydrodynamic modelling indicates that some sedimentation may occur inshore of the berthing jetty, with increases to seabed levels predicted to be in the order of 0.03 to 0.05 m per annum.* *Increased suspended particulates and sedimentation has the potential to interfere with the feeding mechanisms of filter feeding sessile invertebrates (such as the Razorfish, P. bicolor) which in turn could lead to increased mortality of the species at the Project site.*	Similar level of effect based on the revised hydrodynamic modelling. There is likely to be a reduced impact on marine ecological values associated with the sedimentation from port operations vessels due to the predicted lower shipping frequencies and vessel port visits.
Impacts to organisms due to accumulation of shipping related contaminants in sediments. *Over time there may also be the potential for shipping related contaminants to accumulate in the sediment under the berthing jetty and surrounding the jetty. Some chemicals can be acutely toxic to organisms when introduced at concentration above natural background levels, while others can bioaccumulate or biomagnify over time. Given the sediments are sandy, and as the Project is situated on a moderately exposed coastline, the potential for accumulation is less than if the Project was situated in muddy, sheltered conditions.*	Reduced potential for impact. There is likely to be a reduced impact on marine ecological values associated with the contamination of seabed sediments from vessel operations within the port due to the predicted lower shipping frequencies and vessel port visits.
Incidental ore spillage to the marine environment *After consideration of the prevailing moderate energy environment at the Project, the solubility of iron in the marine environment, and assuming iron ore releases (if they occur) are relatively small, the impacts to the marine environment are not expected to be significant.*	No impact/Not applicable. Iron ore export is not within the scope of the Proposed Amendment.
Incidental grain spillage to the marine environment. *The introduction of fine organic matter into the marine environment could result in:* - *Decreased dissolved oxygen as a consequence of increased decomposition by microorganisms.* - *Increased suspended particulates which reduce light penetration and can cause smothering of benthic species, and* - *Increased growth of aquatic plants due to increased nutrient inputs. Nuisance growth of aquatic plants can result in algal blooms and associated toxic effects. In addition, when the plants die, there is a reduction in dissolved oxygen concentrations as the plants decompose.*	No change. The overall risk of incidental grain spillage to the marine environment has not changed from the Evaluated Project. It is noted that some of the initially proposed design measures (i.e. fully enclosed loading and unloading facilities) to mitigate for this risk will not be implemented; nevertheless, this risk remains unlikely and should it occur, the impact would not be significant due to the fact the seabed at the jetty loading location is dominated by sandy substrates with sparse seagrass cover.

Evaluated Project Impact	Proposed Amendment Impact
It is considered unlikely that an accidental spill of grain at the site would result in an unacceptable environmental impact given that accidental releases would be readily minimised and mitigated, and proposed design including enclosed loading, unloading storage and handling facilities	
Oil spills in the marine environment *Increased ship movements in the Spencer Gulf as a result of the Port have the potential to increase the risk of oil spills in the gulf.* *The risk of oil spills in the Spencer Gulf as a result of ship movements to and from the Port were assessed to be low.*	No change. As with other shipping related activities, there is likely to be a reduced risk on marine ecological values associated with the oil spills from vessel operations within the port due to the predicted lower shipping frequencies and vessel port visits.

3.11.3 Mitigation and management carried forward by the Proposed Amendment

Key mitigation and management strategies identified in Sections 6.11, 17.4.2 and Appendix K of the PER carried forward by the Proposed Amendment:

An SEB offset for native vegetation clearance will be delivered in accordance with the Native Vegetation Act and associated regulations.

Measures to manage increased turbidity from construction of the nearshore infrastructure (e.g. silt curtains)

The principles of best management practice (BMP) and best available technology economically achievable (BATEA) will be adopted (Section 17.4.2 of Appendix K of the PER):

- Use of operational procedures that minimise vibration impacts while retaining productive efficiency.
- Equipment, plant and machinery which incorporates advanced and affordable technology to minimise vibration output.

Management and monitoring measures to reduce potential impacts of acoustic pollution including (Section 17.4.2 of Appendix K of the PER):

- Soft start techniques for impact pile driving
- Marine mammal monitoring during impact pile driving undertaken during Southern Right whale calving season (May and November).
- Construction to begin onshore and advance seaward.
- Implementation of ‘safety zones’ for marine fauna in line with the South Australian Department of Planning, Transport and Infrastructure Underwater Piling Noise Guidelines.

Reduction of biosecurity risks associated with operation of the port through biofouling and ballast water management, surveillance and monitoring to detect marine pest introductions.

Emergency response planning in the event that a pest species is discovered.

Key mitigation and management strategies identified in Sections 6.11, 17.4.2 and Appendix K of the PER not carried forward by the project:

The nature of the SEB is likely to differ from the rehabilitation and revegetation proposed from the Evaluated Project.

Any sediment generated from drilling activities would be extracted and pumped to the seabed within a disposal area. This disposal area would be bunded by silt curtains, established within the construction footprint and located away from the rocky reef and seagrass habitats – This proposed mitigation is not thought to be practical or proportional given the significantly reduced number of piles required for the Proposed Amendment and the proposed application of alternative best practice measures for managing sediment dispersion (i.e. the use of silt curtains)

Use of noise insulation and hammer cushions - The use of physical noise attenuation techniques for the proposed piling is not thought to be practical or proportional given the significantly reduced number of piles

required and the proposed application of the alternative best practice measures for managing noise impacts on marine fauna (i.e. use of safety zones)

3.12 Coastal Environment Sediment

The maritime structure proposed for the Proposed Amendment has the potential to cause different coastal and sediment transport effects compared to the Evaluated Project primarily due to the inclusion of a causeway structure extending approximately 240 metres (crest length) from the shore.

The comparison of impacts presented in this section is based on the PER (Section 6.12 and Response Document) as well as revised coastal processes and sediment transport modelling undertaken for the Proposed Amendment (refer to Appendix D).

3.12.1 Comparison of Key Inputs and Assumptions

A comparison of inputs and assumptions relevant to assessing impacts to changes in coastal processes and sediment transport for the Evaluated Project and Proposed Amendment is shown in Table 3-29.

Table 3-29 Comparison of assumptions and inputs for assessment of coastal sediment transport effects

Input / Assumption	Evaluated Project	Proposed Amendment
Length of time vessels moored at the jetty	Approximately 20% of the year. 48 days for Cape Class 16 days for Panamax	Approximately 20% of the year. 60 days for a mixture of Panamax and smaller vessels (down to Handy)
Keel clearance for fully loaded vessels	Minimum 2 m for Cape Class vessels	1.5 m for Panamax Vessels
Pile spacing	18m bents (jetty), 16m bents (wharf)	42 m bents
Causeway	No causeway or causeway structure proposed.	Causeway structure extending approximately 240 m (crest length) from the shore.

3.12.2 Amended Impact Assessment Summary for Coastal Environment Sediment

A Sediment Transport Modelling Investigation has been undertaken to assess changes to the wave, hydrodynamic and sediment transport regime of the marine environment directly offshore from Port Spencer due to the Proposed Amendment.

A series of models were developed to simulate the wave climate, the coupled hydrodynamic and wave flow regime and the sediment transport regime. Where data was available, these models were calibrated against measured data. The project extensively used the data collected as part of a pervious study in the area by ASR Ltd (Grant et al, 2011).

The models used were as follows:

Wave hindcasting was undertaken using the wave model SWAN (Simulating WAves Nearshore) which is part of the Delft3D model suite.

Hydrodynamics and sediment transport were modelled using Delft-Flow coupled with Delft-Wave (which is a front end for SWAN) modules from the Delft3D Model Suite from Deltares, which is an industry standard for hydrodynamic numerical modelling.

Sediment transport modelling was undertaken using the 2DBeach model form the 3DD model suite.

Models were developed for waves, hydrodynamics and sediment transport. In each case, the study site was modelled under three scenarios:

Baseline condition

With the causeway structure included

With the causeway included and with the berthed ship in place.

The pilings of the proposed wharf were not included in the models as they are only approximately 1 m in diameter and are not expected to have a significant impact on the broader sediment transport regime.

Estimated annual changes in accretion and erosion due to the Proposed Amendment were modelled for grain sizes of 0.3 mm and 0.13 mm respectively (refer to Figure 3-12). Sediment with a grain size of 0.13 mm is more mobile than sediment with a grain size of 0.3 mm and so can be considered the worst, or most conservative, case. Annual sedimentation was calculated by averaging the winter and summer annual changes in accretion and erosion due to the presence of the proposed development. Greater accretion in the nearshore on the reefs should be treated with caution as sediment is unlikely to settle on the rocky substrate.

The model results for the Proposed Amendment showed chronic accretion to the south-west of the development and erosion on the north east that could be addressed by intermittent sand transfer from south to north dictated by a beach profile monitoring programme.

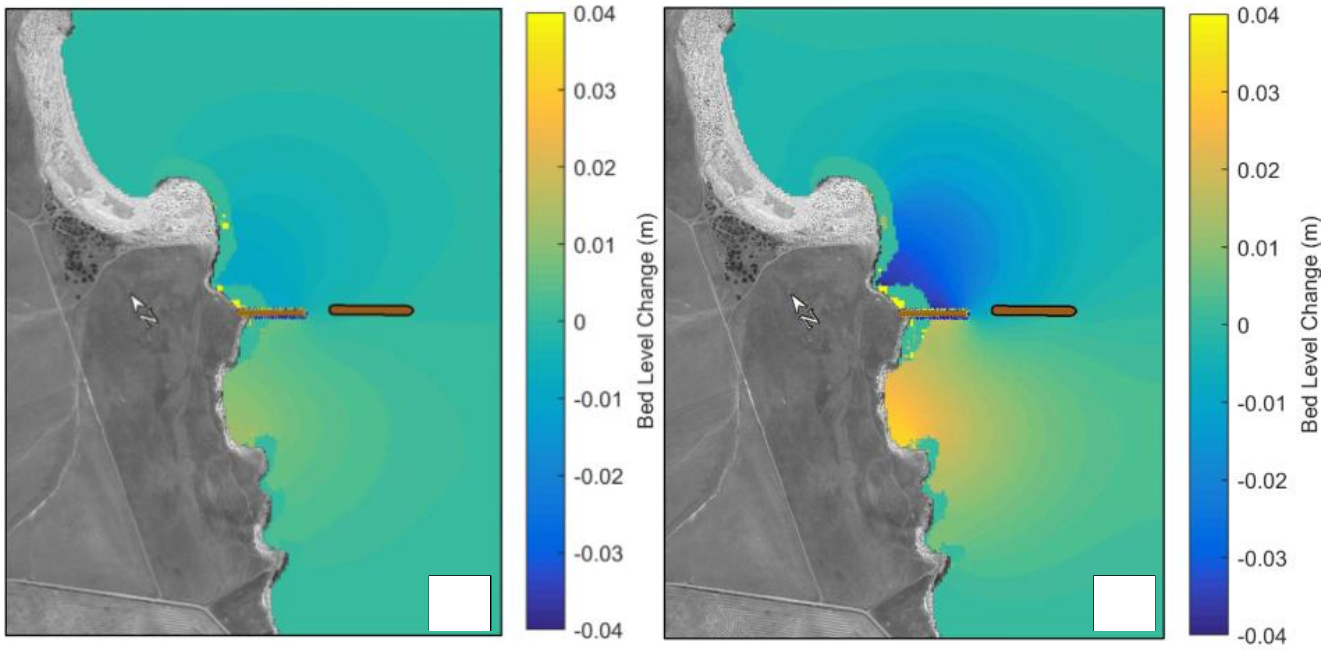


Figure 3-12 Difference in annual sediment accumulation and erosion patterns between baseline and post development scenarios for a grain size of (A) 0.3mm and (B) 0.13 mm. Positive values indicate increased accumulation and negative values indicate increased erosion due to the presence of the development (including ship).

While an equilibrium in accretion/erosion is expected to be reached, the chronic nature of the predicted accretion/erosion means that this is likely to occur over a larger number of years. However, it is unlikely that a steady state will result until or unless the accretion on the southern side progresses to a stage where it is bypassing the solid/nearshore part of the causeway. If this was left to occur, there would be consequent erosion of Rogers Beach to the north. Therefore, annual monitoring with potential sand transfer from the southern to the northern side of the structure is recommended to ensure the coastal environment is protected noting that in this relatively benign environment, sand transfer is likely to be required infrequently.

Table 3-30 identifies the potential impacts due to changes to coastal processes and sediment transport considered for the Evaluated Project and highlights differences and similarities in impact due to the Proposed Amendment.

Table 3-30 Summary of potential coastal impacts for the Evaluated Project and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Changes to local wave heights associated with the vessels moored at the jetty. *With a vessel moored at the jetty, wave heights directly in the lee of the vessel would be reduced by 0.4 to 0.7 m. Wave heights directly in shore of the vessel would be reduced around 0.5 m. This would be offset slightly by a slight increase in wave height to the north and south of the jetty.* *The maximum change in wave induced currents modelled was less than 0.15 m/s. Maximum changes would occur at either side of the headland directly inshore of the jetty.*	Similar Level of effect. The orientation of the vessel for the Proposed Amendment brings the vessels bow onto the prevailing wave climate. The size of vessels is also reduced. With the causeway in place, the shadow of the average wave height extends approximately 110 m along the coastline and with the addition of the ship this extends to 190 m. The reduction in wave energy reduces with distance from the causeway, but within the shadow the average wave height reduces from approximately 0.9 m to 0.6 m. Wave driven currents in the immediate vicinity of the proposed development will be reduced by up to 0.04 m/s from baseline speeds of 0.05 m/s. Increases in wave driven current speeds of approximately 0.03 m/s are expected around the headland to the north of the causeway leading into Rogers Beach from baseline speeds of 0.25 m/s. Between the pocket beach to the south and Lipson island, some small increases in wave driven current speeds of approximately 0.01 m/s are predicted.
Movement of sediment due to a combination of waves, tidal currents and wave induced currents. *It was approximated that the change in the sea bed level in the lee of the vessel could range from 0.03 m/year to 0.05 m/year.*	Similar Level of effect. The results indicate broad (area of approximately 0.15 km^2) post-development accretion to the south of the development between 0.01 m/year and 0.02 m/year (0.5 m to 1 m in 50 years) but up to 0.04 m/annum (2 m in 50 years) in localised areas. Broad (area of approximately 0.08 km^2) post-development erosion to the north of the structure is predicted to be between 0.01 m/annum to 0.02 m/year (0.5 m to 1 m in 50 years) but up to 0.03 m/annum (1.5 m in 50 years) in places.
Beach impacts at Rogers Beach due to jetty construction and operation. *Sediment transport modelling indicates Rogers Beach would be expected to show insignificant change in net erosion rates (0.190 m/year to 0.189 m/year after development).* *Areas of Rogers Beach that experience net accretion rates of 0.147 m/year under existing conditions may experience slightly reduced rates to 0.139 m/year. It is estimated there would be up to 0.35 m less sand on the beach over a 50-year period. However, given these areas of the beach are expected to accrete with time, the nett effect on beach width is expected to be minimal.*	Similar Level of effect The modelling indicates that Rogers Beach to the north will experience a small increase in post-development erosion of up to 0.005 m/annum (0.25 m/year). While an equilibrium in accretion/erosion is expected to be reached, the chronic nature of the predicted accretion/erosion means that this is likely to occur over a larger number of years. However, it is unlikely that a steady state will result until or unless the accretion on the southern side progresses to a stage where it is bypassing the solid/nearshore part of the causeway. If this was left to occur, there would be consequent erosion of Rogers Beach to the north. Therefore, annual monitoring with potential sand transfer from the southern to the northern side of the structure is recommended to ensure the coastal environment is protected noting that in this relatively benign environment, sand transfer is likely to be required infrequently.
Beach impact south of the jetty due to jetty construction and operation. *Predicted that the small pocket of beach immediately south of the jetty may experience reduced erosion rates (0.121 m/year to 0.115 m/year after development. It is estimated there would be up to 0.3 m more sand on the beach over a 50-year period. The extra volume of sand on the beach will be small compared to expected natural variation in erosion and accretion cycles.*	Increased effect immediately south of the wharf, with no significant change at Lipson Cove and Lipson Island. The pocket beach to the south shows predicted post-development accretion of between 0.01 m/year and 0.04 m/year (i.e. 0.5-2 m in 50 years) in places The changes in hydrodynamics, waves and consequently the sediment transport regime, decrease with distance from the development and are expected to be negligible around Lipson

Evaluated Project Impact	Proposed Amendment Impact
Lipson Island and Lipson Cove are not expected to experience change to current sediment transport and beach deposition and erosion due to project infrastructure.	Cove and Lipson Island. Additionally, Lipson cove is south of the development in a northward moving sediment transport regime, as demonstrated by the numerical modelling and the presence and orientation of zeta beaches all along this coast.
Formation of scour holes due to the jetty. *Modelling showed that scour holes would form in the area immediately surrounding the jetty, with depths ranging from 0.3 m to 1.4 m.* *No impacts on vessel movement or manoeuvrability expected.* *The potential increase in depth around each pile due to scour would have minimal impact on wave movements and therefore effect on the beach.*	Reduced level of effect. Reduced number of piles will reduce the overall impact of scour on the jetty. Individual scour impacts are expected to be similar in magnitude, reducing towards the shoreline as the depth to granite reduces. In the inshore region, no scour is expected owing to the presence of rock at the surface.

3.12.3 Mitigation and management carried forward by the Proposed Amendment

Section 6.12 of the PER did not identify specific mitigation and management strategies for coastal environment sediment, although it is noted that a Beach Profile Monitoring and Sediment Management Plan was required as part of the Reserved Matters of Provisional Development Authorisation.

Monitoring and management is also proposed for the Proposed Amendment as follows:

Annual monitoring of sand transfer from the southern to the northern side of the structure to ensure the coastal environment is protected (noting that in this relatively benign environment, sand transfer is likely to be required infrequently).

Monitoring locations to be defined on the northern side of the proposed structure and the southern end of the beach to the north (some 500 m). Trigger levels for remediation actions should be defined in line with acceptable levels of shoreline erosion or ecological considerations. It is important to note that sediment transport rates are relatively low at this site, which means sand transfer to mimic the current sediment transport regime once the structure has been built will be relatively infrequent.

3.13 Heritage and Native Title

A qualitative assessment of potential heritage and Native Title impacts has been undertaken for the Proposed Amendment to enable a comparison with the Evaluated Project (Section 6.13 of the PER and the PER Response Document).

3.13.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels of soil disturbance, which have the potential to disturb heritage values. Updated heritage database searches for the project area did not identify any additional or new heritage values for consideration by the Proposed Amendment.

It is worth noting that since the Evaluated Project was approved, an exclusive native title determination has been made for the Barngarla (Traditional Owners), with the Barngarla Determination Aboriginal Corporation (BDAC) being the corporate entity that is now the legally recognised entity regarding all Native Title and Aboriginal cultural heritage issues related to the project. It is acknowledged that the Barngarla traditional name for Lipson Cove is Boodloo and Peninsula Ports is engaging constructively with the BDAC Board regarding the Proposed Amendment.

3.13.2 Amended Impact Assessment Summary for Heritage and Native Title Impacts

Table 3-31 identifies the potential impacts considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment. It has been assessed that there is no change to the expected heritage impacts due to the Proposed Amendment. As for the Evaluated Project, ongoing management and monitoring will be required.

Table 3-31 Summary of potential heritage and Native Title impacts for the Evaluated Project and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Disturbance of registered (known) Aboriginal Heritage sites/objects. *No impacts to heritage values anticipated.* *No sites listed on the Register of Sites and Objects occur within the proposed disturbance footprint.* *There are no areas or sites under the protection of the Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984 within the project area.*	No change.
Disturbance to areas of mythological and ethnographic significance to the local Traditional Owners. *The project area does have mythological and ethnographic significance to the local Traditional Owners. Level of impact not specifically identified in PER.*	No change. It is acknowledged there may be an impact to the dreaming storyline / historical walking trails that criss-cross the local landscape, however the proposed disturbance would occur in accordance with an Indigenous Land Use Agreement with the local Traditional Owners.
Disturbance to unregistered areas of Indigenous archaeological significance which occur in the dunes adjacent to Rogers Beach. *No impacts to heritage values anticipated. This coastal fringe is not within the project disturbance footprint.*	No change.
Disturbance of unregistered Aboriginal heritage sites/objects. *While no impact identified, this was assessed as a potential risk for the project, with a commitment to undertake further ground-truthing in conjunction with the Traditional Owners.*	No change. The potential for disturbance of unregistered Aboriginal heritage sites/objects is a risk requiring ongoing management and monitoring.
Disturbance to registered non-indigenous heritage values. *No impacts anticipated. No sites/places within the project footprint registered on South Australian Heritage Register or recognised by the District Council of Tumby Bay.*	No change.
Disturbance to non-registered non-indigenous heritage values. *The site of a former water reserve located approximately 600 m inland of the proposed jetty and a former stock route would be impacted.* *Potential for impact to the shearing shed and yard complex located adjacent to Swaffers Road.*	No change, noting no development is proposed along Swaffers Road.
Disturbance to historic shipwreck site. *No impacts anticipated. The wreck of the Three Sisters is located on the beach at Lipson Cove, over 1 km south of the project area.*	No change.

3.13.3 Mitigation and management carried forward by the Proposed Amendment

One mitigation and management strategy was identified in Sections 6.13 of the PER, and this will be carried forward by the Proposed Amendment:

Thorough physical inspection of the Project area undertaken before project construction in consultation with the Traditional Owners.

In addition, the following mitigations are put forward by the Proposed Amendment:

The design approach for the Proposed Amendment is to keep infrastructure as far south as reasonably practicable, to avoid known heritage sites.

Re-vegetation of a buffer area at the northern end of the site to enhance the protection of known heritage sites. Additionally, revegetation along the coastal ridgeline between the silos and Lipson Cove Road, aiming to restore parts of the dreaming storyline / historical walking trails to pre-European condition. Over time Peninsula Ports will work with the Traditional Owners and Council to expand this revegetation approach towards Lipson Cove to improve the amenity and value of the campgrounds there.

Heritage monitoring officers to be used for the duration of the construction phase of the Proposed Amendment.

Cultural awareness training for all personnel on the project.

Ongoing employment of a Traditional Owner Land Management Officer at the site. Subject to agreement with Council this role can support the ongoing management by Council of Lipson Cove (Boodloo) and Rogers Beach;

Use of the site facilities to enable the Traditional Owners to establish a Ranger Base for any future Ranger Programme that may come into existence along this coast line.

3.14 Visual Aesthetics

A Visual Amenity Assessment has been undertaken to identify the change in level of visual impact between the Evaluated Project and the Proposed Amendment (refer to Appendix J).

3.14.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment both propose to develop the project site for a bulk shipping land use and will require similar types and levels of soil disturbance, including blasting, and construction of similar types of infrastructure (road upgrades, internal roads, storage facilities, conveyors, jetty structure).

From a landside perspective, the Proposed Amendment retains silos but removes bulky materials storage shed infrastructure, with bunkers now proposed for grain storage. Blasting and earthworks in the vicinity of the coast will be more localised for the Proposed Amendment compared to the Evaluated Project. The Proposed Amendment also seeks to alter the form and size of the jetty structure, with a straight jetty proposed which includes a combination of a causeway structure and jetty structure. The removal of the berthing jetty means the orientation of ships berthed at the port will also change.

A comparison of key features from the Evaluated Project and Proposed Amendment visual assessments is summarised in Table 3-32.

Table 3-32 Comparison of key features and assumptions of visual amenity assessment

Input / Assumption	Evaluated Project	Proposed Amendment
Project infrastructure	Infrastructure heights varied from 4 m to 30 m above ground or sea level.	Increase in silo vessel height to approximately 35 m with maximum height of the silo facility approximately 45 m. Typical bunker height at stockpile crest of 7m.
Largest expected vessel:	Cape Class	Panamax.

Input / Assumption	Evaluated Project	Proposed Amendment
Operational assumption:	Intent to park shipping vessels 4 km offshore during rough weather conditions.	No offshore mooring point proposed.
Visual Amenity Study Area:	Includes Lipson Cove, Rogers Beach, roughly 4 km off the coast (Viewpoint no. 2), and two sites - roughly 500 m west of the project site on South Coast Road.	Five major viewpoints considered. Previous Viewpoint 2 considered of little value, given view is from open water. New Viewpoint (no. 5) included, adjacent south-west part of site on Lipson Cove Road.
Viewshed modelling to determine areas of potential impact:	ArcGIS v. 10.0 and the 3D Analysist Extension – limited to topography and did not consider vegetation.	Site visit of 23 locations to determine applicable sites for impact assessment. Vegetation considered.
Key observation viewpoints:	VP-1 Rogers Beach VP-2 Spencer Gulf (approximately 1km from jetty) VP-3 Lipson Beach VP-4 Lipson Cove Road VP-5 Swaffers Road.	VP-1 Lipson Cove VP-2 Rogers Beach VP-3 Corner South Coast Road and Lipson Cove Road VP-4 Corner South Coast Road and Swaffers Road VP-5 Lipson Cove Road
Landscape modelling:	3D Studio Max	Photomontages using Nikon D850 digital camera

3.14.2 Amended Impact Assessment Summary for Visual Aesthetics

A visual amenity assessment has been undertaken to determine the proposed change between the Evaluated Project and Proposed Amendment to assess the change in views and visual impact.

The assessment concluded that,

Use and development of the site has the potential for a high level of visual impact, which has already been approved.

Proposed change brought about by the Proposed Amendment is similar in use, scale and proposed infrastructure to that of the Evaluated Project.

The visual impact of the proposed change in use from that which has already been approved would be negligible too low for most viewers.

Table 3-33 identifies the potential impacts due to changes in visual aesthetics considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Table 3-33 Summary of potential visual impacts for the Evaluated Project and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Visual impact at key observation viewpoints due to construction. *It is likely there would be a slight visual impact of the jetty and buildings being constructed as well as equipment and machinery in the laydown area.*	No Change.
Operations	
Visual impact at key observation viewpoints due project infrastructure and operations (e.g. ships at berth). *Overall magnitude of effect assessed as:* *VP-1 Rogers Beach – Moderate* *VP-2 Ocean – Low*	Similar level of effect. Four of the five previous viewpoints were assessed. An alternative viewpoint assessed adjacent south-west part of site on Lipson Cove Road.

Evaluated Project Impact	Proposed Amendment Impact
VP-3 Lipson Cove Beach – Moderate *VP-4 Lipson Cove Road – Low* *VP- 5 Swaffers Road - Negligible*	*VP-1 (now VP-2) Rogers Beach – negligible to low change in views compared to Evaluated Project* *VP-2 – not assessed* *VP-3 (now VP-1) Lipson Cove Beach – negligible to low change in views compared to Evaluated Project* *VP-4 (now VP-3) South Coast Road/Lipson Cove Road – negligible to low change in views compared to Evaluated Project* *VP-5 (now VP-4) South Coast Road/Swaffers Road – negligible to low change in views compared to Evaluated Project* *(now) VP-5 Lipson Cove Road – negligible to low change in views compared to Evaluated Project*
Visual impact of shipping vessel travel. *GIS analysis identified a 16,839 ha potential viewshed associated with parking a vessel 4 km offshore. The vessel would be visible from approximately 50% of this viewshed, including the ocean, along the coast (including Rogers Beach and Lipson Cove Beach) and some areas further inland. Shipping vessels are not expected to be present at the 4 km location for extended periods of time regularly. Their presence is based on port needs and weather conditions.* *The shipping vessel docked on the jetty and nearest to offshore viewers would present the scenario for maximum visual impact.*	No longer applicable / No impact. No regular offshore parking of vessels proposed.
Decommissioning	
Visual impact during decommissioning *Visual impact would not be as severe as for the operational phase. A shipping vessel would no longer be a temporary feature of the viewshed. The impacts of the onshore and offshore facilities would be similar to those during construction.*	No change.

3.14.3 Mitigation and management carried forward by the Proposed Amendment

Mitigation and management strategies carried forward by the Proposed Amendment:

Domed focussed low-level lights.

Mitigations not carried forward by the project:

Nil.

3.15 Socio-Economics

A Socio-Economic Impact Assessment has been undertaken to identify the social and economic impacts and opportunities due to the Proposed Amendment (refer to Appendix F). While the nature of construction activities, timing and scale is expected to remain similar for the Proposed Amendment, the removal of iron ore will alter the effects during operation of the Proposed Amendment compared to the Evaluated Project. The economic viability of the Proposed Amendment is also independent of the simultaneous development of mining projects, mine life and ore prices.

3.15.1 Comparison of Key Inputs and Assumptions

The Evaluated Project and the Proposed Amendment propose to develop the project site for a bulk shipping land use. Key aspects of the Proposed Amendment that are likely to result in changes to the socio-economic impacts are described in Table 3-34.

Table 3-34 Comparison of key features and assumptions of visual amenity assessment

Evaluated Project	Proposed Amendment
Construction	
Peak construction workforce of more than 200 people. Construction is expected to occur over 24-month period.	Peak construction workforce of approximately 150 people. Construction expected to occur over an 18-month period.
On-site living accommodation proposed for construction workers in Tumby Bay.	The accommodation workforce would be accommodated locally (e.g. rental housing, tourist accommodation, etc).
Haul road transport and infrastructure access corridor – from the Lincoln Highway and generally following the alignment of Swaffers Road.	Access corridor from the Lincoln Highway via Lipson Cove Road.
Operation	
Operational workforce of 70 people, comprising 30 who would be directly employed to operate the project and up to 40 employed by operators of the grain and hematite operations on-site. The project would continue to operate throughout the year.	Operational workforce of 10-30 people, during operation of the port, with the peak workforce occurring during the October – December harvest season when most grain deliveries are anticipated.
Hematite in-loading and storage facilities.	No iron ore in-loading or storage facilities proposed.
Operation would involve up to 140 ore truck movements per day from the proposed mine site, with an additional 70 truck movements per day attributable to grain deliveries. Haulage route from Lincoln Highway and generally following the alignment of Swaffers Road.	The catchment area for grain to be transported to site would extend across the central Eyre Peninsula region. Haulage route from Lincoln Highway via Lipson Cove Road.

3.15.2 Amended Impact Assessment Summary for Socio-Economics

The study area for the revised Socio-Economic Assessment comprised those communities that have potential to experience changes due to the construction and operation of the proposal.

The methodology for the Socio-Economic Assessment involved:

- Scoping of the likely socio-economic issues for the Proposed Amendment, based on the review of the socio-economic assessment prepared for the Evaluated Project and updated information for the Proposed Amendment
- Describing existing socio-economic conditions and values in the study area, including population and demography, business and industry, social infrastructure and community values
- Identifying and assessing potential benefits and impacts of the Proposed Amendment on socio-economic values, and comparison of these against the socio-economic benefits and impacts identified for the Evaluated Project
- Identifying additional measures to mitigate identified socio-economic impacts.

Table 3-35 identifies the potential impacts due to changes in visual aesthetics considered for the Evaluated Project and highlights differences in impact due to the Proposed Amendment.

Potential benefits and impacts of the construction and operation of the Proposed Amendment are generally expected to be similar to the Evaluated Project.

Table 3-35 Summary of potential visual impacts for the Evaluated Project and Proposed Amendment

Evaluated Project Impact	Proposed Amendment Impact
Construction	
Construction workforce - Population and demographic impacts. *A workforce of more than 200 people was expected for the Evaluated Project.*	Similar level of effect. It is anticipated that up to 150 people would be directly employed by the Proposed Amendment during the construction phase. This includes the potential for an increase in the percentage of males and younger people residing in the study area during the construction phase and more itinerant workers moving in and out of the study area in search of job opportunities. The provision of local employment and training opportunities through the construction phase may also provide opportunities for young people to remain in the primary study area rather than moving away for employment.
Construction workforce - Changes in local employment opportunities. *A workforce of more than 200 people was expected for the Evaluated Project.* *It was assessed as unlikely the construction of the Project would be able to source a significant number of workers from nearby towns or the Eyre Peninsula region, although there was an intention to create some positions for unskilled, semi-skilled and skilled workers living locally.*	Similar level of effect. While the peak construction workforce for the Proposed Amendment is expected to be below that of the Evaluated Project, potential impacts on employment and training are expected to be similar to those identified for the Evaluated Project. Similar to the Evaluated Project, the Proposed Amendment is also expected to create indirect opportunities for employment through local businesses that supply goods and services to the construction phase. This may include businesses that offer services such as transportation, sub-contract skills.
Construction workforce accommodation *Considered likely that a large portion of the workforce for the Evaluated Project would need to be sourced from outside of the study area, due to the qualifications or experience required and the availability of local workers with* the required skills *Proposed that construction workers would generally be accommodated in a worker accommodation camp in Tumby Bay.*	Altered effect as no construction village is expected to be required. It is likely that demand for accommodation for the construction workforce would generally be in towns closest to the project, for example Tumby Bay and Port Neill, although it is possible that some construction workers may choose to commute further and live in a larger centre such as Port Lincoln. This is likely to result in increased demand by construction workers for rental housing and temporary visitor accommodation in towns near the construction works, such as Tumby Bay and Port Neill. While this is likely to have benefits for owners of tourist accommodation and rental properties, increased demand for accommodation has potential to impact on: Levels of housing stress for some households on low or fixed incomes Flexibility of the tourism sector to meet peak tourist demands Tourism industry in the primary study area due to some people choosing to travel to other towns and locations within the Eyre Peninsula Community cohesion and sense of community for towns closest to the project, due to workers accommodated in private rental housing and short-term tourism accommodation rather than a worker's accommodation camp.
Benefits for local business and industry. *Opportunities for local business and industry through the direct supply of goods and services to construction activities and flow-on impacts for businesses such as restaurants, shops and other services that provide for the day-to-day needs of construction workers.*	Similar level of effect. These benefits are expected to benefit businesses within the primary and secondary study areas and across South Australia. It is acknowledged that Construction of the Proposed Amendment has potential to impact on tourism in the primary study areas (via increased demand for tourist accommodation by construction workers).

Evaluated Project Impact	Proposed Amendment Impact
	Potential impacts on nature-based and recreation-based tourism activities due to changes in visual and environmental amenity during construction are expected to be similar to the Evaluated Project.
Social infrastructure The additional people and construction activity was assessed as expected to create additional demands on existing medical and emergency services, such as police, ambulance and state emergency services, in the case of a serious injury, illness or workplace accident. A corresponding benefit was that the Evaluated Project would support the retention of these local support services in rural communities.	Similar level of effect. An influx of people during construction and construction activities is likely to create additional demand for some local support services and facilities such as medical and emergency services, potentially impacting on the availability of these services for local residents.
Haul road transport and infrastructure access corridor – changes to access and connectivity. Swaffers Road would be constructed as a haul road for heavy vehicles at the beginning of the construction period, enabling it to be used as a dedicated route for heavy vehicles. Construction workers would be transported to site by bus, minimising the number of individual vehicles travelling to and from site.	Altered effect due to the use of Lipson Cove Road for construction deliveries – refer to Section 3.7 for assessment of traffic impacts. Lipson Cove Road provides access to rural properties, including three rural dwellings, and to recreational uses at Lipson Cove including the beach and Lipson Cove campground. During construction, potential impacts of the Proposed Amendment on regional roads such as the Lincoln Highway are expected to be similar to the Evaluated Project. Potential changes in local access and connectivity would mainly be associated with the use of Lipson Cove Road rather than Swaffers Road. An increase in traffic using Lipson Cove Road, including heavy vehicles, has potential to impact on perceptions of road safety for local communities and road users.
Impacts to community values including visual amenity. *Visual impacts of the construction phase would be temporary in nature. Noise and dust emissions may also be experienced.*	Similar level of effect. Construction impacts have the potential to impact on community values relating to such things as scenic amenity, natural environment, local amenity and health and safety. The Proposed Amendment proposes to use Lipson Cove Road for construction haulage. An increase in haulage vehicles using Lipson Cove Road has potential to impact on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users (e.g. visitors to Lipson Cove campsite). Refer to Section 3.7 for assessment of traffic impacts.
Operation	
Operational workforce - Population and demographic impacts. *The Evaluated Project was expected to require about 30 full time staff for operations, with an additional 40 expected to be employed by the hematite and grain operators on-site as part of material transport and handling. Extra truck drivers would also be required to transport product to the port.* *Up to half of the Project employees are expected to work on a fly in/fly out basis and, while on shift, would reside at the accommodation village built for the construction period. The remaining workers were anticipated to be sourced locally.* *The Project's operational phase was assessed as unlikely to impact on the social profile of Tumby Bay and Port Neill.*	Similar level of effect. While it is likely that some workers would come from local communities or from communities across the Eyre Peninsula, it is likely that some workers may come from other areas. While this may result in a small temporary increase in the local population, this is not expected to impact on the wider population and demography of the primary study area.
Operational workforce housing and accommodation	Altered effect. Due to the seasonal nature of some positions, it is likely that any non-local workers would be accommodated in

Evaluated Project Impact	Proposed Amendment Impact
Up to half of the Project employees are expected to work on a fly in/fly out basis and, while on shift, would reside at the accommodation village built for the construction period.	temporary visitor accommodation, providing temporary economic benefits for some owners of tourist accommodation near the project. There is expected to be capacity in the tourist accommodation to accommodate the relatively small workforce. As such, potential impacts on temporary visitor accommodation or local rental housing during operation are generally expected to be negligible.
Operational workforce - Changes in local employment *This was expected to create opportunities for residents with suitable skills and experience. Three apprentice and two trainee positions were also expected to be available for operations.*	Reduced benefit. Potential employment opportunities with the Proposed Amendment would less than the Evaluated Project Employment for the Proposed Amendment will range from approximately 10 to 30 during the harvest period.
Benefits for local business and industry. *Impacts on local business during operations were expected to be moderate and positive.*	Reduced benefit. While these benefits would be similar to the Evaluated Project, the scale of benefits for local business and industry from the operation of the port would generally be reduced given the smaller scale of operations Proposed Amendment (i.e. 10 jobs peaking to 30 jobs during grain harvest season rather than 70 jobs). It is noted that the Proposed Amendment will have positive impacts on grain producers within the Eyre Peninsula by removing double handling of grain (through the provision of on-site storage), reducing haulage distances and subsequent transport costs
Impacts to local tourism *The operation of the Project was expected to have minimal effect on the tourism industry and associated activities for Port Neill and Tumby Bay. Separate accommodation for Project workers would minimise impacts on established tourist accommodation in the towns. The Lipson Cove campsite, to the south of the Project, would continue to operate and access to Rogers Beach, to the north, would be maintained.*	Similar level of effect. Overall, the Proposed Amendment is expected to have minimal impact on tourism activities in centres such as Tumby Bay and Port Neill. While the Lipson Cove campsite would continue to operate, the presence of port infrastructure may impact on the use and enjoyment of the campsite for some people.
Social infrastructure *Impacts on local services such as medical facilities, the police and other emergency services were assessed as minor.*	Similar level of effect. Similar to the Evaluated Project, potential impacts of the Proposed Amendment on local services such as medical and emergency facilities are expected to be minor, given the relatively small workforce.
Impacts to community values including visual amenity. *The PER cross-references the relevant sections for dust, noise and air quality.*	Similar level of effect - particularly in relation to such things as scenic amenity, natural environment, local amenity and health and safety. The Proposed Amendment proposes to use Lipson Cove Road for access to the port. An increase in haulage vehicles using Lipson Cove Road has potential to impact on local amenity and perceptions of road safety for residents of rural properties at Lipson Cove Road and other road users (e.g. visitors to Lipson Cove campsite). Refer to Section 3.7 for assessment of traffic impacts. Overall, these impacts would be less than the Evaluated Project given the shorter operating period and the reduced number of haulage vehicles with the removal of the mining related vehicles.
Impacts to traffic due to haulage of ore and grain. *Section 6.15.4.21 of the PER identified that traffic impacts during operation are were expected to consist of 140 ore truck movements a day (two-way movements), when the Project reached peak operations. Another 70 truck movements each day would be attributable to grain deliveries. This activity would be seasonal, with*	Regional network – similar level of effect. Site access – altered effect. Potential impacts of the Proposed Amendment's operation on regional roads such as the Lincoln Highway are expected to be similar to the Evaluated Project, although the scale of these impacts are likely to be reduced given the shorter grain delivery

Evaluated Project Impact	Proposed Amendment Impact
more trucks delivering to the Project (up to 140 movements) during harvest than other times of the year.	period (e.g. harvest period compared to year-round grain and ore deliveries). Potential changes in local access and connectivity would mainly be associated with the use of Lipson Cove Road rather than Swaffers Road. An increase in traffic using Lipson Cove Road, including heavy vehicles, has potential to impact on perceptions of road safety for local communities and road users during the three-month grain delivery period. The upgrade of Lipson Cove Road to support the Proposed Amendment's operation would improve access and road safety for local communities and visitors to Lipson Cove. Refer to Section 3.7 for assessment of traffic impacts.
Regional traffic benefits due to the location of the port *Operations at Port Spencer would reduce grain truck movements through Port Lincoln that are already a community concern. The location, with its own access to Lincoln Highway via Swaffers Road also prevents traffic impacts through established towns.*	Increased benefit. The impacts of heavy vehicles through Port Lincoln are currently expected to have increased following the closure of the railway line. The Proposed Amendment project will reduce the flow of heavy vehicles in Port Lincoln. Refer to Section 3.7 for assessment of traffic impacts.

3.15.3 Mitigation and management carried forward by the Proposed Amendment

Section 6.15 of the PER did not identify specific mitigation and management strategies for socio-economic impacts. The Proposed Amendment will consult with tourism representatives about peak construction worker demand periods to manage potential impacts on tourism in the study area and avoid potential for any residual impacts post-construction.

4. Risk Assessment and Mitigation

This chapter presents a qualitative risk assessment undertaken for the Proposed Amendment and compares the results with the risk assessment completed for the Evaluated Project. The risk assessment has been undertaken for the Proposed Amendment in accordance with the framework described in Section 7.2 of the Evaluated Project PER. The results are presented in Table 4-4, and includes commentary (***in bold italics***) on the basis for the revised risk rankings.

A summary of the definitions and criteria adopted for the risk assessment are reproduced below for reference (Table 4-1 to Table 4-3).

Key terms used throughout the risk assessment include:

Consequence: the outcome or severity of an impact/event.

Likelihood: the estimated probability of occurrence, or frequency of occurrence, of an event over time.

Risk: is a combination of the likelihood of an event occurring and the severity of the consequence of the event.

Table 4-1 Description of Likelihood (as per Section 7.2 of the PER)

Description	Likelihood Criteria (read as either/or)
Almost Certain	The event will occur The event is of a continuous nature The likelihood is unknown
Likely	Will probably occur during operation lifetime
Possible	Could occur in most operations
Unlikely	Could occur in some operations but is not expected to occur
Rare	Has almost never occurred in similar operations but conceivably could

Table 4-2 Description of Consequence (as per Section 7.2 of the PER)

Description	Consequence Criteria (read as either/or)		
	Social	**Environmental**	**Economic and Legal**
Insignificant	Not of concern to the wider community No inquiries or complaints	Possible impacts within the proposed Project site boundaries and immediate marine environment but without noticeable consequence No impacts of consequence at local, regional or State level	No costs or limited cost for rehabilitation or mitigation No breach of regulator standards or licences
Minor	Not of significant concern to local or wider community Isolated inquiries or complaints	Some reversible impact within the proposed Project site boundaries and immediate marine environment with no significant long-term changes May be rehabilitated or alleviated without outside assistance	Cost for any rehabilitation is minor No breach of regulator standards or licences
Moderate	General local concern Multiple inquiries and/or complaints	Significant changes within the proposed Project site boundaries or marine environment with potential for long term change and remediation required	Possible breach of legal obligations – inquiries and/or instruction from regulatory authorities

Description	Consequence Criteria (read as either/or)		
		Minor changes outside proposed Project site boundaries that may be simply rehabilitated or alleviated with outside assistance	
Major	Will attract significant public concern Widespread complaints and/or lobbying by representative groups	Substantial and significant changes within and/or outside the proposed Project site boundaries that can only be partially rehabilitated or alleviated Long-term consequences	Major costs associated with rehabilitation/alleviation Serious breach of legal obligations – regular inquiries by regulatory authorities and penalties for non-compliance
Catastrophic	Major public outrage Deaths or widespread health and economic effects on public	Extreme permanent changes to social or natural environment that cannot be practically or significantly rehabilitated or alleviated	Major costs associated with rehabilitation / alleviation and penalties Major breach of legal obligations – continual involvement of regulatory authorities and legal investigation for non-compliance

Table 4-3 Qualitative risk matrix

			Likelihood of Consequence				
			E	D	C	B	A
			Rare	Unlikely	Possible	Likely	Almost Certain
Severity of Consequence	5	Insignificant	Low 5E	Low 5D	Low 5C	Moderate 5B	Moderate 5A
	4	Minor	Low 4E	Low 4D	Moderate 4C	High 4B	High 4A
	3	Moderate	Moderate 3E	Moderate 3D	High 3C	High 3B	Extreme 3A
	2	Major	High 2E	High 2D	Extreme 2C	Extreme 2B	Extreme 2A
	1	Catastrophic	High 1E	Extreme 1D	Extreme 1C	Extreme 1B	Extreme 1A

This risk assessment has been undertaken for comparative purposes. Detailed mitigation and monitoring measures for the Proposed Amendment identified through the impact assessment process are provided as part of the Environmental Management Framework for the Proposed Amendment documented separately (in the Amendment to PER document, but are summarised in Table 4-4 below).

Table 4-4 Qualitative risk assessment for the Proposed Amendment and comparison with the Evaluated Project (EP = Evaluated Project, PA = Proposed Amendment)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
1	Air emissions – dust and fugitive emissions *Risk of exceedance of project air quality criteria.*	The closest sensitive receptor is around 500 m from the project site. Eyre Peninsula can experience high wind and existing dust movement events. There is potential for dust associated with ground clearing and construction activities. The Project site is generally clear with minor vegetation cover. There is potential for dust from loading and unloading of grain, hematite and future export products.	No emissions from hematite and future export products. Greater potential for dust emissions associated with grain due to increased number of unloading points and use of bunkers.	High (Almost Certain × Minor)	Extreme (Almost Certain × Moderate) ***Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.***	<u>Construction</u> EP and PA: Air Quality Management Plan will be developed for construction phase including clearing, rehabilitation and wind protection measures. <u>Operations</u> EP and PA: Ship loading will include dust controls. PA only: Operational controls will include wind monitoring (direction and speed), with reduced operations in adverse wind conditions. EP only: All un-loading activities will occur in enclosed buildings. Conveyor belts will be fully enclosed (it is not possible to cover all conveyors for the PA. Storage sheds will include ventilation systems, dust collectors and air filters.	**Low** (Unlikely × Minor) *Air dispersion modelling predicted compliance with Ambient Air Quality NEPM criteria (1988 and 2003) at sensitive receptors.*	**Moderate** (Unlikely x Moderate) *Air dispersion modelling predicted compliance with the air quality criteria for the Proposed Amendment.* ***Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
2	Greenhouse Gas (GHG) Emissions	Construction phase GHG will arise from earth moving equipment, offshore jetty construction equipment, generator, transport vehicles and light vehicles. Operations phase GHG will arise from power use onsite associated with site loading and storage facilities and offices as well as transport of good to the Project. Due to the power and fuel requirements for the Port it is inevitable that GHG will be produced as part of normal development.	Nil.	Moderate (Almost Certain x Insignificant)	Low (Unlikely x Insignificant) ***While GHG emissions will occur, impacts due to project emissions alone are considered unlikely.***	<u>Construction and Operations:</u> EP and PA: Where practicable, local and recycled materials will be used. Energy efficiency measures will be assessed and implemented during construction and operations phase. Fuel and power use will be monitored during construction and operation. <u>Operations:</u> EP and PA: Future potential for the Port to join the proposed Eyre Peninsula 'green power' grid. This will continue to be investigated.	Moderate (Almost Certain x Insignificant) *Overall the port offers the potential to significantly reduce GHG emissions associated with ore transport to other port options, while it is recognised the Ports establishment will create GHG.*	Low (Unlikely x Insignificant) ***Overall the port offers the potential to reduce GHG emissions associated with road transport of grain to Port Spencer compared with the distance of road transport to Port Lincoln, while it is recognised the Ports establishment will create GHG.***
3	Noise *Risk of exceedance*	The nearest sensitive receptor to the Project site is approximately 500 m north of the Project boundary. The Project is located about 1,000 m from	Removal of iron ore from the development scope.	Extreme (Almost Certain x Moderate)	Extreme (Almost Certain x Moderate)	<u>Construction:</u> EP and PA:	Low (Unlikely x Insignificant)	Moderate (Unlikely x Moderate)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
	of project air noise criteria.	the majority of noise sensitive locations. The nearest residence to Lipson Cove Road is 200 m. The Lipson Island Conservation Park informal camping area is 1.5 km from the Project site. Based on current zoning the noise levels for the project are 47 dB(A) during daytime and 40 dB(A) during night time activities. Noise from vehicle, equipment and loading/unloading operations has potential to disturb residents, fauna and visitors.	Reconfiguration of the site to provide significant bunker storage (and corresponding increase in un-loading and reclaim activities) Seasonal delivery of grain. Occurs within an 8-week harvest period, over a 17-hour day		***Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.***	Cetacean monitoring will be undertaken during marine piling to minimise impacts to marine mammals near the Project area. A noise and vibration monitoring regime will be developed for construction to confirm expected levels. <u>Operations</u> EP and PA: Mobile equipment will use broad band reverse alarms and are expected to meet night time noise criterion. Generators will be located in such a way as to minimise offsite noise. EP Only: All unloading activities will occur in enclosed buildings. Conveyor belts will be fully enclosed (it is not possible to cover all conveyors for the PA.	*Noise modelling estimates indicate residences along Lipson Cove Road will not exceed noise criteria from road traffic, although the noise criterion was exceeded for a residence along Swaffers Road*	***Moderate consequence rating considered appropriate as if the risk were to eventuate, an offsite receptor would be impacted in the short term.***
4	Stormwater / Surface water	Surface water flows in and around the Project area are limited to rainfall-based events. Stormwater from the port hardstand and works areas has potential to leave the site and enter the marine environment. SA EPA require stormwater from such a facility to be managed onsite and avoid discharge to the marine environment.	Changes in rainfall data and AR&R parameters have reduced the amount of water expected to require management on-site.	Extreme (Almost Certain x Moderate)	Extreme (Almost Certain x Moderate) ***Moderate consequence rating considered appropriate as if the risk***	<u>Construction and Operations:</u> EP and PA: No stormwater discharge from the site to the ocean. Stormwater detention basins and channels will capture and retain stormwater onsite and minimise offsite surface water flow onto the Project area. All chemicals and fuels will be stored in appropriate bunded facilities.	Low (Unlikely x Minor)	Low (Unlikely x Minor) ***Mitigations and management measures designed prevent and***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		There is potential for stormwater contamination from onsite chemical and fuel storage areas.			***were to eventuate, the local marine environment would be impacted in the short term.***	Captured stormwater will be reused onsite. Surface water and stormwater basins and channels will be maintained to prevent sediment build up.		***contain impacts to immediate site.***
5	Groundwater	Groundwater levels at the Project site range from 0.9 m above AHD and 2.3 m. The Project does not plan to use any groundwater resources. Project activities including chemical and fuel use have potential to impact groundwater resources. Onsite hydrocarbon storage facilities are proposed with a 68,000 L capacity.	A saline bore will be used to service construction water needs. The site is not within a Prescribed Area.	Moderate (Possible x Minor)	Moderate (Possible x Minor) ***Effects are expected to be limited to the site base on the limited nature and duration of activities.***	<u>Construction and Operations:</u> EP and PA: All chemicals and fuels will be stored in appropriately bunded areas. Appropriate spill kits will be maintained onsite during construction and operations phase. PA only: A construction well permit will be obtained if the bore is to extend more than 2.5 m below ground level. Use of saline water will be contained within the site and avoid retained native vegetation. <u>Operations:</u> EP and PA: Any onsite domestic wastewater management to comply with local planning requirements.	Low (Unlikely x Minor)	Low (Unlikely x Minor) ***Routine risk able to be managed by standard controls.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
6	Terrestrial Flora	The Project site is highly modified and dominated by pasture flora species with no significant trees or threatened species identified. All native vegetation within the Project area is disturbed or degraded. With the exceptions of the Low Shrubland along the cliff top and the Tall Open Shrubland associated with Rogers Beach, vegetation is considered to be of low habitat and biodiversity value. No threatened or rare species occur in the Project area. Vegetation clearance is required as part of Port construction as well as Swaffers Road upgrade. Approximately 2.78 ha of low-grade native vegetation is required for site clearing to enable construction, out of a total of 48 ha of land required for Stage 1. The total site footprint is 140 ha. A further 3.89 ha of degraded scattered native vegetation is required to be cleared in the widening of Swaffers Road. A total of 15.66 ha of native vegetation is required to be offset through the establishment of a SEB.	No native vegetation clearance required along Swaffers Road or immediately adjoining Rogers Beach. Pruning of vegetation along Lipson Cove Road may be required to improve sight lines and safety. Approximately 3 ha of poor-quality native vegetation is required to be cleared at the site.	Moderate (Almost Certain x Insignificant)	Moderate (Almost Certain x Insignificant) ***Vegetation clearance will be required but will be contained to generally poor-quality areas within the site.***	<u>Construction</u> EP and PA: A Construction Environmental Management and Monitoring Plan will be developed. Only those areas required for the Project will be cleared. Significant Environmental Benefit (SEB) offset will be provided for vegetation clearance. A Weed and Pest Management Plan will be developed and implemented during all phases. <u>Operations:</u> EP and PA: A Weed and Pest Management Plan will be developed and implemented during all phases. EP only: A site Rehabilitation and Revegetation Plan will be developed including native species for replanting PA only: Siting of infrastructure primarily within the area that has historically been cleared of native vegetation (the paddocks).	Low (Possible x Insignificant)	Moderate (Almost certain x Insignificant) ***Considered appropriate to maintain an 'almost certain' likelihood, as vegetation clearance will occur (as for the Evaluated Project) despite the fact it will be offset.***
7	Terrestrial Fauna	The Project site is highly modified and dominated by pasture flora species with no significant trees or threatened	Nil.	Low	Low	<u>Construction and Operations:</u> EP and PA:	Low	Low

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		species located. The habitat and biodiversity value of remaining native vegetation is low and disturbed, except for the Low Shrubland located along the coastal cliff top, that is of regional significance, and supports several species of lizard. There were no native fauna species of state or national significance identified during Spring survey or expected to depend on the site. There is potential to disturb or impact fauna through construction and operation activities associated with light, noise and vehicle movement.		(Possible x Insignificant)	(Possible x Insignificant)	Vehicle movement to remain on designated road access areas only. <u>Construction:</u> EP and PA: Any trenches or holes to be left uncovered will be inspected daily for trapped fauna. Any trapped fauna to be released into nearby habitat. <u>Operations:</u> EP only: The creation of a SEB habitat for the EP would increase the habitat available to local and regional fauna. For the PA: Revegetation and rehabilitation of land adjoining Rogers Beach and the south eastern portion of the site would have a similar effect. This will be in addition to the SEB offset provided for vegetation clearance.	(Possible x Insignificant)	(Possible x Insignificant)
8	Terrestrial Weeds, Pests and Pathogens	All native vegetation within the Project area is disturbed or degraded with weeds and invasive species making up 33% of species composition. There are pest fauna species present including rabbits, foxes and other feral species. There is potential for spread of weeds associated with construction activities	Nil.	Moderate (Possible x Minor)	High (Possible x Moderate) ***Moderate consequence rating considered appropriate as the***	<u>Construction and Operations:</u> EP and PA: All plant equipment and machinery entering and leaving the site should be clean and pest/soil/weed free. All waste will be managed in accordance with site environmental management procedures and disposed of accordingly.	Low (Possible x Insignificant)	Moderate (Unlikely x Moderate) ***The mitigation measures are considered to reduce the likelihood of***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		or introduction with equipment entering the site.			***spread of weeds is likely to extend offsite.***	A Weed and Pest Management Plan will be developed and implemented for construction and operations in compliance with the requirements of the Natural Resources Management Act 2004.		***weed, pest and pathogen risks, not the consequence.***
9	Lipson Island Terrestrial Fauna	Lipson Island is located approximately 1.5 km south of the jetty and is located in the State Lipson Cove Conservation Park. Lipson Island supports populations of breeding birds including the Little Penguin (not a listed species), Fairy Terns (listed as vulnerable), and migratory waders. There is potential for noise and light from Port operations to disturb fauna species.	Nil.	High (Possible x Moderate)	High (Possible x Moderate)	<u>Construction and Operations:</u> EP and PA: Lights at the Port will be domed downward focused low-level lights and will minimise potential light pollution. Measure and monitor potential light levels at Lipson Cove to demonstrate mitigation is effective.	Low (Unlikely x Minor)	Moderate (Unlikely x Moderate) ***It is considered appropriate to retain a moderate consequence, because if an impact occurs, it will occur off-site.***
10	Lipson Island Terrestrial Flora	No clearance of native flora present on Lipson Island.	Nil.	Low (Rare x Insignificant)	Low (Rare x Insignificant)	<u>Construction and Operations:</u> EP and PA: There are no specific management measures proposed. Lipson Island is located within a State park administered by Parks SA and does not form part of Centrex's Project area. There are no negative Project impacts expected to native flora at the site.	Low (Rare x Insignificant)	Low (Rare x Insignificant)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
11	Lipson Island Marine Fauna and Flora	Surveys undertaken at Lipson Island did not identify inter-tidal marine species of conservation significance or marine flora species. There is potential for impacts in the unlikely event of an oil or fuel spill, or waste leaving site.	Nil	Low (Unlikely x Minor)	Low (Unlikely x Minor)	<u>Construction and Operations:</u> EP and PA: A Waste Management Plan will be developed to ensure all waste types produced by the Project are managed appropriately and do not contribute to marine waste in surrounding areas. <u>Construction:</u> EP: Pile fabric filtering will be used around each pile during construction to minimise the potential for turbidity associated with the Project. PA: Use of silt curtains during marine construction. <u>Operations:</u> EP and PA: Port operations will include emergency procedures and protocols in the unlikely event of a marine oil or fuel spill.	Low (Unlikely x Minor)	Low (Unlikely x Minor)
12	Soils	The Project is located on a rocky headland and some blasting will likely be required as part of construction civil works. Soils are predominantly sodic with high erosive potential. There is potential for soil contamination associated with chemical, fuel and	No risk of iron ore spill to exposed ground. Saline water is proposed for use during construction.	Moderate (Possible x Minor)	Moderate (Possible x Minor)	<u>Construction and Operations:</u> EP and PA: Only those areas required for Port operations and construction will be cleared. Vehicle movement will be limited to designated access tracks only.	Low (Unlikely x Minor)	Low (Unlikely x Minor)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		waste management onsite or spillage of ore onto exposed ground. There is potential for wind and water erosion in cleared areas of site.				All chemicals and fuels to be stored in appropriately bunded areas. A Waste Management Plan will be developed in accordance with reduce, reuse and recycle principles. Appropriate spill kits will be maintained onsite during construction and operations phase. Private access to Rogers Beach maintained. Soil erosion and sediment drainage will be managed and monitored during the project (especially construction and decommissioning). EP only: All hematite unloading activities will occur in enclosed buildings. <u>Construction:</u> EP and PA: Exposed areas will be rehabilitated where suitable. Dust suppression watering will be undertaken during clearing and construction activities. Blasting undertaken by personnel certified to design and execute blasting operations. Blasting carried out in accordance with all relevant government codes and regulatory requirements.		

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
13	Marine Flora (Jetty)	Marine surveys have identified that macroalgal dominated rocky reefs and seagrass meadows are the most common native vegetation type within the proposed jetty area. These are representative of those found further afield in the region. It is estimated rocky reef habitat and seagrass may have some level of disturbance due to the Project and be limited to that area under and around the jetty. The potential displacement of marine fauna associated with seagrass loss is expected to be small compared to extent of seagrass and macroalgal assemblages in the region. The jetty is proposed to be 515 m long, 55 m wide with a 345 m berthing jetty at 90° to the main jetty. It is estimated 64 jetty piles and 120 berthing jetty piles would be required, subject to actual final design needs. Potential impacts due to jetty shading, turbidity or sedimentation. No significant inter-tidal, shell fish bed, marine mammal haul out sites or seabed habitats identified.	A straight wharf with an approximate overall length of 600 m, designed to cater to Panamax vessels is proposed. This includes am approximately 240 m groyne extending from the shore. The revised design will result in a higher level of seagrass clearance than previously proposed due to the causeway replacing portions of the piled jetty. It is estimated that 18 piles will be required rather than 184. No marine plant is required for	Moderate (Possible x Minor)	High (Almost certain x Minor) ***Seagrass clearance will be required but is limited to the project area.***	<u>Construction:</u> EP and PA: A Construction Environmental Management and Monitoring Plan will be developed. End over end jetty construction method will minimise marine impacts. Seagrass loss will be offset in accordance with the requirements of the Native Vegetation Act 1991. EP only: Pile fabric filtering will be used around each pile during construction to minimise the potential for turbidity associated with the Project. PA only: Use of silt curtains during marine construction. <u>Construction and Operations:</u> EP and PA: A marine Emergency Response and Incident Management Plan will be developed. Conveyor belts will be fully enclosed.	Moderate (Possible x Minor)	High (Almost certain x Minor) ***Considered appropriate to maintain an 'almost certain' likelihood, as vegetation clearance will occur (as for the Evaluated Project) despite the fact it will be offset.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
			construction of the wharf.					
14	Marine Fauna (Jetty)	There were no threatened or endangered marine species identified during marine survey. There were some recreational and commercially significant fish species identified in the rocky reef and seagrass areas. The Project site does not offer significant habitat to marine mammals or cetaceans. There were Greenlip and Blacklip abalone found in reef surveys and fringing seagrass areas around the Project area. Marine fauna may be impacted by changes to marine flora as well as noise, turbidity or sedimentation impacts, fishing from visiting vessel crews.	It is estimated that 18 piles will be required rather than 184.	High (Likely x Minor)	Moderate (Possible x Minor) ***Duration and extent of underwater noise from piling activities significantly reduced.***	Refer Item 13, Marine Flora (jetty) and Item 15, Marine Pests. <u>Operations</u> EP and PA: Visiting ship crews will not be permitted to leave vessels while berthed at Port Spencer. Site security protocols will be implemented to prevent illegal fishing or leaving of vessels. Fishing by Port personnel or third parties will not be permitted from the Port site. <u>Construction:</u> EP and PA: During piling operations visual spotters will monitor the ocean to ensure marine mammals and cetaceans are not present within 500 m of the activities.	Moderate (Possible x Minor)	Low (Unlikely x Minor) ***Duration and extent of underwater noise from piling activities significantly reduced. Monitoring and controls expected to further reduce likelihood.***
15	Marine Pests	There is potential for introduction of marine pests associated with ballast water and hull fouling of visiting ships. Marine surveys identified the presence of marine pest, Asian Date Mussel, at the site.	Nil.	High (Possible x Moderate)	High (Possible x Moderate)	<u>Operations:</u> EP and PA: All vessels to comply with *Australian Ballast Water Management Requirements (now 2017)* and the *Australian Quarantine Regulations 2000*. A Management and Monitoring program will be developed to identify potential	High (Possible x Moderate)	High (Possible x Moderate)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
						marine pest species and appropriate management measures. A control and monitoring program for the present Asian Date Mussel will be developed for the Port.		
16	Coastal Processes	There is potential for jetty construction to impact movement of sediment and lead to scouring around the Project area and therefore impact beaches and other coastal processes. Rogers Beach is located adjacent the north of the Project site.	The inclusion of a causeway, the absence of a berthing wharf and smaller vessel sizes will slightly alter the nature of coastal effects, particularly immediately north and south of the wharf.	Moderate (Possible x Minor)	High (Possible x Moderate) ***Moderate consequence considered appropriate, as effects likely to be experienced outside of immediate footprint.***	<u>Construction:</u> EP and PA: A Construction Environmental Management and Monitoring Plan will be developed. EP only: Pile fabric filtering will be used around each pile during construction to minimise the potential for turbidity associated with the Project. PA only: Annual monitoring of sand transfer from the southern to the northern side of the structure to ensure the coastal environment is protected (noting that in this relatively benign environment, sand transfer is likely to be required infrequently). Use of silt curtains during marine construction.	Low (Possible x Insignificant) *Based on hydrodynamic modelling only localised sediment and scouring effects around the jetty are expected.* *Significant impacts to beaches around the Project are not expected, including Rogers Beach and Lipson Island.*	Moderate (Possible x Minor) ***Based on hydrodynamic modelling localised sediment and scouring effects around the causeway are expected.*** ***Significant impacts to beaches around the Project are not expected, including Rogers Beach and Lipson Island.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
17	Traffic	The main traffic movements to and from the Project will be road transport of hematite and grain and construction traffic over a 24-month period. Transport from Wilgerup Mine to the Port (Swaffers Road) is not considered as part of this PER. Heavy vehicle access will be via currently unsealed Swaffers Road and light vehicle via the currently unsealed Lipson Cove Road. Increased traffic poses potential safety, amenity, and noise impacts.	Construction period of 18 months. Traffic movements to and from the project will be road transport of grain during harvest and staff passenger vehicles throughout the year Site receivals occur over an 8-week harvest season operating up to 17-hour days / 7 days a week, resulting in peak traffic volumes. Ship export occurring throughout the year. Heavy and Light Vehicle Access will be via Lipson Cove Road	Extreme (Almost Certain x Moderate)	Extreme (Likely x Moderate) ***Although traffic will increase, TIA indicates the roads are within capacity. Likely allocated to reflect higher potential for traffic incident without road upgrades.***	<u>Construction and Operations:</u> EP and PA: Lipson Cove Road would be sealed and upgraded All Project vehicles will comply with State and Project speed restrictions and vehicle access limits. EP only: Swaffers Road would be widened and sealed to cater for expected heavy vehicle traffic. The intersection of Swaffers Road and Lincoln Highway will consider a right turn facility and final design will be undertaken in conjunction with DPTI. Upgrade of traffic warning signs at the intersection of Coast and Swaffers Road and vegetation pruning to increase sight distances. Discussion will be held with Council regarding the potential sealing of at least 130 m of Coast Road to the south and 180 m to the north to minimise the potential for gravel drag out and safety risks to Swaffers Road. PA only: Intersection upgrade to Lipson Cove Road / Lincoln Highway junction.	Moderate (Possible x Minor)	Moderate (Unlikely x Moderate) ***Moderate consequence retained as any effects will be experienced off the project site.*** ***Measures will reduce potential for traffic safety or capacity risks.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
						Provision of marshalling areas on site to prevent queuing on the road.		
18	European Heritage	Archaeology survey of the Project site and Swaffers Road did not identify any European heritage sites of significance as listed under the South Australian Heritage Register or recognised by DENR or Tumby Bay Council.	Nil	Low (Rare x Insignificant)	Low (Rare x Insignificant)	Nil	Low (Rare x Insignificant)	Low (Rare x Insignificant)
19	Maritime Heritage	The Three Sisters maritime wreck is located approximately 1.5 km south of the jetty in the Lipson Island Conservation Park. This was identified during Project archaeology surveys. There are no listed maritime heritage sites within close proximity or expected shipping lanes to the Port.	Nil.	Low (Rare x Insignificant)	Low (Rare x Insignificant)	Nil	Low (Rare x Insignificant)	Low (Rare x Insignificant)
20	Indigenous Heritage	No sites, as defined under the Aboriginal Heritage Act 1988, were listed on the SA Register of Sites and Objects or Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984 within the Project area. The Rogers Beach dunes are likely to have unregistered Indigenous heritage items; however, this is outside the Project area. Although there are no archaeological or anthropological sites of significance expected within the Project area there	Nil.	Low (Unlikely x Minor)	Low (Unlikely x Minor)	<u>Construction:</u> EP and PA: Prior to any construction activities occurring, a physical inspection of the Project area would be undertaken, in consultation with the local Indigenous heritage representatives. Standard procedures would be developed and implemented on-site for the Project to redress discovery of items or sites of heritage significance and ensure appropriate stop work processes are implemented.	Low (Unlikely x Minor)	Low (Unlikely x Minor)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		is potential for artefacts to exist and disturbance through construction excavation.				PA only: Re-vegetation of a buffer area at the northern end of the site to enhance the protection of known heritage sites. Re-vegetation along the ridge line and coastal strip between the silos and Lipson Cove Road to seek to return the coastal dreaming story lines and traditional walking paths to closer to pre-European condition. Heritage monitoring officers to be used for the duration of the construction phase of the Proposed Amendment. Cultural awareness training for all personnel on the project.		
21	Visual Amenity	The Project is located along remote coastline on the Eyre Peninsula and will alter the current coastal view. The site is located in gently undulating coastal areas. Rogers Beach located adjacent the north of the site is accessible with unsealed track through existing farmer properties. Lipson Island Conservation Park is located 1.5 km south from the Project jetty and includes a small informal camping area. The nearest sensitive receptor is inland approximately 1 km.	A straight wharf with an approximate overall length of 600 m, designed to cater to Panamax vessels is proposed. This includes am approximately 240 m groyne extending from the shore. Site earthworks will be more	High (Almost Certain x Minor)	High (Almost Certain x Minor)	<u>Construction and Operations:</u> EP and PA: Decommissioning phase should the Project proceed is likely to be decades into the future. At this stage removal of unnecessary land-based infrastructure would be reviewed. Lights at the Port will be domed focused low-level lights which will minimise light spill. Port facilities will be coloured in earthen tones to reduce visibility. Infrastructure to be built behind the headland. EP only:	Low (Possible x Insignificant)	Moderate (Almost certain x Insignificant) ***Following mitigations, development of a port at the site will still have a visual impact.***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
			localised than for the EP. Except for the silos, site infrastructure (i.e. bunkers) will be lower profile/scale than previously proposed iron ore and grain storage sheds. Re-vegetation undertaken along the eastern portion of the site will provide some screening from Lipson Cove.			Planting of screening vegetation between 2-4 m height on Lipson Cove Road along southern Project boundaries.		
22	Waste	There is potential to generate minor volumes of chemical, domestic, septic, packing and office wastes. The draft SA Waste Strategy 2010-2015 outlines the preferred waste management hierarchy. Waste poses a number of potential hazards including attraction of pests, contamination of soil and water resources, and negative impacts to marine flora and fauna.	Nil.	Moderate (Possible x Minor)	Moderate (Possible x Minor)	<u>Construction:</u> PA only: Spoil generated from site earthworks would be reused during construction. <u>Construction and Operations:</u> EP and PA: A Waste Management Plan will be developed in accordance with reduce, reuse and recycle principles for construction and operation phases and appropriate tracking systems.	Low (Possible x Insignificant)	Low (Possible x Insignificant)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
						All waste will be disposed of in accordance with EPA requirements. An approved domestic septic system will be installed and suitably maintained. PA only: Development of a procurement policy to encourage purchase and use of materials with recycled content, minimise packaging and materials and use materials that can be recycled at the end of their life. Contractors and suppliers expected to reflect the policy requirements in their procurement activities.		
23	Chemical Storage and Handling	The Project will include a 68,000 L fuel oil storage facility and a 10,000 L fuel storage facility. Other minor chemical volumes will be stored onsite for general operational uses. There is potential for chemicals to contaminate surface, ground and marine water, soil and ecology resources through spills or leaks.	Approximately 30,000 L bulk diesel fuel tank for power generation and 10,000 L bulk diesel fuel for site machinery and equipment.	High (Possible x Moderate)	High (Possible x Moderate)	<u>Construction and Operations:</u> EP and PA: A Waste Management Plan will be developed in accordance with reduce, reuse and recycle principles for construction and operation phases and appropriate tracking systems. Fuel and chemical tracking systems to be implemented onsite. All waste will be disposed of in accordance with EPA requirements. Stormwater detention basins and channels will capture and retain stormwater onsite and minimise offsite surface water flow onto the Project area.	Low (Unlikely x Minor)	Low (Unlikely x Minor)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
						All chemicals and fuels will be stored in appropriate bunded facilities. Fuel oil and fuel storage facilities will comply with the requirements of AS1940:2004, The storage and handling of flammable and combustible liquids. Appropriate spill kits will be maintained onsite during construction and operations phase.		
24	Maritime Spills, Leaks and Anti-foulants (Port area)	There is potential for vessel spills or leaks as well as anti-foulants to pose a contamination risk to the Port area. Contamination could impact marine fauna and flora, as well as sediment and water quality in and around the area. Significant spills while at berth are uncommon in general port operation. The Port will be used for export only and maritime import of fuel or chemicals is not planned as part of the operations under this PER.	Nil.	Moderate (Possible x Minor)	Moderate (Possible x Minor)	<u>Construction and Operations:</u> EP and PA: Development of a marine Emergency Response and Incident Management Plan will be undertaken. Refer Item 23, Chemical Storage and Handling. A marine water monitoring program will be developed as part of operations and construction to monitor water quality <u>Operations:</u> EP only: Conveyor belts will be fully enclosed (it is not possible to cover all conveyors for the PA).	Low (Unlikely x Minor)	Low (Unlikely x Minor)
25	Spencer Gulf: Maritime Spills	There is potential for vessel spills to pose a contamination risk to the Spencer Gulf. This would be predominantly associated with a shipping accident (damage to vessel)	Nil.	Moderate (Unlikely x Moderate)	Moderate (Unlikely x Moderate)	<u>Operations:</u> EP and PA: A detailed hydrographic study would be undertaken prior to operations to establish	Low (Rare x Minor)	Moderate (Rare x Moderate) ***Moderate rating***

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		or poorly maintained vessel. Contamination could impact marine fauna and flora, as well as sediment and water quality in and around the area. Significant spills in deep water, away from reefs and coastal area are uncommon in the Spencer Gulf. Vessels will not be travelling within marine parks or reef areas. The Port will be used for export only and maritime import of fuel or hazardous chemicals is not planned as part of the operations under this PER. There will not be fuel or transfer of waste/materials loading or unloading undertaken by vessels within the Gulf.				a clear shipping lane from the Port to Spencer Gulf deep water. Appropriate navigation aids will be installed. Emergency response procedures for spills in the marine environment would adhere to the requirements specified in Australia's National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances (AMSA, 2007).		***retained as by definition, effects would impact waters outside of the project area.***
26	Spencer Gulf: Marine Mammal Collision	There is potential for marine mammal collision with a ship or propeller during shipping movements to and from the Port within the Spencer Gulf. The Port area or Spencer Gulf deep water is not significant habitat for breeding purposes, where more protected waters are preferred. There is potential for mammal movement within the area, including whales, dolphins or seals. Shipping numbers will add to existing shipping traffic in the gulf.	PA proposes to use smaller vessels and will result in reduced number of ship movements.	Moderate (Unlikely x Moderate)	Moderate (Unlikely x Moderate)	<u>Operations:</u> EP and PA: Refer Item 25. Shipping traffic would not travel through marine park areas (Sir Joseph Banks or Lipson Island) and remain within deep-water gulf channels.	Low (Unlikely x Minor)	Low (Unlikely x Minor)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
27	Vessel Anchored Stability	An anchoring study was undertaken to assess the potential for vessel movement should an anchor not hold in varying weather conditions. The study demonstrated anchors would have a low risk of not securing Cape class vessels (PB, 2011). In strong weather conditions shipping vessels will be parked 4 km offshore.	Simulations undertaken for the PA demonstrate that even under the most extreme weather conditions, a Panamax size vessel can be berthed at the wharf (using two tugs). No regular offshore parking of vessels proposed, however may occur ad-hoc depending on shipping schedules, so an anchorage location to be agreed through the Port Declaration process.	Low (Unlikely x Minor)	Low (Unlikely x Minor)	<u>Operations:</u> EP only: A detailed hydrographic study would be undertaken prior to operations to establish a clear shipping lane from the Port to Spencer Gulf deep water and would undertake opportunistic offshore sediment sampling to confirm sea bed conditions for anchoring. PA only: Two tugs will be used for each ship coming into berth, regardless of weather conditions.	Low (Unlikely x Minor)	Low (Unlikely x Minor)
28	Local and Regional Economics	There are limited expected negative economic impacts. There is potential for the Port to offer local and regional	The construction and operational workforce for the PA is reduced	Moderate (Possible x Minor)	Moderate (Possible x Minor)	<u>Construction</u> PA only: Consultation will be undertaken with tourism representatives about peak	Low (Unlikely x Insignificant)	Low (Unlikely x Insignificant)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		employment and supply contract opportunities. The Project workforce may pose short term supply and price pressure to local rental accommodation options, particularly during construction phase. The Port site is located on a relatively small area of land and unlikely to cause significant negative impacts to agricultural production in the area.	compared to the EP.			construction worker demand periods to manage potential impacts on tourism in the study area and avoid potential for any residual impacts post-construction. Project specific accommodation facility not expected to be required. <u>Construction and Operations:</u> EP and PA: Positions will be open to local and regional applicants with suitable skills. Contract and supply options will be open to local and regional businesses including for the accommodation facility. EP only: Project workers will potentially be accommodated in a purpose-built Centrex Tumby Bay accommodation facility to reduce pressure on local housing.		
29	Local and Regional Infrastructure	There is potential for the Project's water and power demands to add to regional infrastructure supply burden and government expenditure costs. Centrex would pay the capital costs required to extend a spur line from the existing ElectraNet power transmission line and SA water main water pipeline to the site. The Port is a privately funded development. Centrex would fund local	On-site power generation only. On-site rain water harvesting, storage and re-use (No SA Water connection); Road upgrades limited to Lipson Cove Road and its intersection with	Low (Unlikely x Insignificant)	Low (Unlikely x Insignificant)	PA Only: Ongoing formal engagement with District Councils of Tumby Bay, Lower Eyre Peninsula and Cleve regarding ongoing traffic impact monitoring during operations. Negotiation of Road Maintenance Agreements with impacted Councils. Aim is to not leave Councils with unfunded maintenance liabilities. Working with Eyre Peninsula Local Government Association and DPTI to	Low (Unlikely x Insignificant)	Low (Unlikely x Insignificant)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
		Swaffers and Lipson Cove road upgrades.	Lincoln Highway – not Swaffers Road.			quantify reduction of impacts on DPTI network associated with rail line closure (reduced vehicle movements to Port Lincoln). Potential need for investment into strategic east-west freight link as identified by SMEC (2019a) and the TIA.		
30	Local and Regional Services	The Project may contribute to an increased demand on health and emergency services associated with workforce numbers and industrial activities. There are existing health and emergency services in the region and local townships, including Tumby Bay Hospital. The construction workforce will be significantly higher than operations.	The construction and operational workforce for the PA is reduced compared to the EP.	Moderate (Possible x Minor)	Moderate (Possible x Minor)	<u>Operations:</u> EP and PA: The proponent will link and plan with local emergency and health services to keep them informed of Project development, demand and risks. Emergency response plans will be developed and implemented for the site during construction, operations and decommissioning phases. First aid services will be provided onsite for minor ailments and injuries.	Low (Unlikely x Minor)	Low (Unlikely x Minor)
31	Social amenity	There is potential for social disruption associated with fly in fly out construction/operations workforce from antisocial behaviour, disruption to usual local sense of amenity etc. Construction phase will have over 200 employment positions and up to 70 for operations. Many may be fly in / fly out workers to ensure appropriate skills and experience.	The construction and operational workforce for the PA is reduced compared to the EP (peaking at 150 during construction and 30 during harvest). It is anticipated that the operational	High (Possible x Moderate)	High (Possible x Moderate)	<u>Construction and Operations:</u> EP and PA: A Code of Conduct, including a shift zero tolerance of alcohol policy, for all Project personnel will be implemented. Refer Item 25, Local and Regional Economics. The impact from construction to operations phase will reduce significantly with the smaller workforce. EP only:	Low (Unlikely x Minor)	Low (Unlikely x Minor)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
			workforce will reside within the general project area.			Project workers will be potentially accommodated in purpose-built accommodation including meals and transport to reduce pressure on local housing, roads and community.		
32	Tourism and Recreation Values	The Project is in a remote area of the coastline on private land. Tourism provides contribution to local and regional economy. The Port may provide a point of tourist interest. A private beach (Rogers Beach) abuts the northern aspect of the site. Access to the beach will be maintained by Centrex. Lipson Cove has a small informal camping area approximately 1.6 km south of the proposed jetty. Significant negative noise or light impacts are not expected at this site. There are no major built tourism areas or sites within close proximity to the site,	Over time Peninsula Ports will work with the Traditional Owners and Council to expand this revegetation approach towards Lipson Cove to improve the amenity and value of the campgrounds. Ongoing employment of a Traditional Owner Land Management Officer at the site. Subject to agreement with Council this role can support the ongoing management by Council of Lipson Cove (Boodloo)	Low (Unlikely x Insignificant)	Low (Unlikely x Insignificant)	<u>Construction and Operations:</u> EP and PA: Refer Item 21, Visual Amenity. Project design includes consideration of visual screening aspects including vegetative screening, built infrastructure colour, and use of existing topography to screen the site.	Low (Unlikely x Insignificant)	Low (Unlikely x Insignificant)

No.	Project Aspect	Evaluated Project (EP) Detail	Differences due to Proposed Amendment (PA)	Raw Risk (L × C)		Management Measures	Mitigated Risk (L × C)	
				EP	PA		EP	PA
			and Rogers Beach; Use of the site facilities to enable the Traditional Owners to establish a Ranger Base for any future Ranger Programme that may come into existence along this coast line.					

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