EIS

WHALERS WAY ORBITAL LAUNCH COMPLEX

ENVIRONMENTAL IMPACT STATEMENT

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This draft Environmental Impact Statement ('Draft EIS') has been prepared by SouthernLaunch.Space Pty Ltd ('Southern Launch').

The proposed development is subject to both Commonwealth and South Australian legislation for the assessment of planning and environmental impacts. This Draft EIS has been prepared for the purpose of assessment by the South Australian Government under the South Australian *Development Act 1993*. The document has been prepared for that purpose only. A separate referral will be made to the Commonwealth Government pursuant to the *Environment Protection and Biodiversity Conservation Act, 1999*.

Southern Launch has relied on information provided by specialist consultants, government agencies and other parties and has taken all reasonable steps to review the information contained in the document and to ensure it is correct at the date of submission. However, MasterPlan does not take responsibility for the accuracy or completeness of the information.

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PROPONENT DETAILS

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CONTENTS / detailed contents section follows this page

CONTENTS / 1

CONTENTS / 2

CONTENTS / 3

CONTENTS / 4

CONTENTS / 5

CONTENTS / 6

CONTENTS / 7

CONTENTS / 8

CONTENTS / 9

FIGURES / 1

FIGURES / 2

FIGURES / 3

PHOTOGRAPHS / 1

3

3.1 Looking south to monument
3.2 Looking south from Cape Wiles Lookout
3.3 Sinkhole
3.4 Looking south-east from southern coastal cliffs with Cape Wiles in background
3.5 Looking south-west from southern costal cliffs
3.6 Looking west from coast cliffs south of Site B
3.7 Coast cliffs at south-western extent of site
3.8 Theakstones Crevasse at north-western extent of site

3.9 Example of existing signage infrastructure
3.10 Example of existing signage infrastructure

3.11 Example of existing toilet infrastructure

3.12 Example of existing tourist infrastruture
3.13 Example of existing tourist infrastruture
3.14 Example of existing tourist infrastruture

3.15 Example of existing accumulated waste
3.16 Example of existing accumulated waste
3.17 Example of existing accumulated waste
3.18 Example of existing accumulated waste
3.19 Example of existing accumulated waste

3.20 Example of existing infrastructure at end of life

3.21 Example of existing access roadway conditions
3.22 Example of existing access roadway conditions
3.23 Example of existing access roadway conditions
3.24 Example of existing access roadway conditions
3.25 Example of existing access roadway conditions
3.26 Example of existing access roadway conditions

3.27 Example of existing access roadway conditions north of Site D
3.28 Example of existing access roadway conditions north of Site D

3.29 Looking south-east across Site A

PHOTOGRAPHS / 2

PHOTOGRAPHS / 3

TABLES / 1

TABLES / 2

EXECUTIVE SUMMARY

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1.0 INTRODUCTION

1.1 Project Overview

SouthernLaunch.Space Pty Ltd ('Southern Launch') is seeking approval to establish a multi-user satellite launch facility and associated infrastructure at Whalers Way on the southern tip of the Eyre Peninsula, from which it proposes the launch of micro and small-lift rockets. The facility is to be called the Whalers Way Orbital Launch Complex ('WWOLC') and will be available for commercial hire by various domestic and international entities to meet growing demand for polar and sun-synchronous orbit satellite insertion.

Southern Launch is an Adelaide-based company founded in 2017 and comprises of defence and industry experts. The company was established to bring polar earth orbit space launch capabilities to Australia. A key objective of the company is to embrace new launch technologies to develop the most efficient, robust, a4nd cost-effective ways of getting rockets and payloads into orbit.

The WWOLC will consist of four (4) separate sites together comprising the Project Footprint, consisting of two (2) launch sites, a supporting infrastructure site including a dam, magazine and storage, and a range control facility for launch control and site administration. The Project will also include upgrades to existing access tracks as required.

The WWOLC will be located at Whalers Way, at the southern tip of Eyre Peninsula in Sleaford, South Australia, which is approximately 25 kilometres south-west of Port Lincoln. The site is predominately undeveloped vegetated coastal land. The constrained Project Footprint will occupy a very small proportion of the land with the overwhelming majority of the allotment containing the site to remain undisturbed. The location was selected as the preferred site after achieving the highest rating following a detailed and extensive multi-criteria analysis.

The proposed facility will be on freehold land owned by Theakstone Property Pty Ltd. Southern Launch have entered into a Commercial Access Lease ('the Lease') with the landowner for specified purpose of this project.

The WWOLC is proposed to be developed in four (4) stages over time in response to emerging market opportunities and conditions. Different elements of the Project are proposed to commence at the various stages from late 2021 to 2023, dependant on the timing of regulatory approvals. Launch of small-lift vehicles from one (1) of the launch sites is intended to commence in Stage 1. Construction will progressively occur after all relevant approvals have been granted.

1.2 The Process

1.2.1 Major Project Declaration

On 22 August 2019, the Minister for Planning (the Minister) declared the proposed project by Southern Launch a "Major Project" pursuant to Section 46 of the *Development Act, 1993*. Subsequently the proponent lodged an application under the *Development Act, 1993* on 20 November 2019 to seek approval for the facility.

On 23 July 2020, the State Planning Commission ('SPC') determined the level of assessment for the application would be an Environmental Impact Statement ('EIS') and issued Assessment Guidelines ('Guidelines') on 20 August 2020 for its preparation.

The EIS has been prepared by the proponent in accordance with Guidelines issued by the SPC. They set out the assessment issues associated with the proposal as determined by the SPC.

1.2.2 Environmental Impact Statement Scope and Purpose

The scope of the EIS is to identify, describe and consider the potential impacts associated with the construction and operation of WWOLC at Whalers Way, including the impact on humans, animals, and the natural environment. The EIS also considers the broader social and economic implications of the proposal at a local, State and National level.

The Guidelines identify 17 principal issues/impact topics required to be addressed in the EIS, and the level of assessment required - standard, medium or critical level assessment. A total of 110 separate assessment requirements are listed under the 17 Issue/Impact headings.

The EIS has been structured around the content and assessment requirements outlined in the Guidelines. Chapters 1 to 6 describe the background to the Project, the need for the Project, the site selection process, and a project description. Chapters 7 to 23 are structured to follow the assessment requirements identified in the Guidelines and provide an analysis of the environmental, social, and economic effects of the Project, mitigation measures, and the level of consistency with relevant Government policy and legislation.

The EIS also comprises a separate volume of specialist reports that form the basis of the analysis contained in the EIS, together with all relevant plans, technical drawings, and other data essential to the Project.

1.2.3 Public and Agency Consultation

Following lodgement with the Commission, the EIS will be reviewed and then released for public and agency comment (for at least 30 business days). The Commission will conduct a hearing prior to the closure of submissions at which the public may make representations.

At the conclusion of the public consultation process the proponent will prepare a response to the representations and may amend aspects of the Project and the EIS. The response document will be released for public information.

The Minister for Planning, with advice from Plan SA, will consider the public submissions, Agency comments, the final EIS and the proponents' response to submissions, and prepare an Assessment Report. The Assessment Report will be a public document.

The Governor of South Australia, on the advice of the Minister for Planning, will subsequently make a decision on the proposal. This decision will be notified in the Government Gazette and on the SA Planning Portal. The decision of the Governor is final and cannot be appealed under the *Development Act, 1993* by the proponent or any third party.

2.0 THE PROJECT

Southern Launch propose to establish a multi-user rocket launch facility, the Whalers Way Orbital Launch Complex, at Whalers Way at the southern tip of Eyre Peninsula. The facility is to be developed in response the growing demand for the launch of domestic and international vehicles for polar and sun-synchronous orbit satellite insertion.

2.1 Project Rationale

Most commercial rocket launch pads in use today were built during the 1960's and 1970's in as close proximity to the equator as possible to maximize the inertial velocity imparted on the launch vehicle. These facilities were typically purpose built, each designed to only operate a single manufacturer's rockets and predominantly launching large satellites into Geostationary Earth Orbits ('GEO').

Advances in satellite technologies have enabled cheaper nano- and micro-satellites in Low Earth Orbit ('LEO') and Polar and Sun Synchronous Orbits ('SSO'). This satellite technology advancement has revolutionised the space industry, advancing the number of missions these smaller satellites undertake and significantly reducing the size of the rockets needed to get them into orbit. Few of the current launch pads throughout the world are capable of easily and safely launching a rocket into these Polar or SSO orbits without expending a prohibitively large amount of fuel to shift the orbit inclination.

Southern Launch's objective is to bring polar Earth orbit space launch capabilities to Australia by developing a launch facility with the capability to cater for the launch of nano- and small-satellites into polar and SSO Orbits. Southern Launch's approach is to capitalise of Australia's many geographical advantages for low orbit launches and embrace world leading knowledge and futuristic technologies to simplify space launch and subsequently drive down customer cost, in order to provide the most efficient, robust and cost-effective satellite insertion facility in Australia and internationally.

The Whalers Way Orbital Launch Complex has been conceived specifically for these micro- and small-lift rockets enabling them to launch and operate far more economically than the larger GEO satellites.

The market to launch the estimated 6,200 small satellites needed between 2017-2026 is estimated at US $30.1 billion and has spawned the creation of over 130 companies worldwide that are developing new, micro- and small-lift rockets. With more than half the satellite market going into small rockets and polar orbits, the estimated market Southern Launch can address, is therefore estimated at approximately US $15.6 billion.

2.1.1 Potential Direct Benefits

Southern Launch is proposing to take advantage of these global trends and emerging market drivers by developing a launch facility that would be made available to third-party rocket manufacturers who would be responsible for securing their own payloads.

Southern Launch's Whalers Way Orbital Launch Complex seeks to create a 'centre of gravity' attracting both local and international rocket and satellite manufacturers to South Australia. This will create more technology related jobs in Australia.

By the time the facility is complete and in full operation, the estimated average employment impact of Southern Launch's operation assessed over the full ten-year analysis period would be to increase employment by 76.2 full time equivalent ('FTE') positions. It is also predicted the facility would result in an impact on Gross State Product ('GSP') of $53.4 million in 2018/19 values across the decade, assuming consumption impacts from workers at Southern Launch and its supply chain are included in the analysis.

2.1.2 Potential Indirect Benefits

Establishment of the launch facility would have the potential to attract one or more of the launch vehicle operators using the facility to establish either a final assembly and testing facility, or a full launch vehicle manufacturing facility in the State. If this does occur, it will significantly increase the economic benefits from the launch facility on the South Australian economy.

The predicted benefits include an increase in on-going employment of 142 FTE positions once it is operational and gross impact on economic activity through increase real GSP by $318.4 million in 2018/19 values across the decade, assessed over the full ten-year analysis period.

It is also expected that a facility of this nature will introduce a new arm of tourism to the region. Space related infrastructure and events can become significant tourist attractions for enthusiasts, families, student, or tourist groups. Once the site is established the public will be able to observe launches and visit the facilities.

Southern Launch also intends to work closely with the education sector, including schools and tertiary education facilities, investigating the establishment of a programme by which Australian schools will be able to sponsor dedicated rocket payloads on a competitive basis. In addition, companies that launch from the facility will be requested to undertake public outreach activities at local communities and schools. This will provide an opportunity for engagement with the community and education on the facility, the launch process and the launch vehicles.

2.1.3 Consequences of Not Proceeding

Not proceeding with the Project would result in the forecasted direct and indirect economic and social benefits accrued from the Project as described to not be realised. In such a circumstance, the market for the launching of vehicles and payloads as proposed will still exist and will be focused on locations where launch facilities exist or are being developed.

Having regard to there not being other advanced proposals for competing SSO launch facilities within Australia, there is a high probability that, should the proposed project not proceed, the market for such launches will be met overseas.

2.2 The Proponent

SouthernLaunch.Space Pty Ltd is an Adelaide-based company founded in 2017 and comprises of defence and industry experts with an advisory board. Southern Launch was established to develop a commercial operation capable of addressing the rapidly increasing demand for high latitude launching sites for polar and sun-synchronous orbits.

The company has two complementary purposes; one dedicated to the design, construction, and operation of a dedicated polar Earth orbit launch capability, and the other to research and implementation of new and novel space launch vehicle flight hardware for customers.

Southern Launch has the capability to manage all aspects of a launch campaign, from customer-specific launch vehicle selection, associated launch preparation and operations through to mathematical flight performance simulations, safety management and logistics. The company has already undertaken overland sub-orbital launch site testing for rocket motors and payloads at their Koonibba Test Range (Koonibba, South Australia), and undertook two rocket launches from the Range in September 2020.

2.3 Project Description

The complex will be designed to launch the latest technology 'smallsat' satellites which are typically weighted between several kilograms ('cubesat') to a maximum of several hundred kilograms. Consequently, the launch vehicles (rockets) will also be relatively small (in comparison to earlier satellite launch vehicles and heavy-lift rockets), typically being in the range of 10 to 30 metres tall.

It is expected the of operation of the WWOLC will initially accommodate in the order of one rocket launch per two months, increasing over time to rocket launch per fortnight to a maximum of 36 orbital launches and six sounding rocket launches per year. Whilst several weeks of preparation will be involved in preparing for a launch, the actual launch itself, from ignition to orbit, will take approximately 45 minutes. Of this time, the launch will only result in impacts on the terrestrial site and locality for a maximum period of up to three minutes.

The WWOLC is proposed to be developed in stages over time at an estimated cost of approximately $43M. The current proposal represents the initial development of the complex and is the subject of this EIS. It comprises two separate rocket launching sites, a supporting infrastructure site, and a range control facility.

2.3.1 Project Components

The WWOLC will consist of four (4) separate sites together comprising the Project Footprint.

The four (4) sites comprise of the following:

- Launch Sites - Sites A and B;
- Infrastructure Site – Site D; and
- Range Control Facility - Site E.

The design development of the Project Footprint layout and siting was determined based on multiple criteria including buffer distances, launch exclusion zones, extent of native vegetation, accessibility, and topography. The Project Footprint layout within the Whalers Way site is depicted in **Figure A**.

Subject Allotment
Zone Boundary
Key Road
Lease Boundary

CTP Caravan and Tourist Park
Con Conservation
CWOI Coastal Waters annd Offshore Islands
Ru Rural

SITE A Launch Facilities
SITE B Launch Facilities
SITE D Infrastructure
SITE E Range Control

Key Site Access
Radius 3120m to Site A Launchpad
Radius 2100m to Site B Launchpad

FIGURE A

SITE PLAN DEVELOPMENT CONCEPT

SOURCE: MASTERPLAN

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2.3.1.1 Launch Sites – Sites A and B

Two launch sites are proposed containing a range of elements and structures and will provide integrated, and largely self-contained facilities for the assembly, preparation, staging, and launch of the various vehicles to be launched from the WWOLC.

Each of the two launch sites will contain a similar range of elements and structures, with the configuration of each varying in response to the prevailing conditions at each site, and the need to cater for different launch vehicles.

Launch Site A is intended to cater for larger launch vehicles typically of greater than 30 tonnes up to approximately 100 tonnes. The site contains a launch pad (with flame trench) at the southern end of the site and assembly building and car park at the northern end. A dam is located adjacent the southern end of the site. A helipad is located centrally and to one side between the launch pad and assembly building. Other infrastructure includes two lighting towers, flare stack, radar pad, fire control equipment, septic tank, and pump, and launch control equipment.

Launch Site B is intended to cater for smaller launch vehicles typically of up to approximately 60 tonnes. The site contains a launch pad (with flame trench) at the southern end of the site and assembly building and car park at the other end. A dam is located adjacent the northern end of the site. As mentioned previously, a helipad is located centrally and to one side between the launch pad and assembly building.

2.3.1.2 Infrastructure Site – Site D

The Infrastructure Site is a construction compound proposed to accommodate activities and facilities that will support the construction and, subsequently, the on-going maintenance of the overall WWOLC facility.

The infrastructure site will consist of the following; a quarry to produce engineered pavement materials in the initial stage of the development, which will subsequently be converted into a water storage dam with a 30 megalitre capacity; a pump station; a workshop/maintenance building; a magazine for the storage of explosive compounds and dangerous goods; and the potential provision for future on-site power generation.

The site will be enclosed by a chain wire mesh fence topped with barbed wire and equipped with a lockable double gate.

2.3.1.3 Range Control Building – Site E

Site E will accommodate the range control building to house the operational, security, and emergency services of the complex and will oversee all operations on the site. The facility will also incorporate facilities catering to visitors to the site. The site is located adjacent the main entrance to the facility and will provide perimeter security services.

The southern and eastern portions of the site will feature two stormwater detention facilities and a large car parking area. The car parking area has been configured in a manner to act as a staging area in emergency events.

The eastern portion of the site will feature the range control building. The building will be designed to complement the character of the locality and enhance the launch experience for both staff and visitors.

2.3.1.4 Access Track

Each of the above sites will be physically separated from each other on the site and connected by an internal access track network. Internal site access will be developed utilising the existing access track network where possible, with minor extensions as required. Upgrades will occur as required to accommodate the anticipated vehicle traffic. The existing external road network has been assessed and is considered suitable for purpose.

2.3.1.5 Temporary Infrastructure

Temporary infrastructure associated with construction of the development is required and will primarily include a concrete batching plant, site and construction offices and facilities, laydown areas, and construction access tracks. Temporary sites are indicated on the plans and have been included in the assessment of environmental effects.

2.3.2 Project Operations

The number of launches based on the initial phase of the development is anticipated to commence with approximately six launches in the first year of operations, increasing to a maximum of 36 orbital launches per year in year five of operations.

It is envisaged that there would typically be one or two sounding rocket launches undertaken at Whalers Way per year with a maximum of potentially six per annum, resulting in an estimated 42 launches per year based on the site capacity and capability subject to this EIS.

2.3.2.1 Launch cycle

Typically, a launch cycle will run in the order of three to five weeks from occupation to vacation of a launch site; however, the exact timeframe will vary based on the nature of the launch vehicle and the specific requirements of an individual launch mission.

Specific operational procedures are proposed for the delivery and operation of a rocket launch, including transportation of rocket components and payloads to the site, rocket assembly on site, transport to launch pad, testing on launch pad, preparation and clearance of launch site and flight corridor, and rocket launch.

2.3.2.2 Safety Exclusion Zones

To ensure people are safe during the launch process, an exclusion zone is required to be established around the launch site (Launch Exclusion Area), and on the ground along the path the rocket will fly to get into space (Launch Exclusion Corridor). For safety reasons, no unauthorised persons or vehicles are allowed in these areas during a launch.

Exclusion Zones will only be in effect when they are needed, and the public will be given ample notice before they are put in place through Notices to Airmen (NOTAMS) and Notices to Mariners (NOTMARS). Additional notification of launches via media channels will be undertaken to inform the public. The exact size and location of an exclusion zones will be based on the size of the rocket being launched at the time and the orbit the rocket will go into.

2.3.3 Project Staging and Timing

Subject to the timing of approvals, the development proposal is anticipated to be undertaken in four (4) principal stages between 2021 and 2025 as follows:

- Stage 1 (2021) - Launch Site B;
- Stage 2 (2022) - Range Control Facility;
- Stage 3 (2022/23) - Infrastructure Site D; and
- Stage 4 (2023) - Launch Site A.

3.0 THE PROJECT SITE AND LOCALITY

3.1 Site Selection

The Whalers Way site at Sleaford was identified following a comprehensive site selection process across Australia as the ideal project location. The Whalers Way area was selected from an analysis of nine candidate sites within five identified areas across southern Australia that broadly met the locational criteria. Central to the selection criteria was the safety requirements specified under the Space (Launches and Returns) Act 2018.

Specific location criteria included the availability of unobstructed flight paths, low aircraft/shipping volumes, low population in the immediate vicinity, year-round temperate climatic conditions, coupled with the availability of a skilled local workforce and a robust logistics supply network. The most critical criteria for site selection, was a high latitude location suited to launching rockets into a low Earth orbit and being remote enough to minimise any risks or hazards associated with rocket launching.

The fundamental constraint to suitable launch sites is an inability for launched vehicles to pass over populated land. In essence, this key constraint means that orbital launch sites need to be located in immediate proximity to the coast, without any populated land (including individual dwellings), between the launch site and the water.

Other criteria relate to the servicing of the site from a logistics and workforce perspective, and to the operational and security requirements of the site. It is important that the site is within commuting distance from a service centre of a sufficient size that it has a broad range of facilities, services and skills.

The Whalers Way site is a large, contiguous allotment, in close proximity to the coast, held as freehold land, located in proximity to Port Lincoln. The site has no dwellings or other human occupied facilities located on it and the closest dwellings were located an appropriate distance away to allow suitable buffer zones to be established.

The site is largely covered with remnant vegetation; however, previous recreational uses have resulted in some degraded areas of vegetation. The site is the subject of a Heritage Agreement; however, some areas of the site are specifically excluded from that agreement. The site is surrounded by a narrow coastal reserve, however, much of this is disposed as inaccessible cliffs and coves and only accessible from the subject site. For these reasons this has been selected as the preferred location.

3.2 The Subject Site

The Project Site is on the southern tip of Eyre Peninsula at Sleaford. The area is locally known as Whalers Way. The Project Site comprises an area of some 1,200 hectares and is bounded by the -34.923-degree line of latitude to the north and the sea to the south, east and west. The site is predominantly an undeveloped vegetated coastal area, punctuated by access tracks, open areas, and dated infrastructure relating to its present recreational use.

The Project Site is subject to a Heritage Agreement pursuant to the *South Australian Heritage Act, 1978*. Under the above agreement the land is dedicated to the conservation of native vegetation and native fauna. The Heritage Agreement will require amendment to facilitate the Project.

The coastal interface is characterised by cliffs of varying heights and rocky outcrops, with a few areas also having coved beaches. The nature of the coastal interface means that the majority of the coastline and adjacent areas is located in the adjacent coastal reserve.

The remnant vegetation on the site varies in form primarily based on the distance from the coastline and the nature of the ground conditions. Recreational and tourism activities, including camping, is evident, with areas degraded by vehicle access, and areas of accumulated rubbish.

Access to the site is currently permitted at the goodwill of the landowner through the purchase of a visitor pass.

3.3 The Locality

The locality extends in all directions from the allotment containing the subject site and takes in land to the north and north-east and marine areas to the south, west and east including Liguanea Island, located approximately 5.0 kilometres to the south of the allotment.

The characteristics of the locality vary substantially from area to area. To the north the landscape gives way to an increasing proportion of cleared farmland used for a mixture of broadacre cropping and grazing.

Throughout the locality there are several rural roads, infrastructure, fencing, farm buildings, water tanks, troughs, pipelines, and a number of dwellings. Further to the north and east farmland gives way to the Lincoln Conservation Park. To the west there is a mix of vegetated areas and farmland, and the Cathedral Rocks windfarm.

The level of amenity in the locality is best described as tending towards the higher end of moderate. It is positively influenced by good quality vegetation, coastal views and vistas combining the vegetated areas with sweeping vistas of the ocean, particularly from elevated locations. It is negatively influenced by primary production uses bringing the typical impacts of such uses, the limited but evident traffic movements on unsealed roads and the condition of some of the built form and infrastructure.

4.0 PRELIMINARY CONSULTATION AND ENGAGEMENT

Southern Launch has engaged extensively with various agencies including the District Council of the Lower Eyre Peninsula ('DCLEP'), the City of Port Lincoln ('PLCC'), Primary Industry and Regions South Australia ('PIRSA'), and the Regional Development Australia Whyalla Eyre Peninsula ('RDAWEP').

Engagement has also occurred with the local fishing industry, local residents, industries and education sector interest. Both RDAWEP and Southern Launch have also approached surrounding owners and occupiers on a case-by-case basis to help the local community understand the proposed development.

The South Australian Government has established the 'Southern Launch Taskforce' comprising members from Defence SA; Department of Trade and Investment ('DTI'); Department for Infrastructure and Transport ('DIT'); Attorney General's Department – Planning and Land Use Services ('PLUS'); Environment Protection Authority ('EPA'); Country Fire Service ('CFS'); Department for Energy and Mining ('DEM'); South Australian Police ('SAPOL'); Department for Environment and Water ('DEW'); Department of Treasury and Finance ('DTF'); and Safework SA and Primary Industries and Regions, South Australia ('PIRSA').

Southern Launch is yet to start a formal public engagement program. A public awareness program was commenced on 5 December 2018 when the Premier of South Australia formally announced the potential for development of the site. Southern Launch plans to start formal public outreach events to provide further information immediately following the lodgement of the EIS with the State Government. These events will be held in Port Lincoln, Tulka and Coffin Bay and will be open to the public.

5.0 ASSESSMENT OF IMPACTS

5.1 Effects on Native Vegetation

5.1.1 Assessment Approach

To inform the EIS a series of technical investigations were undertaken by ecological consultants. AECOM have prepared a Terrestrial Ecological Assessment which involved detailed site surveys to determine the vegetation characteristics and assessed the significance of potential project impacts.

A Marine Ecological Assessment was undertaken by J Diversity to determine the anticipated impacts on marine flora including an analysis of the local marine environment, and an assessment of the impacts of the proposal on the marine environment.

5.1.2 Findings

5.1.2.1 Terrestrial Native Vegetation Key Findings

Six (6) vegetation associations were observed on the site, of varying levels of condition and disturbance. All associations were considered typical of a coastal area along the southern Eyre Peninsula.

The Project will require the clearing of 23.76 hectares of native vegetation for construction including launch pads, access tracks and associated laydown areas. No threatened flora species listed under the EPBC Act, NPW Act or Commonwealth Listed Species were observed within the areas to be cleared. It is deemed unlikely that any such flora species are present.

Clearance and project activities have the potential to result in a variety of impacts that may affect the condition of native vegetation on the site in both the short and long term. These impacts include direct loss of vegetation through clearance; degradation of vegetation condition through indirect impacts such as edge effects, habitat fragmentation, irrigation effects, and dispersal of pest plants; and fire risk.

Most impacts are constrained to areas immediately surrounding the Project Footprint and their impact can be offset through appropriate mitigation and management strategies.

5.1.2.2 Marine Native Vegetation Key Findings

The Marine Ecological Assessment considered potential construction impacts (including noise) and operational impacts (including collision of rocket debris with wildlife, noise and vibration impacts, and pollution associated with debris).

It was determined that neither construction nor operational impacts are likely to impact on marine flora. Neither sound nor debris (functioning as a high-speed projectile) would have any significant impact on marine flora below the surface because of rapid attenuation of both forms of energy on entering the water.

Impacts of debris settling into the benthic environment was also considered. Rockets are constructed predominantly from inert materials including carbon fibre with some metal, including aluminium, stainless steel, and titanium, and would not result in negative impacts on ocean water quality or marine vegetation. Due to the low toxicity of the fuel to be used and its rapid dissociation on contact with water, toxic concentrations of propellant would be localised and short term.

5.1.3 Mitigation and Management

The clearance of 23.76 hectares will be offset in accordance with NVC guidelines.

A Significant Environmental Benefit (SEB) has been calculated by Southern Launch for this project and currently stands at $965,407.76. Southern Launch will either provide a SEB in the form of an inground offset, or through payment of the required fee.

Construction and operation of the Project will be managed in accordance with a CEMP and OEMP to ensure that all impacts are mitigated, managed and monitored. Management strategies include but are not limited to the use of construction methods that limit impact on surrounding vegetation; application of buffers within the Project Footprint; management procedures to limit dispersal of pest and weed species; application of appropriate firefighting measures and controls. Native vegetation that is not cleared for the Project will be protected and managed as part of the ongoing management procedures for the facility.

No direct mitigation or management strategies are required in respect to marine vegetation.

5.2 Effects on Native Fauna

5.2.1 Assessment Approach

An assessment of effect on Native Fauna has been undertaken through the Terrestrial Ecological Assessment and Marine Ecological Assessment.

A Noise and Vibration Assessment was prepared in respect to noise impacts on human populations. The noise level predictions were applied to the Terrestrial Ecological Assessment to assess noise and vibration impacts to wildlife across all project phases.

A specific investigation was undertaken by Jacobs in relation to effects on Coastal Raptor bird species.

5.2.2 Findings

A total of 34 fauna species were recorded on the land. This included 28 bird species, four mammal species, and two reptile species. Six threatened fauna species (birds) were recorded during field surveys and ten other threatened species are known to occur at Whalers Way. Twenty-five species listed under the EPBC Act as Threatened or Migratory and/or Marine that are known, likely or possible to occur in Whalers Way and include:

- Diamond Firetail.
- Eastern Osprey.
- Western Whipbird (eastern).
- Rock Parrot.
- Southern Emu-wren (Eyre Peninsula).
- White-bellied Sea Eagle.

A number of marine fauna (invertebrates, fish, and shark species) have been identified in studies in areas proximate to the site or suitable habitats likely to contain these species have been noted. Marine mammals, including the Australian Sea Lion, Long-nosed Fur Seal, and six species of cetaceans have been recorded on and around Liguanea Island.

5.2.2.1 Construction Effects on Terrestrial Fauna

The removal of vegetation (some 23.76 hectares of vegetation required to accommodate the facility) is likely to result in habitat loss posing the largest risk of adverse impacts for terrestrial biodiversity (including threatened and protected species) arising from the Project. The impact may be direct in the form of vegetation and habitat clearance, or indirect, such as a reduction in flora and fauna diversity due to shortages in available habitat resources or habitat degradation in areas adjacent to direct impacts.

Other potential construction impacts include fauna injury and/or death during construction related activity. The Threatened bird species known to occur in the Project Footprint are mobile species that are likely to be able to avoid construction activities. Construction activities will be managed in accordance with the CEMP which will include specific procedures to minimise the likelihood of fauna injury or death from construction related activity.

5.2.2.2 Operational Effects on Terrestrial Fauna

Vegetation clearance may result in fragmentation of habitat. The habitat in the local area is contiguous and provides ample connectivity across Whalers Way. Most species in Whalers Way are mobile and able to traverse the distance of cleared areas. Fragmentation is therefore considered limited and unlikely to be considered significant.

Other potential impacts may arise from changes in environmental conditions along the edges of habitats (edge effects), and the introduction of pest plants, weeds, and pest animals. Human activity across the site may disrupt ecological processes and form barriers to normal fauna behaviour. Light spill and dust impacts will have potential for both localised and longer-term impacts on some species.

The risk of launch failure impacting on mainland terrestrial biodiversity is extremely low. Direct impact would require the rocket to explode at the point of ignition at launch. Due to the proximity of the launch sites to the ocean, within a few seconds after launch the trajectory of the launch will carry the vehicle over the ocean.

The main consequential risk in an ignition point failure is the resulting potential for fire. Fire risks will be mitigated through the installation of Southern Launch firefighting equipment at every launch event, along with the water deluge system. Initial firefighting capabilities during rocket launches will be augmented by local Country Fire Service (CFS) crews.

White-bellied Sea Eagles occupy a territory and nest on the offshore Liguanea Island greater than 5.0 kilometres from the launch sites. An abandoned nest is present along the Whalers Way coastline. Current disturbance at Whalers Way from interactions with amateur photographers and drone users is suspected to a have caused nest abandonment.

Two known abandoned Eastern Osprey nests are located at Cape Wiles and another between Cape Wiles and Cape Carnot. Due to human disturbance from recreational activities, including hiking, car parking, and lookouts, the two nests are highly likely to be abandoned. It has been determined that there is potential for the territory of an Eastern Osprey pair to overlap the Project Footprint; however, it is unlikely that the area forms a breeding habitat for the pair.

A consequence of the Project is improved management of public access to the site, which will better control the current pedestrian and vehicle access and activity on clifftop tracks. The Project will benefit the local population, by reducing the current level of human disturbance. It is anticipated that the Eastern Osprey may have the opportunity to use the coastline more actively.

The management of public access and recreational activity on the site arising from the Project will eliminate the historical dumping of waste left on the site for extended periods, which is a major cause of attracting pest fauna species. The Project should therefore have a positive effect in reducing the distribution of pest fauna species in the area.

5.2.2.3 Effects on Marine Fauna

The marine environment most at risk to occur from launch failure and impact of debris on the ocean floor. Neither sound nor debris (functioning as a high-speed projectile) would have any significant impact on marine life below the surface. Debris will settle in the benthic environment.

Impacts of launch failure on Liguanea Island has been considered. Suborbital rockets will be launched with a trajectory away from Liguanea Island. Polar or Sun Synchronous trajectories pass close enough to Liguanea Island to present a risk. Collisions of high-speed projectiles with fauna on Liguanea Island could occur as a result of launch failure or explosion. For a debris fragment to collide with fauna on Liguanea Island, it would require not only failure of the rocket, but at such a precise time as would result in fallout over the island, and one or more of the few fragments falling on the island to coincide with the sparsely distributed fauna. Risk analysis modelling indicates that the potential for this to occur and result in fauna casualty on Liguanea Island is extremely remote.

Rocket debris settling on sea floor and impacting marine species has been considered. Rockets are constructed from predominantly inert materials and would not result in negative impacts on ocean environment. There may be batteries of similar volume to several of car batteries, which would be expected to have a minor localised impact that would dissipate rapidly.

5.2.2.4 Noise Impacts on Fauna Population

In respect to impacts on wildlife, noise levels above 93 dB(A) could result in temporary hearing loss, auditory fatigue, masking of environmental noise, and behavioural/physiological effects. At the construction phase noise at this level would be limited to within 10 – 20 metres of the noisiest activity. Potential behavioural and/or physiological effects are noted as possible. It would be impossible to reduce construction noise to an inaudible level.

The risk of operational noise impacts from supporting infrastructure is minimal and would be limited to the temporary masking of communication signals and/or a brief behavioural response.

Rocket launch and testing events have the greatest potential to disturb and cause an adverse physiological or behavioural impact on the local wildlife. Noise levels above the measured ambient level at distances further than 5.0 kilometres from the launch are predicted. 140 dB(A) has been identified by AECOM as the permanent hearing damage threshold for wildlife. No wildlife is predicted to be exposed to these levels.

Protected species including the Southern Emu Wren (Eyre Peninsula), Western Whipbird (eastern) and the Australia Fairy Tern inhabit the area. Risk factors include increased stress, adverse behaviour reactions and physiological impacts.

The Australia Fairy Tern is highly mobile and has a range that extends around majority of Australia's mainland. It is unlikely that the Project will result in a decrease in size of an important population.

Noise may displace individual Western Whipbird (eastern) species in the area. These impacts are anticipated to be localised and of short duration therefore should not reduce the area of occupancy for an extended period in the local vicinity.

The Southern Emu Wren (Eyre Peninsula) is sensitive to discrete, unpredictable disturbances such as sudden loud noises that can cause physiological effects, such as stress, avoidance and fright-flight responses. The Project is likely to reduce the area of occupancy for this species.

There is no clear consensus within available literature whether long term behavioural changes on wildlife would be caused by launch vehicles or if the birds in this area would habituate to the sound of launches and testing.

5.2.3 Mitigation and Management

Guided space launch rockets are fitted with Flight Termination Systems (FTS) or Automated Flight Termination Systems (AFTS), or other Australia Space Agency approved safety hardware which seek to reduce the risk to life and property on the ground in the event of a failure. An FTS or AFTS is a safety critical system and is subject to a high level of design scrutiny and certification.

5.2.3.1 General Mitigation and Management Strategies for Fauna

In order to avoid (where possible), manage and mitigate project risks and potential impacts during all phases of the Project, mitigation measures are to be adopted and detailed within the CEMP and OEMP. These proposed mitigation measures respond to project specific issues and opportunities, address legislative requirements, and incorporate industry standard practice.

These proposed mitigation measures are to be implemented at detailed design, pre-construction planning, during construction, post construction and rehabilitation of disturbed areas, and operation stage.

In addition to the CEMP and OEMP, a number of detailed stand-alone management plans and/or procedures will be prepared to provide more detailed processes in relation to certain matters, including but not limited to an Emergency Response Management Plan, Bushfire Hazard Management Plan, Waste Management and Minimisation Plan, Flora and Fauna Management Plan, and Native Vegetation Management Plan.

5.2.3.1 Noise Mitigation and Management Strategies for Fauna

In respect to noise impacts, a series of practical measures will be employed to minimise impacts from noise and vibration as detailed within the CEMP and OEMP:

- Source noise mitigation measures will be implemented to minimise noise impacts during launch events, this will include a water deluge system and blast walls as appropriate. Gas operated bird scare gun will be used to disperse any fauna from proximity to the launch site in the lead up to a launch or testing event.
- Construction noise will be minimised by limiting intensity and duration of high impact activities near sensitive wildlife area where possible.
- Construction and operation of the Project will be managed in accordance with the CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures outlined. Good practice construction noise management measures will be incorporated into the applicable CEMP and OEMP.
- As the long-term impacts are unknown, a plan to monitor the behaviour of protected wildlife in response to noise will be included within the CEMP and OEMP. Southern Launch will also sponsor up to two (2) PhD students to undertake further research on the impact of rockets launches on wildlife in Whalers Way.

5.3 Effects on Human Populations

5.3.1 Assessment Approach

Within the EIS detailed investigation of the Project impacts from a land use perspective is provided as well as analysis of potential impacts on local communities. The Noise and Vibration assessment provides analysis of the expected impacts from noise and vibration on human populations across all project phases.

5.3.2 Findings

Existing industry in the locality has also been comprehensively described in the EIS and includes commercial fishing and aquaculture, farming, mining and petroleum exploration, a major wind farm, and other general infrastructure typical of a rural locality including homesteads. Aircraft movements are likely to occur in airspace affected by rocket launch activities.

A number of conservation areas, national parks and marine parks occur in the wider locality.

5.3.2.1 General Effects on Human Populations Key Findings

Potential impacts of the Project have been considered in terms of practical, physical and economic impact. In particular:

- Existing land uses and general amenity will largely be unaffected by the construction and operation of the complex, including from rocket launches.
- Mining and petroleum activities are recognised, and impacts are able to be managed by appropriate communication protocols and regulatory processes.
- Aircraft and shipping movements affected intermittently by the utilisation of a rocket launch exclusion zone can be minimised and accommodated into planned schedules through appropriate notice to operators in accordance with industry regulations and procedures.
- Significant isolated activities/infrastructure including the Cathedral Rocks wind farm and the Cape Willes HF Ocean Radar Site, and regional transport and essential infrastructure (roads, pipelines, transmission lines) will not be affected.
- The cultural and heritage values of the region are not impacted.
- The subject site is freehold land and therefore native title rights over the site have been extinguished.
- In principle agreement has been reached to alter the existing Heritage Agreement and maintain the same area of vegetation subject to protection.
- General public access throughout the (privately owned) site for recreation purposes will become more regulated and managed. Abundant opportunities for recreational access on publicly owned land is available generally throughout the greater region.

In respect to local communities, of key consideration has been the largest centre in proximity, being Port Lincoln. In the lead up to launch events, it is expected that a number of people associated with that particular launch will travel to the region, relying on local accommodation, leisure, and food and beverage services. It is also expected that a facility of this nature will introduce a new arm of space related tourism to the region.

It is anticipated that the Port Lincoln community has existing capacity to respond to the likely increased activity and demand generated by additional visitation to the area as a consequence of the Project and will respond and grow as necessary as the operations continue.

Port Lincoln contains education and health facilities that are considered to have adequate capacity to accommodate, and in turn benefit from, any increase in demand as a result of increased visitation and workforce generated by the proposal.

Public safety generally will be preserved through the implementation of appropriate buffer zones to exclude people when the launch is taking place. The proposed launch sites are ideally located in this regard, as appropriate buffer zones can be achieved without a requirement to exclude people from adjacent freehold allotments or terrestrial publicly accessible locations, such as public roads and beaches.

No dwellings are located within the planned launch safety areas, so no one will need to be evacuated during launches. The nearest inhabited dwelling is positioned some 3.0 kilometres from the nearest launch site.

5.3.2.2 Noise Impacts on Human Population Key Findings

The assessment of noise and vibration impact on human population focuses on the closest dwellings to the WWOLC. Noise levels during construction at the nearest dwelling will be compliant with the relevant noise criteria under the *Environment Protection* (Noise) *Policy 2007*. Noise from supporting infrastructure during operation is likely to be inaudible at the nearest dwelling.

The noise levels for launches and testing has been assessed in accordance with the USA Federal Aviation Administration criteria. This conservative assessment applies worst case meteorological conditions and does not account for the smaller rockets planned for use at WWOLC.

Noise from launches will temporarily alter the quiet setting for up to two minutes and up to 15 seconds for testing. This is likely to cause some annoyance and disturbance. A comparable level of sound would be an aircraft flyover at low altitude. This impact is not considered significant.

Vibration should not be perceived at nearby residences and is limited to the launch site surrounds.

5.3.3 Mitigation and Management

Most potential impacts upon local human populations are able to be minimised and/or mitigated through specific construction and operational procedures, much of which is addressed in the draft CEMP and OEMP and associated specific management plans, accompanying the EIS. This includes a series of practical measures to be employed to minimise impacts from noise and vibration on human receptors:

- Source noise mitigation measures will be implemented to minimise noise impacts during launch events, this will include a water deluge system and blast walls.
- Construction and operation of the Project will be managed in accordance with the CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures outlined. Good practice construction noise management measures will be incorporated into the applicable CEMP and OEMP.

- Administrative measures proposed by Southern Launch would also include a plan to notify residents of upcoming launch activities and to restrict human presence within required set back distances prior to a launch in accordance with the *Space (Launches and Returns) Act 2018*.
- A noise monitoring and reporting program would also be developed to verify noise impacts of launch activity on nearby residents and will include a program of assessment, monitoring and reporting.

5.4 Effect on the Physical Environment, Water, and Air Quality

5.4.1 Assessment Approach

To determine the effect on the physical environment, water, and air quality a series of technical investigations have been conducted, including the following:

- Air Quality Assessment;
- Stormwater Assessment;
- Greenhouse Gas Assessment; and
- Geotechnical Assessment.

These technical assessments and their findings have informed the development and planning of the design, construction, and operational stages of proposed project.

5.4.2 Findings

5.4.2.1 Coastal Landforms and Environment

Soil types within this area ranged from bare sheet limestone to moderately mobile sand dunes. Between these extremes, the large part of the area was highly alkaline decomposed limestone and light grey loams.

The geology of the Lower Eyre Peninsula is made up of three (3) distinct geological units, the Semaphore Sand, Bridgewater Formation, and the Carnot Gneiss. The site is underlain at shallow depth by calcareous aeolianite with a travertine crust (Qpe) and the surface exposures at the site comprise Semaphore Sand (Qhcks), which is described as foredune and dune sand, white to cream quartz and shelly sand.

While the coastal landscape of the subject land is sensitive to erosion, the scale and separated locations of the development sites help to limit and fragment the potential effect. The Project Sites were selected to utilise areas that presented a lower environmental condition and were predominately flat and limited the need for significant earthworks to accommodate the respective facilities. Neither the construction nor operation of the WWOLC is expected to result in material erosion of the coastal clifftop dune environment.

The proposed development is not expected to have any impact on the coastal cliff environment. Impact on the natural terrestrial landscape will be predominantly limited to the four (4) specific facility sites only. At the closest point the launch sites are at least 200 metres in land from the coastal cliffs. At this distance it is unlikely that the proposed operations including launch events would impact on the coastal clifftops or limestone and calcrete formations.

5.4.2.2 Marine Environment

As previously discussed in this summary, potential impacts on marine flora and fauna resulting from the Project activities are expected to be limited. Any impacts are expected to be able to be controlled through appropriate management strategies.

Stormwater and wastewater runoff provide the greatest source of potential pollution of the marine environment. A Total Surface Water Cycle Management (TSCM) will be employed throughout the WWOLC. The TCSM will ensure that all water will be reused, and no site generated surface runoff will leave the site.

A separate package wastewater treatment system will be provided for each facility site to accept and treat wastewater generated from kitchen and ablution facilities. Treated wastewaters will be reused for irrigation with the Project Footprint with no wastewater permitted to be discharged from the site.

5.4.2.3 Pollution and Greenhouse Gas Emissions

Stormwater and wastewater are potential pollution sources. These matters have been addressed in respect to impacts on the marine environment in preceding sections of this summary.

Rocket launching and testing will produce air emissions with potential to cause pollution. Air quality assessment emissions were estimated for dispersion modelling on a worst-case basis. From a review of rocket engine exhaust emissions data, the following pollutants were identified as relevant to include in the assessment:

- Carbon monoxide (CO) – combustion product from liquid RP1 (kerosene) fuel.
- Nitrogen oxides (NO2) – combustion product from liquid RP1 (kerosene) fuel.
- Hydrogen chloride (HCl) – emitted from certain solid fuel engines.
- Particulate matter (PM) – emitted as part of all combustion.

The emission rates for each pollutant depend on the size of the rocket (engine capacity) and the rocket fuel type. The main contributor to the estimated Greenhouse (GHG) inventory is emissions from the combustion of diesel used for stationary purposes. The second contributor is diesel consumption for electricity generation purposes.

The contributions of the predicted annual GHG emissions resulting from the Project are a relatively small proportion of both the Australian and South Australia total emissions. It should be noted, that should the Project not proceed, the demand for the launches will most likely be met through launches on other locations. As such, the emissions generated by the Project should have a minor effect on global climate change.

5.4.2 Mitigation and Management

Detailed design will define temporary and permanent storm water, erosion and sediment/pollution control measures in a Soil Erosion and Drainage Management Plan (SEDMP) as part of the CEMP.

Each of the facility sites within the Complex have been selected to occupy areas of flat topography and areas that presented a lower vegetation condition rating and lower coverage of vegetation as possible.

Stormwater is to be captured on each launch pad site and no stormwater is to leave any site. The retention and reuse of stormwater on-site prevents the potential for run off and potential contamination or other impact on the environment immediately surrounding the site.

Revegetation is to occur through natural regeneration as well as through assisted planting to create a vegetated buffer between the disturbance footprint and adjacent values. Plantings (tube stock and seed) to consist of native species analogous to adjacent vegetation community.

International and Australian safety regulations prescribe which chemicals can be used for propulsion. Storage on site will occur in bunded areas and vessels in appropriate containers for the particular substance being stored in accordance with these regulations.

5.5 Economic Effects

5.5.1 Assessment Approach

An Economic Impact Analysis has been undertaken by The South Australian Centre for Economic Studies (SACES) to understand the potential economic impacts of the proposed launch activities.

5.5.2 Findings

Primary areas of potential economic impact arise from the direct operations of the Southern Launch facility, the capital works required to establish it, and the potential visitor numbers associated with the launches.

Should the launch facility be successfully established it is possible that there will be spin-off benefits with one (1) or more launch vehicle manufacturers relocating either final assembly, or their full manufacturing operations, to South Australia.

5.5.2.1 *Regional Development*

Southern Launch has worked extensively with regional organisations during the planning stage of the development to identify economic opportunities as the Project proceeds. Southern Launch will continue to liaise closely with key regional organisations, stakeholders and business groups to ensure that opportunities emanating from the proposed development are maximised.

5.5.2.2 *Tourism*

The proposal is anticipated to result in significant tourism opportunities for the region and South Australia. These will include visitors to the region to view launches, visitors seeking to explore and understand the facility and space industry. Off shoot business will also benefit.

As a highly novel industry which is only located in small number of locations around the world, the facility has the potential to draw significant numbers of people to South Australia and the local region.

Current recreational activities on the subject land will be changed in respect to their management and arrangement, nevertheless similar opportunities for camping and recreation are available throughout the region and tourist activity can be accommodated without any substantive loss to the overall level of economic activity currently generated in the region.

Southern Launch will seek to work with local tourism organisations and operators to ensure that the potential benefits to the region area maximised. This will include seeking to facilitate the development of experiences associated with the facility.

5.5.2.3 *Commercial Fishing Industry*

Access to and the use of surrounding coastal waters will largely be undisturbed by the proposed operations, save for access to certain areas during specific launch events. Ocean and airspace areas directly affected by a rocket launch will be temporarily restricted by the establishment of Launch Exclusion Zone mandated by the Australian Space Agency under the Space (Launches and Returns) Act 2018. This will potentially impact on commercial fishing operations on an intermittent basis as operators will be excluded from entering the Exclusion Zones.

Exclusion zones will be enforced for the minimum amount of time possible to ensure the least disruption to commercial fishing (and other marine based activities) and notified through Notice to Mariners (NOTMAR).

There are no aquaculture zones within the marine area likely to be impacted by Exclusion Zones and no direct impact on the commercial aquaculture sector. It is understood aquaculture related boat movements occur in the locality. The same arrangements for notification to the commercial fishing industry will also apply.

5.5.2.4 Mining and Petroleum activities

There is one (1) Minerals Exploration Licence (EL), one (1) Extractive Mineral Lease (EML), and three (3) Exploration Permits for Petroleum (EPPs) activities in the locality that may be impacted by the Project.

One (1) potential drilling target area for a EL lies adjacent the launch safety zones; however, given the location of the mining and retention leases, it is unlikely that any future operations will be impacted by the construction and/or operation of the Project. A sand mining operation by the project landowner exists to the north of the Project Site. The landowner is aware of the proposal and established communication protocols exist.

It is unlikely that operation of the Project will impact petroleum exploration. Two (2) petroleum exploration leases nearby have recently had their application to extend their work programs rejected, which could have a significant implication on their continuation. The third petroleum lease has recently submitted a formal request to surrender exploration permit.

5.6 Transport and Access

5.6.1 Assessment Approach

A Transport and Access Impact Assessment has been undertaken by WGA to evaluate the current and proposed access arrangements for the site and to assess the impact on the transport network.

5.6.1 Findings

Access to the site is available via the existing arterial and local road network. From Port Lincoln. Access to the site follows Proper Bay Road, Fishery Bay Road to Right Whale Road before entering the site and private access known as Whalers Way Road.

A series of bush tracks currently provide access to various coastal, camping and picnic areas throughout the site, but mainly around the coastal perimeter of the site. The existing tracks are of varying quality and accessibility. Notwithstanding the private ownership of the site, public access within the site is currently possible through the purchase of a permit.

The analysis of transport and access requirements and impact on the existing transport network both on and off site, concluded:

- Some geometric realignment and road upgrades to the internal access network will be required to enable the safe passage of all vehicles to the proposed launch sites. Realignment of some of the internal intersections may be required to achieve safe sight distances.

- A total of 12 heavy vehicles per day and additional worker (light vehicle) traffic is projected to access the site on a daily basis (weekdays only) to construct the new tracks and associated launch site infrastructure over the construction phase.
- Once the launch pad is operational, total traffic (excluding tourist traffic) is expected to be approximately 56 vehicles per day with 8 per cent of that volume being commercial vehicles.
- Some additional maintenance, such as more frequent grading, will likely be required on Fishery Bay Road to cater for the additional proposed traffic volumes.
- Access tracks within the site will be constructed/upgraded and maintained at a standard which are suitable for the traffic volumes, the vehicle types, and the speed environment required. Roads and tracks will generally be of gravel construction but may be upgraded to asphalt in the longer term.

The two launch sites will incorporate a Helicopter Landing Site (HLS) for emergency operations to be designed to suit the requirements of "CAAP 92-2(2)'Guidelines for the establishment and operation of onshore Helicopter Landing Sites". Helicopter movements to and from the site are anticipated to occur only in respect of emergencies and not as a regular operational element.

5.7 Visual and Amenity Impacts

5.7.1 Assessment Approach

A Landscape and Visual Impact Assessment has been undertaken by WAX to assess the potential visual impact of the proposed launch complex. The assessment evaluates the existing landscape character, undertakes a visual impact assessment of the proposed facilities and provides analysis of the degree of visual change.

In order to quantify where the various sites will be visible from a series of Zone of Theoretical Visual Influence (ZTVI) maps were prepared for each of the four (4) facility sites. The degree of effect on the visual amenity was determined based on the Guidelines for Landscape and Visual Impact Assessment.

5.7.2 Findings

The landscape of Whalers Way, the Lower Eyre Peninsula and the subject site received a moderate to high ranking in terms of the scenic quality.

The launch facility sites will contain permanent and temporary structures. Permanent infrastructure consists of buildings with a maximum height of 10.0 metres and elevated water tanks with a maximum height of 23 metres. Given the scale of the proposed developments, the existing landscape character, and the distance over which the visual effects are likely to occur, the visual impact of permanent infrastructure has been described as slight. To ensure the visual impact is limited, a suitable paint finish will be selected to visually integrate structures.

The launch facilities will also contain a 40-metre-high lightning tower; however, this is a slender piece of infrastructure and is unlikely to cause a visual effect in the locality. Consequently, this piece of infrastructure has not been included in the ZTVI assessment.

Temporary structures will be present during launch events and include launch gantries which reach a height of 30 metres. Temporary structures will be present for a limited period and irregularly. This assessment also encompassed the impact associated with the 20-metre-tall flare stacks which are utilised on launch days to burn off excess fuel.

The visibility of Site A on launch days extends south over the coastal waters and east along the coastline to Black Lookout. At this point, the north-south ridgeline of the eastern escarpment forms a defined visual envelope.

While the visible structures will alter the visual landscape when visible, it is not expected that the impact would severely or substantial degrade the visual quality of the landscape. As discussed, the scale, degree of transparency, and slender nature of the infrastructure means that the visual impact will be slight. It is noted that structures of this nature are not uncommon to a coastal and rural locality such as this.

Visual impacts from the sea looking back at the proposed development sites typically occur at distances over a kilometre offshore. The height of the coastal cliffs creates a defined viewshed that screens the coastal edge from any potential visual impacts. Glimpsed views of the buildings and structures will be seen from coastal water at a distance of several hundred metres.

5.8 Effect on Cultural Heritage Values

5.8.1 Assessment Approach

A cultural heritage assessment has been prepared by archaeologist and anthropologist Scott Cane. This included a detailed site survey with representatives of the Nauo Native Title Claimant group to ascertain what culturally significant sites for Aboriginal heritage are present within the Subject Site, Project Footprint or located in proximity to this area.

A desktop assessment of non-Aboriginal heritage within the area was undertaken to quantify the location of heritage items and assess the potential for impacts arising from the Project.

5.8.2 Findings

5.8.2.1 Aboriginal Heritage

The Project is located within the traditional lands of the Nauo speaking people. As a freehold allotment, no native title claim under Native Title Claim Nauo No. 2 applies to the subject allotment. Native Title Claim Nauo No. 2 applies and will continue to apply to coastal land and waters surrounding the subject allotment.

Two areas of mythological significance are located within the southern portion of Whalers Way area but not within the identified Project Footprint, both relating to a large mythic complex known informally as 'Seven Sisters'.

Two areas of archaeological significance were located within the subject area but not within or in proximity to the proposed launch or related infrastructure sites.

Three artefacts were identified within the area proximate of Launch Site A within a deflated dune in the north-eastern corner of the identified boundary area. These artefacts include two flaked pieces of quartzite and a hydrated core of chalcedony. No artefacts or sites were identified within or near Launch Site B, however, one artefact, a ground and percussion damage granite cobble, was identified within dune swales to the west of Launch Site B. No artefacts or other signs of Aboriginal occupation were found in the remaining areas.

The investigation concluded that the frequency of artefacts is so low as to have little cultural value and should not impede development of the complex. In response to the findings a minor alteration to the boundary for Launch Site A was undertaken to exclude the area where artefacts of indigenous cultural value were identified.

5.8.2.2 Non-Aboriginal Heritage

There are no non-aboriginal heritage places or elements within the Project Site or Project Footprint. A State Heritage Place, the Former Fishery Bay Whaling Station, is located in proximity to the northern boundary of the Project Site but will be unaffected by the development.

5.8.3 Mitigation and Management

The construction and operation of the Project will be conducted in accordance with the CEMP and OEMP, which outline the methodology to be employed in the event a culturally significant artefact or site is identified or disturbed during construction or operation. In the event of such an encounter all works will cease in the vicinity until further instruction from a suitably qualified individual can be obtained.

5.9 Hazard Risks

5.9.1 Assessment Approach

Southern Launch has prepared an Emergency Management Plan and associated Risk Register in consultation with SA Police, the South Australian Country Fire Service, and the SA Ambulance Service.

The aim of the Whalers Way Emergency Management Plan ('WWEMP') is to develop a timely and coordinated response and recovery strategy for emergencies at, or in the vicinity of, the Project Site.

5.9.2 Findings

This WWEMP provides the base document for conducting a Risk Assessment. The main aim of the risk assessment process is to maintain staff and public safety throughout the core functions of the operation.

Southern Launch will operate a generic risk assessment list. Modifications to the risk list may occur to meet the requirements of individual launches. The risk assessment process will be constantly reviewed and further developed.

In summary, the risks identified in relation to the operation of the complex can be analysed in respect to the following three operational areas:

- Range infrastructure and activities, e.g., the storage and handling of rockets, hazardous substances, operational accidents.
- Rocket launching and testing.
- Off-range activity, including on land, in the sea, and airspace.

5.9.2.1 Hazards for Habitation and Other Activity

Noting the proposed launch path is to the south and directly over the sea, the risk of impact on surrounding dwellings and property, public infrastructure and human life arising from a catastrophic event on the range or during a launch event is considered to be minimal.

5.9.2.2 Airfields, Overflight and Marine Danger Areas

Southern Launch is cognisant of the commercial and private aviation that can overfly the launch site, and commercial and recreational shipping activities through the Launch Exclusion Zones. These will temporarily and spasmodically disrupt airline and shipping from time to time.

As part of any launch process, Notices to Airmen (NOTAMS) for air and Notice to Mariners (NOTMAR) for sea traffic will be issued. On the day of the launch Airservices Australia will be constantly contacted to update on launch times and other relevant factors.

5.9.2.3 Transport of Rockets and Components

Transportation of rocket components, including engines, bodies and payloads will arrive at the complex from their port of entry into Australia and then be transported to Whalers Way. The transport will be overseen by Southern Launch and undertaken by third-party contracted licenced transport organisations. These companies are required to comply with all relevant transport and handling safety standards.

5.9.2.4 Safety On-site

Southern Launch will adopt a range of safe working practices and procedures to be managed and implemented through separate management plans (outlined in the accompanying OEMP and CEMP.

Only duly trained, certified and authorised Southern Launch or the rocket launch customer staff will participate in the pre-launch, launch and payload recovery activities, unless there is an incident, accident or other emergency – then emergency services personnel and appropriate civilians may become involved.

5.9.2.5 Bushfire Management Plan

A specific Bushfire Management Plan has been drafted and is included within the Emergency Management Plan. This plan will outline what actions are to occur and what arrangements for seeking refuge, evacuation and relocation are available. It will also highlight potential issues to be considered when taking appropriate action in the event of a bushfire approaching the site.

5.9.2.6 Emergency Evacuation Plan

Southern Launch have developed an Emergency Evacuation Plan which is included within the Emergency Management Plan. This will ensure the safe staged evacuation of the WWOLC in the event of an emergency. The Plan outlines key personnel relative to the plan and responsibilities, potential hazards, and key triggers for the implementation of the Evacuation Plan.

5.10 Security and Safety

5.10.1 Assessment Approach

A Protective Security Assessment was prepared by Spartica Australia. The assessment considers potential vulnerabilities and offers security considerations to control threats in respect to the physical, technological, and human domains.

5.10.2 Findings

The assessment considered a full range of potential security threats and quantified the probability of these threats occurring. The considered threats included actions such as an armed attacker, espionage, theft, trespass and many others.

The results of the assessment identified the likelihood of most threats to be in the medium and low range of probability, with four in the high range of probability during the operational phase of the Project. None of the identified threats were in the very high probability range.

The assessment considers potential vulnerabilities and offers security considerations to control threats in respect to the physical, technological, and human domains.

The recommendations of the assessment have been incorporated into many of the physical design features of the facility, and the development of the various operational, security and safety procedures as detailed elsewhere in this EIS.

1 INTRODUCTION

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1.0 INTRODUCTION

1.1 Purpose of EIS

On 22 August 2019, the Minister for Planning (the Minister) declared the proposed project by SouthernLaunch.Space Pty Ltd ('Southern Launch' and referred to in this EIS as 'the proponent') to establish a multi-user rocket launch facility at Whalers Way, Sleaford, South Australia, a "Major Project" pursuant to Section 46 of the *Development Act, 1993*.

Subsequently the proponent lodged an application under the *Development Act, 1993* on 20 November 2019 to seek approval for the facility.

On 23 July 2020, the State Planning Commission ('SPC') determined the level of assessment for the application would be an Environmental Impact Statement ('EIS') and issued Assessment Guidelines ('Guidelines') for its preparation. The purpose of the EIS is to provide information relevant to the assessment of the environmental, social, and economic impacts of the proposed development.

The EIS has been prepared by the proponent in accordance with Guidelines issued by the SPC. They set out the assessment issues associated with the proposal along with their scale of risk as determined by the SPC. A more detailed explanation of the EIS and the assessment process is contained in **Section 1.7** below.

The EIS will be made available for public exhibition and will form the basis of the assessment of the proposal by the Minister, including reference to any public submissions and government agency comments.

The EIS provides:

- A description of the Project, including:
  - the rationale and objectives for the Project;
  - the site selection process;
  - a description of all proposed structures, buildings, and infrastructure; and
  - a description of the management and operational strategies associated with the Project.
- Details of the applicant.
- Details of the site and locality.
- A summary of stakeholder and community consultation undertaken by the proponent.
- A risk assessment of the Project.
- An outline of the statutory approvals process, relevant development policy, and other related legislative requirements.

- Assessment of the impacts of the Project in relation to the environment, including management and impact mitigation measures where appropriate, specifically in regard to:
  - conservation areas and values;
  - coastal areas and processes;
  - marine ecology;
  - terrestrial ecology;
  - the hydrogeological environment, including surface water, groundwater and soils;
  - air quality;
  - noise, vibration, and light;
  - biosecurity;
  - heritage including aboriginal and non-aboriginal, and built and natural;
  - climate change and sustainability; and
  - any other issues relevant to the assessment of the proposal.
- Assessment of the social impacts of the Project, including:
  - impacts on the local community;
  - impacts on the wider community, up to South Australia as a whole; and
  - impacts on specific sectors of the community.
- Assessment of the economic impacts of the Project, including:
  - economic benefits of the Project;
  - consequences of the Project not proceeding; and
  - alternatives to the Project.
- Commitments made by the proponent to deliver net benefits to the environmental, social, and economic values.
- Offsets to the actual and/or potential impacts and risks that the Project poses.
- An environmental management framework for the management and monitoring of the Project to achieve the outcomes.
- Potential future decommissioning and closure of the development.

The appendices to the EIS contain a number of specialist technical reports, references and other information commissioned by the proponent to investigate and report on the environmental, social and economic impacts of the proposal. These technical reports have been prepared to assist in the planning and development of the proposal and to respond the issues raised in the Guidelines. The reports provide additional detail and analysis to that summarised in the EIS report.

A checklist of required information (as stated in the Guidelines), cross-referenced against its location within the EIS, is provided in **Appendix E**.

1.2 Background and Objectives of the Proposal

1.2.1 The Project

Southern Launch propose to establish a multi-user rocket launch facility at Sleaford, South Australia. The Project is in response the growing demand for the launch of domestic and international vehicles for polar and sun-synchronous Orbit satellite insertion (often known as 'CubeSats').

The Project is known as the Whalers Way Orbital Launch Complex ('WWOLC') and is described as such throughout the EIS.

CubeSats are very small satellites and as such require much smaller rockets than those associated with traditional satellite launch vehicles. The WWOLC facility will be designed to launch small rockets only and many of these vehicles will carry several satellites at a time.

Typical vehicles will range between 9.0 and 30 metres tall with a payload capacity of 50 kilograms to 400 kilograms and will deploy satellites at altitudes typically around 1,000 kilometres above sea level.

The number of launches is anticipated to initially be low and grow over time, with approximately six (6) launches anticipated in the first year of operations, increasing to a maximum of 36 orbital launches in year five of operations. The frequency of launches will occur on a variable basis, with multiple rockets sometimes being launched over several days and other periods where there are gaps of weeks or even months between launches.

In addition to the 36 orbital launches, the launches of up to six (6) sounding rockets by year five of operations will occur, with these rockets not reaching orbit, but gathering data to inform subsequent orbital launches.

Establishment of the Project is anticipated to be undertaken in five (5) phases between 2021 and 2025 at an estimated cost of approximately $43M.

A detailed description of the Project is contained in **Section 3** of the EIS.

In summary the Project will consist of the following:

- Two (2) rocket launch sites and associated infrastructure.
- A range control facility.
- Assembly facilities (a total of two (2) – one (1) at each launch site).

- Supporting infrastructure including:
    - Diesel and/or Hydrogen Fuel Cell Powered Generators;
    - Helicopter Pad(s);
    - Water Tanks;
    - Water Capture and Treatment Systems;
    - Launch Pads;
    - Lightning Rods;
    - Anemometer Towers;
    - Engine Test Stands;
    - Propellant (liquid, hybrid and solid) Storage;
    - Secure Block Houses;
    - Blast Walls;
    - Bunding (for blast wave deflection); and
    - Installation of Fibre Optic and Satellite Communication Systems.
- Workshop building.
- Main water storage dam.
- Water retention basins (a total of two (2) – one (1) at each launch site).
- Construction of internal access roads and parking areas.
- Visitor viewing area and interpretative facilities.
- Temporary infrastructure associated with construction of the development, including but not limited to:
    - temporary concrete batching plant;
    - temporary site and construction offices and facilities;
    - temporary laydown areas; and
    - temporary access tracks.

At the time of lodging the development application, it was envisaged a total of up to six (6) separate launch pads would be identified in the investigations for the EIS and their location was shown indicatively in the application. The development application stated:

> *The current development proposal for the Launch Complex is anticipated to be undertaken in five phases across four of the six potential sites between 2019 and 2024.*
>
> - *Phase 1: A permanent launch pad and permanent launch support infrastructure.*
> - *Phase 2: A second permanent launch pad and permanent launch support infrastructure.*

- *Phase 3: A permanent range operations centre, and permanent visitors centre.*
- *Phase 4: A permanent engine test stand and test support infrastructure.*
- *Phase 5: A third launch pad and permanent launch support infrastructure.*

Southern Launch is also investigating the establishment of non-traditional launch facilities, the construction of which would be located at one of the launch sites identified on the ***attached*** *Site Concept Plan.*

The scope of the first phase of the Project has been refined since lodgement of the application. Following further design, the scope now comprises the establishment of two (2) traditional rocket launch facilities only, together with the site infrastructure and access outlined above. The non-traditional launch facilities have been removed from the proposal.

The precise nature and design of additional launch facilities is still under evaluation at this time, and subject to emerging technologies and market requirements. Any future facilities beyond those detailed in this EIS will be the subject to a further application and assessment process, subject to relevant regulatory requirements, at the time they are proposed in future.

Accordingly, the current project scope, and therefore the scope of the EIS, is limited to the first phase of the establishment of the overall launch complex, comprising two (2) traditional rocket launch sites only. The general site infrastructure and development proposed will support the establishment of the initial two (2) sites.

Whilst the site selection process has identified a site with an area and characteristics capable of accommodating at least six (6) launch facilities, the scope is now only for the two (2) launch sites. As foreshadowed in the development application, the construction of any further sites will be incremental and will be the subject of additional environmental impact assessment and approval at the time such facilities are proposed. Any future assessment will necessarily investigate and consider the cumulative impact of the facility.

1.2.2 Project rationale

The Whalers Way site at Sleaford has been identified as the preferred location for the launch complex through an extensive review of potential locations across Australia based on specific location criteria (discussed further in **Section 4.0**). In summary, the unobstructed flight paths, low aircraft/shipping volumes, low population in the immediate vicinity, year-round temperate climatic conditions, coupled with the skilled local workforce and a robust logistics supply network, makes the Whalers Way ideal for the establishment of technologically advanced launch operations at cost-competitive prices.

Historically, satellites have been used mainly to transmit TV signals, provide internet, and relay telephone calls. To do this, these telecommunication satellites have been put into orbit around the Earth's equator in what are known as Geostationary orbits, around 36,000 kilometres above the Earth's surface. One (1) Geostationary orbit around the Earth takes 24 hours, and because the Earth rotates every 24 hours, these satellites seem to be stationary over one (1) location on the Earth (Geo) and need to be launched into orbit from locations near the Earth's equator.

An important trend in the space sector is the expanding range of uses for small and micro satellites (such as CubeSats) in low Earth orbits (also known as polar and sun-synchronous orbits). At a typical distance from the Earth of around 1,000 kilometres above sea level, these are significantly lower than the more traditional geosynchronous orbits.

CubeSats are now proposed to be constructed and built in Australia.

CubeSats need to 'see' the whole of the Earth and are therefore launched into polar orbits that go around the North and South Poles while the Earth spins around on its axis. Given CubeSats are smaller, and orbit at typically around only 1,000 kilometres above sea level, the rockets that launch them are also much smaller than those required to launch the larger Geostationary satellites.

Low Earth orbits can be most efficiently achieved from higher latitudes. Most existing launch sites throughout the world are designed for geosynchronous orbits and are situated much nearer to the equator and hence not suited to launching the new smaller launch vehicles. This makes the southern coast of South Australia, with its lack of population centres, or major air routes or maritime transportation routes to its south, an attractive potential launch site.

Southern Launch was established to develop a commercial operation capable of addressing the rapidly increasing demand for high latitude launching sites for polar and sun-synchronous orbits. Such a dedicated polar Earth orbit launch facility is aimed at providing clients throughout the world with rapid response, cost effective access to space.

As technology improves and electronics get smaller, it is likely that more of the functions of the bigger geostationary satellites will be built into smaller, cheaper satellites.

The WWOLC will be made available to third party rocket manufacturers who would be responsible for securing their own payloads. Four potential clients have already been identified whose launch vehicles are at an advanced stage of development. A significant number of potential future clients have also been identified, whose vehicles are earlier in the development cycle.

Should the launch facility be successfully established in South Australia, it is anticipated that there will be significant benefits to allied manufacturing. There is the potential for one (1) or more launch vehicle manufacturers to be attracted to locate either final assembly, or potentially their full manufacturing operations, to South Australia.

The proposal also involves the development of facilities reinforcing and acting upon the existing government policy to create a space-enabled economy within South Australia and will further reinforce regional development.

The Australian Civil Space Strategy 2019-2028 identifies a strategic vision for the Australian space sector, specifically:

> *"A globally responsible and respected space sector that lifts the broader economy and inspires and improves the lives of Australians."*

The strategy identifies a strategy for growth including four main strategic space pillars, to:

- Open International Doors for global competitiveness.
- Increase our National Capability.
- Promote a responsible space sector culture through responsible regulation, risk management and culture.
- Inspire industry, researchers, government, and the Australian community to grow the next generation of the space workforce.

The proposal is consistent with the vision and strategies outlined in the Australian Civil Space Strategy and will assist in achieving the strategic pillars while operating within the responsible regulatory framework.

The South Australian Government has prepared the Space Innovation and Growth Strategy Action Plan 2016-2020. The 'Action Plan' sets out a South Australian Government priority to "*capture the opportunities of space to grow our economy and create high value jobs of the future*".

The Action Plan has three (3) interconnected pillars focussing on:

- growing South Australia's economy through space activity;
- invigorating South Australia's space innovation ecosystem; and
- engaging international cooperation with lead countries.

Arising from the three (3) interconnected pillars, is the primary action "to *increase awareness*". This is essential in the promotion of the South Australian space economy and to increase awareness of the space sector as an innovative area to invest and collaborate.

The Action Plan recognises that the South Australian Space Industry Centre will lead the state's space industry development efforts, offering focused and responsive support to drive the growth of South Australia's space sector and deliver key projects and facilities.

As a directly envisaged form of development, the proposal is highly consistent with the Space Innovation and Growth Strategy (South Australia) Action Plan.

Subsequently, this plan has translated into the establishment of the South Australian Space Industry Centre (SASIC), the vision and mission of which is articulated in the South Australian Growth State Space Sector Plan 2020-2030.

Working with industry SASIC has advanced the pillars set out in the earlier plan, which are now expressed as:

- contribute to the whole of government national strategy for space;
- capitalise on the phenomenal opportunities presented by NewSpace; and
- cultivate South Australia as a centre of gravity for Australia's expanding space activities.

A number of goals are aligned with these pillars to support the establishment and growth of a robust and enduring space sector which provides substantial employment, economic output and allied opportunities in South Australia.

The Project is closely aligned with the pillars and a number of the goals expressed in the plan, most specifically:

- launch into accessible lower earth orbits – enabling industry to develop space qualified, or 'flight heritage' products;
- many, small, connected satellites – supporting the development of many, small, connected satellites with disruptive approaches to design and technology;
- an expanding workforce – developing a comprehensive space education program that leads to a sizeable interdisciplinary space workforce with depth that supports healthy exchange of professionals between industry and/or academia;
- an innovation ecosystem – with a steady pipeline of start-up and scale-up space related companies with strong investment potential in South Australia; and
- supportive infrastructure – the sector having access to the infrastructure needed to promote the space industry, demonstrate investment potential, and unlock business opportunities.

1.2.3 Preliminary Consultation and Engagement

Southern Launch has engaged extensively with both the District Council of the Lower Eyre Peninsula (DCLEP) and the City of Port Lincoln (PLCC).

The Regional Development Australia Whyalla Eyre Peninsula ('RDAWEP') has been consulted on numerous topics, including engagement with the local fishing industry, local residents, industries and education sector interest.

RDAWEP brokered the introductions between Theakstone Property Pty Ltd and Southern Launch that secured the subject site for the Project. Both RDAWEP and Southern Launch have also approached surrounding owners and occupiers on a case-by-case basis to help the local community understand the proposed development.

The Department of Primary Industry and Regions (South Australia) (PIRSA) have been briefed on the proposal.

The South Australian Government has established the 'Southern Launch Taskforce' comprising members from:

- DefenceSA (chair);
- Department of Trade, Tourism and Investment;
- Office of the State Coordinator General;
- Department for Planning Transport and Infrastructure (DPTI);
- Environment Protection Authority (EPA);
- Country Fire Service (CFS);
- Department for Energy and Mining (DEM);
- South Australian Police (SAPOL);
- Department for Environment and Water (DEW);
- Department for Treasury and Finance (DTF); and
- Department for Primary Industries and Regions, South Australia (PIRSA).

Preliminary discussions have been held with the Deputy Chief Commissioner South Australian Police and Country Fire Services.

Southern Launch is yet to start a formal public engagement program. A public awareness program was commenced on 5 December 2018 when the Premier of South Australia formally announced the potential for development of the site.

Southern Launch plans to start formal public outreach events to provide further information immediately following the lodgement of the EIS. These events will be held in Port Lincoln, Tulka and Coffin Bay and will be open to the general public.

1.3 The Proponent

SouthernLaunch.Space Pty Ltd is an Adelaide-based company founded in 2017 and comprises of defence and industry experts with an advisory board. Southern Launch has an agreement with SCISYS Deutschland GmbH to utilise their space software for mission control purposes.

Southern Launch was established to bring polar Earth orbit space launch capabilities to Australia. The company has two (2) complementary purposes, one (1) dedicated to the design, construction, and operation of a dedicated polar Earth orbit launch capability. The other to research and implement new and novel space launch vehicle guidance and control algorithms on flight hardware for customers.

A key objective of the company is to develop the most efficient and robust ways of getting rockets and payloads to orbit, embracing futuristic technologies to simplify space launch and subsequently drive down launch costs. The company has world leading knowledge of space launch systems and their launch needs, as well as experience in the design and implementation of optimised ascent trajectories and vehicle control algorithms in software and hardware.

Southern Launch have the capability to manage all aspects of a launch campaign, from customer-specific launch vehicle selection, associated launch preparation and operations through to mathematical flight performance simulations, safety management and logistics.

Southern Launch has already utilised the Koonibba Test Range (KTR) at Koonibba, South Australia, an overland sub-orbital launch site for testing rocket motors and payloads, with options for aerial and ground-based recovery. The WWOLC and the KTR will establish a significant rocket launching and logistics hub in South Australia. In September 2020, Southern Launch undertook two (2) rocket launches from the Koonibba site. These were the first private space capable rocket launches in Australia and clearly demonstrate Southern Launch's expertise in this field.

Ultimately, it is Southern Launch's plan to build and supply the launch infrastructure to enable rocket and satellite manufacturers to come on site and launch their rockets within 48 hours' notice. In doing so, Southern Launch will usher in the new paradigm for "*just-in-time*" space access.

Corporate detail in respect of Southern Launch is contained in **Appendix F**.

1.4 Project Summary

Southern Launch propose to establish a multi-user rocket launch facility at Sleaford, South Australia known as the Whalers Way Orbital Launch Complex ('WWOLC'). The purpose of the Project is in response the growing demand for the launch of domestic and international vehicles for polar and sun-synchronous Orbit satellite insertion (often known as 'CubeSats').

Typical vehicles will range between 9.0 and 30 metres tall with a payload capacity of 50 kilograms to 400 kilograms and will deploy satellites typically at around 1,000 kilometres above sea level.

The number of launches is anticipated to be low initially and grow over time, with approximately six (6) launches anticipated in the first year of operations, increasing to a maximum of 36 orbital launches in year five of operations. The frequency of launches will occur on a variable basis, with multiple rockets sometimes being launched over several days and other periods with gaps of weeks or even months between launches.

In addition to the 36 orbital launches, the launches of up to six (6) sounding rockets by year five of operations will occur, with these rockets not reaching orbit, but gathering data to inform orbital launches.

Establishment of the Project is anticipated to be undertaken in five (5) phases between 2021 and 2025 at an estimated cost of approximately $43M.

1.5 Project Staging and Timing

The development proposal is anticipated to be undertaken in the following sequence between 2021 and 2025. The elements and staging of the proposal are set out in **Table 1.1**.

Table 1.1: Project Elements

ELEMENT	DESCRIPTION	TIMING
Launch Site – Site B	A rocket launch facility sited designed to support small-lift launch vehicles with sizes from micro to larger conventional (less than 10 tonnes up to approximately 50 tonnes).	Stage 1 - 2021
Range Control Facility – Site E	A permanent range control facility which will provide facilities for launch control, range control, security, office, administration, and visitor facilities.	Stage 2 - 2022
Infrastructure Site – Site D	Infrastructure facilities including a dam, magazine, and ancillary storage facilities.	Stage 3 – 2022/2023
Launch Site – Site A	A rocket launch facility which will predominantly be utilised for larger launch vehicles (greater than 30 tonnes to up to over 100 tonnes).	Stage 4 - 2023
Access Upgrades	Existing access tracks will be upgraded as required to provide appropriate, all-weather access to each of the sites. New access connections will be provided to connect the sites to the existing and upgraded access tracks.	Progressively from the commencement of the Project

ELEMENT	DESCRIPTION	TIMING
Supporting Infrastructure	• Diesel and/or Hydrogen Fuel Cell Powered Generators. • Helicopter Pad(s). • Water Tanks. • Water Capture and Treatment Systems associated with each site. • Lightning Rods. • Anemometer Towers. • Engine test stands. • Propellant (Liquid, Hybrid and Solid) Storage. • Secure Block Houses. • Blast Walls. • Bunding (for Blast Wave Deflection). • Installation of Fibre Optic and Satellite Communication Systems. • construction of internal access roads. • visitor viewing area and interpretative facilities.	Progressively from commencement of project as each launch site is developed
Temporary facilities required during construction	• Temporary concrete batching plant. • Temporary site and construction offices and facilities. • Temporary laydown areas. • Temporary access tracks.	At the commencement of each stage of construction

1.6 Legislative Requirements and Approval Processes

In order to proceed, the Project requires approval under the South Australian planning system. Specific elements of the Project and certain activities will also require additional approvals, licences or permits under other legislative requirements as and when applicable.

This section identifies the processes, procedures, and policies under which the application must be assessed and determined under the South Australian planning system.

The section also identifies the principle legislative instruments in addition to the planning system under which certain aspects of the proposal will require separate approvals, licences or permits.

1.6.1 South Australian Development Act 1993

At the time of lodgement of the proposal, the South Australian planning system was under transition from the *Development Act 1993* (the "Development Act") to the *Planning Development and Infrastructure Act 2016* (the "PDI Act"). The timing of changes to the legislation and the timing of the various stages of the Project intertwine but are important in determining the correct processes and policies for processing and assessing the application.

The Project was originally formulated as a concept under the planning regime operating under the Development Act, which provided the framework for determining the appropriate assessment pathways and policy for assessment.

Early discussion with the South Australian Government indicated the Project was of such substance that it should be assessed as a Major Project under the Development Act, affording the highest and broadest level of assessment available. This pathway also leads to the requirement for the preparation of an Environmental Impact Statement. Importantly, under the Major Project pathway, whilst applicable policy under the planning system is relevant, the Minister for Planning may have regard to any other matter considered relevant to the assessment and determination of the Project.

The following sets out the relevant legislative actions and dates applicable to the Project.

1 July 2016	The Planning Development and Infrastructure Act commences, with the majority of its sections suspended such that the Development Act continued to be the relevant legislation for assessment of development in South Australia.
20 November 2019	The proponent requests the Minister for Planning declare the Project a Major Project under Section 46 of the Development Act.
1 July 2019	Phase 1 of the Planning and Design Code comes into operation under the PDI Act, which introduces new planning policy that supersedes the Development Plan policy applying under the Development Act for the Outback and unincorporated areas of the State. The Planning and Design Code policies did not apply to the site of the Project but did apply to the marine and offshore islands to the south of the site including area likely to be under the flight path of rockets launched from the facility.
22 August 2019	The Minister for Planning declared the Project a Major Project under the Development Act. At this point the assessment of the Project becomes subject to the provisions under Section 46 of the Development Act for the duration of the assessment and ultimate determination of the Project. The timing of this declaration, and the introduction of Phase 1 of the Code, effectively means both the policies under the Development Act, and those under the PDI Act, are relevant to the assessment of development in the unincorporated areas of the State (outback and offshore islands).
20 November 2019	The development application in accordance with the Major Project declaration under the Development Act is lodged. At this point the policies relevant to assessment of the application are those operating under the Development Act (as contained in the relevant Development Plan under the Act) and which apply to the site of the proposal, alongside the policies introduced under Phase 1 of the Planning and Design Code which apply to land and marine areas to the south of and surrounding the site.

23 July 2020	The State Planning Commission formally determined the level of assessment to require and Environmental Impact Statement (EIS) and issued guidelines for the preparation of the EIS. Notably the guidelines require the EIS consider the planning policies under the Development Act and the PDI Act.
31 July 2020	Phase 2 of the Planning and Design Code commences, which superseded the Development Plan policies for the rural areas of the State, including the Project site. Ordinarily assessment of a development application in this situation would remain subject to assessment against the policies in place at the time of lodgement of the application only. However, as a Major Project and in accordance with the Guidelines issue by the State Planning Commission, the policies under both Acts are required to be considered.
19 March 2021	The Final Phase of the Planning and Design Code comes into operation and the provisions of the PDI Act in relation to development assessment become operative. The new code policies do not apply to the Project and the Project remains to be assessed and determined under the provisions of the Development Act.

In summary, the Project must be assessed and determined as Major Project under Section 46 of the now superseded Development Act, and in accordance with the EIS Guidelines, must have regard to planning policies under both the Development Act and the PDI Act.

Under the Development Act, development must be approved under the Act before it can commence, unless it is exempted from requiring approval. Development is defined under the Act and associated regulations and generally includes the construction of buildings and structures, a change in the use of land, and the division of land. The Southern Launch proposal contains elements of all three (3):

- a change in land use of the land to an aerospace facility;
- the construction of buildings, structures, and infrastructure to support the facility; and
- the division of land (in the form of a lease that exceeds five years) to create legal title to the site.

As the Project has been granted Major Project status, the Project must be assessed in accordance with the Major Project provisions set out under Division 2 of the Development Act. Subsequently, the State Planning Commission determined the assessment of the Project will require the preparation of an Environmental Impact Statement (EIS).

The purpose and description of the EIS process is described **Section 1.7** below.

Following preparation and assessment of the EIS, the Governor of South Australia, on the advice of the Minister for Planning, will make a decision on the application.

The decision is final and is not able to be appealed under the Act by either the applicant or any third party.

1.6.2 Relevant Planning Policies under the Development Act 1993

Whilst the *Planning, Development and Infrastructure Act, 2016* has come into effect in the District Council of Lower Eyre Peninsula in which the subject site is located, the Assessment Guidelines require consideration of the proposal against relevant provisions of the Development Plan under the *Development Act, 1993*. This is appropriate, having regard to the Project being declared a major project pursuant to the *Development Act, 1993* and on the ongoing transitional process occurring across South Australia between the two (2) pieces of legislation.

The majority of the allotment containing the site is located in the Coastal Conservation Zone of the Lower Eyre Peninsula Council Development Plan – Consolidated 12 July 2018. A small portion to the east of the allotment containing the site is located in the Caravan and Tourist Park Zone. Land further to the north of the allotment containing the site is located in the Primary Production Zone and the Water Protection Zone.

The marine waters adjoining and surrounding the site were subject to the Land Not Within a Council Area (Coastal Waters) Development Plan consolidated 12 December 2017 prior to the introduction of Phase 1 of the Planning and Design Code which commenced prior to lodgement of the application. Accordingly, whilst the policies of the Land Not Within a Council Area (Coastal Waters) Development Plan were never applicable to assessment of the application, they are considered in this EIS assessment for completeness.

The relevant policies of the Development Plan are reproduced in **Appendix G**.

An assessment of the Project against the relevant policies of the Development Plan is provided in **Section 19** of this EIS.

1.6.3 The Planning, Development and Infrastructure Act 2016

As noted above, the South Australian planning system has transitioned, with the *Development Act, 1993* and Development Plans being replaced by the PDI Act and the Planning and Design Code (the Code). Notwithstanding, pursuant to transitional arrangements, the application is being processed under the provisions of the *Development Act, 1993*.

The Planning and Design Code (the 'Code') is the policy document for assessment of development applications under the new PDI Act. The Code has been implemented in stages across the state Phase 1 of the Code applied to the unincorporated land and marine area south of the subject land, and Phase 2 of the Code introduced new policies directly affecting the site. being located within the District Council of Lower Eyre Peninsula.

The Guidelines for preparation of the EIS instruct that the policies for development as set out in the Code must be identified and considered.

Policies in the Code are expressed in relation to zones, sub-zones, and overlays that apply spatially in the Code, and in relation to certain kinds of development identified in the Code. The following Code zones and overlays apply directly to the site or to land and marine areas immediately adjoining the site (as indicated):

- Coastal Conservation Zone (applies to site).
- Caravan and Tourist Park (applies to site).
- Coastal Waters and Offshore Islands Zone (adjoins the site).
- Visitor Experience Sub Zone (applies to the site).

In addition to zones, the Code contains a number of overlays which are policies that apply to larger geographic areas and mostly reflect State-wide policies. Overlays applicable to the allotment containing the site include:

- Coastal Areas overlay.
- Historic Shipwrecks overlay.
- Hazards (Bushfire - High Risk) overlay.
- Marine Parks (Managed Use) overlay.
- Native Vegetation overlay.
- Prescribed Wells Area overlay.
- State Significant Native Vegetation overlay.
- Water Resources overlay.

The relevant policies are reproduced in **Appendix H**.

An assessment of the Project against the relevant policies listed above is provided in **Section 19** of this EIS.

1.6.4 The South Australian Planning Strategy

The allotment containing the site is located within the area of the Eyre and Western Region Plan (April 2012) volume of the South Australian Planning Strategy.

The preface by the then Minister for Planning the Hon John Rau MP states:

> *"The Eyre and Western Region Plan is designed to ensure that the region remains a great place to live, work and visit for many years to come. Based on a presumption of strong economic growth, the plans indicate where new housing, industry and commercial activity should be best located – and not located. The plan outlines the different roles and functions of towns and addresses important issues such as the way industrial, commercial and residential areas connect and impact on each other."*

The strategy identifies that the region is serviced by "*Extensive infrastructure includes four of the state's nine major export ports, three major regional airports (including the state's largest regional airport in terms of runway length at Whyalla) and connections to the national road and rail network*s" which benefit the proposed development providing the logistics of receiving rockets by sea prior to relatively short land transportation to the site.

The key issues identified for the Eyre and Western region can been grouped into four (4) themes:

- Environment and sustainability:
    - balancing native vegetation management, the protection of vulnerable ecosystems and the maintenance of aesthetically pleasing landscapes with economic development;
    - supporting native habitat areas so they can adapt to and survive climate change;
    - planning for sustainable coastal development while protecting coastal land and waters;
    - locating development away from hazardous areas and ensuring that appropriate prevention measures are in place;
    - supporting the region's water security, including developing strategies to harvest and recycle water supplies and developing alternative water sources;
    - supporting development of renewable energy; and
    - adapting development and services to cater for the effects of changing climatic conditions.
- Economic development:
    - retaining and enhancing the region's unique natural assets and culture to support tourism;
    - supporting aquaculture growth by allocating land for service providers and processing;
    - protecting and encouraging diversification of activities on primary production land;
    - supporting existing and new mining and energy developments;
    - supporting and encouraging development of alternative energy resources;
    - attracting and retaining a skilled workforce; and
    - supporting industries in adapting to the effects of climate change.
- Population, settlements, and culture:
    - supporting development of a range of residential accommodation options to support the diversity of residential needs (for example affordable and aged housing);
    - retaining and attracting young people and skilled personnel;

- identifying cultural values and encouraging a 'sense of place' in each community;
- providing adequate and accessible community services; and
- building population, employment and services in key growth centres that can also serve rural and remote residents and businesses.

• Infrastructure and service provision:

- maximising the use and adaptability of infrastructure through consolidation, clustering and economies of scale;
- protecting land corridors for expansion or augmentation of infrastructure;
- providing adequate infrastructure (for example, transport facilities, communications, energy, water security) to support development of mining, agriculture aquaculture and tourism;
- supporting the development of social and community infrastructure; and
- protecting services for airlines and the Royal Flying Doctor Service.

1.6.5 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The *Environment Protection and Biodiversity Conservation Act 1999* ('EPBC Act') is a Commonwealth Act designed to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places defined in the EPBC Act as matters of national environmental significance. It covers environmental assessment and approvals, protects significant biodiversity, and integrates the management of important natural and cultural places.

The EPBC Act comes into operation where a proposed development or activity has the potential to have a significant impact on a matter of national environmental significance. Such a proposal is defined as a 'controlled action' and requires approval pursuant to the EPBC Act from the Commonwealth Environment Minister.

Following initial investigations, the proponent concluded that there was a potential that the application would involve a 'controlled action' under the EPBC Act and accordingly will formally refer the development to the Commonwealth Department of Agriculture, Water and the Environment ('DAWE') for assessment.

This referral will be lodged with DAWE prior to the end of May 2021.

1.6.6 Other Relevant Legislation

Separate to the Major Development assessment process under the *Development Act, 1993* the proponent will need to comply with and/or obtain any other necessary approvals, permits and licences under related legislation as follows.

1.6.6.1 Environment Protection Act 1993

The *Environment Protection Act, 1993* ('the EP Act') provides the regulatory framework to protect South Australia's environment, including land, air and water.

The EP Act sets up a framework which imposes both a general environmental duty, which applies to everyone and a licencing regime, where activities of prescribed environmental significance require a licence from the EPA in order to operate. Discussions with the EPA have indicated that, whilst the proposal as a whole is not captured as a specific activity of environmental significance, there are elements of the proposed facility which will potentially require a licence from the EPA.

It is expected that the extent to which a licence (or licences) is required will be confirmed by the EPA following their review of the EIS. Licences under the EP Act can only be granted once the approval required under the *Development Act, 1993* has been issued.

1.6.6.2 The Native Vegetation Act 1991

Some areas of native vegetation will need to be cleared in association with the development:

- minor areas of removal associated with the upgrading of existing and establishment of new access tracks as outlined in **Section 5**;
- clearance of the vegetated areas of the four (4) facility sites including Launch Sites A and B, Infrastructure Site D and Range Control Site E detailed in **Section 5**; and
- clearance associated with perimeter and individual facility security fencing detailed in **Section 5**.

The *Native Vegetation Act 1991* provides protection for native vegetation in South Australia and sets out a process for applying to clear vegetation. Approval to clear native vegetation in South Australia is required under the Act unless exempted under the *Native Vegetation Regulations 2017*.

Native vegetation is defined as any naturally occurring local plant species that is indigenous to South Australia, from small ground covers and native grasses to large trees and water plants. It also includes naturally occurring regrowth and in certain circumstances, dead trees.

The requirements a proponent must undertake for the clearance of native vegetation for Major Developments and Projects include:

- Notification or application to NVC - In accordance with the Development Act, the NVC is provided an Environmental Impact Statement (EIS), Public Environment Report or Development Report for comment.

- Assessment - The NVC will assess the clearance against whether there are any other alternatives that involve no clearance, less clearance or clearance of vegetation that is less significant (or has been degraded to a greater extent than the vegetation proposed to be cleared).
- Approval - Clearance can occur if development consent is granted under the Development Act and the provision of a Significant Environmental Benefit (SEB) (on-ground or payment) is approved by the NVC.
- SEB - required as per SEB approval (or payment into the Native Vegetation Fund).

1.6.6.3 National Parks and Wildlife Act 1972

The National Parks and Wildlife Act establishes reserves and provides for the protection and management of native plants and animals in SA. It is an offence to take a native plant or protected animal without approval. Threatened plant and animal species are listed in Schedules 7 (Endangered Species), 8 (Vulnerable Species) and 9 (Rare Species) of the Act.

Persons must not:

- take a native plant on a reserve, wilderness protection area, wilderness protection zone, land reserved for public purposes, a forest reserve, or any other Crown land;
- take a native plant of a prescribed species on private land;
- take a native plant on private land without the consent of the owner (such plants may also be covered by the *Native Vegetation Act 1991* (NV Act);
- take a protected animal or the eggs of a protected animal without approval;
- keep protected animals unless authorised to do so, and
- use poison to kill a protected animal without approval.

1.6.6.4 Coast Protection Act 1993

The Coast Protection Act provides for the conservation and protection of the South Australian coast.

The proposal does not have any direct impact on the coast or coastal processes. The EIS will be referred to the Coast Protection Board for comment and it is expected the Board will provide comment and if appropriate any recommended conditions of approval for consideration by the Minister.

1.6.6.5 Landscape South Australia Act, 2019

Under the *Landscape South Australia Act 2019* (LSA Act) landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation. Under the LSA Act there is eight regional Landscape SA boards (LSA boards), responsible for administering the LSA Act.

1.6.6.6 Natural Resources Management Act 2007

This legislation has been repealed and replaced by the LSA Act.

1.6.6.7 Dangerous Substances Act 1979 (SA)

This Dangerous Substances Act regulates the keeping (retaining), handling, transport, conveyance, and disposal of dangerous substances defined under the Act.

The Act imposes a general duty to take reasonable care in relation to the use, handling etc. of dangerous substances with respect to health and safety, damage to property and environmental harm.

Depending on volume, the bulk storage and conveyance of dangerous substances prescribed by the regulations may require a licence under the Act.

Southern Launch must comply with the Act in keeping, using, transporting, and otherwise dealing with dangerous substances associated with the Project. The bulk storage and management of prescribed dangerous substances (including petroleum products associated with the Project) are anticipated to need to be licensed under the Act.

1.6.6.8 Work Health and Safety Act 2012

Operations at the site will be subject to the requirements of the *Work Health and Safety Act, 2012*. Southern Launch will address requirements under this legislation through the development of policies and procedures for both construction and operations of the proposed facility.

1.6.6.9 Aboriginal Heritage Act 1988 (SA)

The Aboriginal Heritage Act provides for the protection and preservation of Aboriginal heritage in South Australia.

Investigations have been undertaken to inform the design process and determine compliance with the Act and minimise the risk of damaging or disturbing cultural sites.

The proponent has consulted with local Indigenous groups to ensure compliance with the Act during construction and operation. Detailed processes and procedures will be incorporated into construction and operational management plans.

1.6.6.10 Native Title (South Australian) Act 1994

The Native Title (South Australian) Act recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs.

Native Title claims are dealt with in the Federal Court under the Commonwealth Act.

As an alternative to litigation, the State government supports the negotiation of Indigenous Land Use Agreements (ILUAs).

The subject site is freehold land and native title over the site has therefore been extinguished.

1.6.6.11 Environment Protection (Sea Dumping) Act 1981 (Cth)

The Environment Protection (Sea Dumping) Act implements the 1996 Protocol to the Convention on the *Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972*.

It is an offence under the Act to dump 'controlled material' into Australian waters from a vessel, aircraft or platform without a permit.

There is no equivalent South Australia legislation that is operational, so the Commonwealth Act applies also to State waters. Sea dumping in State waters is regulated under the *Environment Protection Act 1993*.

Any proposal to dump 'controlled material' in the marine environment would be subject to the Commonwealth Act.

1.6.6.12 Climate Change and Greenhouse Emissions Reduction Act 2007 (SA)

The Climate Change and Greenhouse Emissions Reduction Act promotes ecologically sound development in South Australia by addressing issues associated with climate change.

It sets a target of reducing greenhouse gas emissions by 60 per cent (to an amount equal to 40 per cent of 1990 levels) by 2050.

The Act has no direct application, but the proponent acknowledges relevant State government policy and climate change strategy.

1.6.6.13 Marine Parks Act 2007

The Marine Parks Act seeks to protect and conserve marine biological diversity and marine habitats in South Australia through the declaration and management of marine parks.

The proposal is not anticipated to not have a direct impact on marine parks.

1.6.6.14 Fisheries Management Act 2007

This Fisheries Management Act provides for the conservation and management of the aquatic resources of the State, the management of fisheries and aquatic reserves, the regulation of fishing and the processing of aquatic resources, the protection of aquatic habitats, aquatic mammals and aquatic resources and the control of exotic aquatic organisms and disease in aquatic resources.

The proposal will not have a direct impact on aquatic resources.

1.6.6.15 Heritage Places Act 1993

The Heritage Places Act identifies places and objects of non-Aboriginal heritage significance for conservation under the Act. Approval for activities affecting a State Heritage Place is required from the SA Heritage Council unless the activity is part of a development application and has been considered in the assessment of that application.

There are no State Heritage Places or Local Heritage Places on the site.

1.6.7 Civil Aviation Act 1988 (Cth)

The *Civil Aviation Act 1988* establishes a regulatory framework for maintaining and improving the safety of civil aviation, which has a focus on preventing aviation accidents and incidents. The Act establishes the Civil Aviation Safety Authority (CASA) which is responsible for regulating safety in civil air operations and the operation of Australian aircraft outside Australian territory.

Under the *Civil Aviation Act 1988*, CASA regulates civil air operations in Australian territory, the operation of Australian aircraft outside Australian territory, ensuring compliance with aviation safety standards and the issuing of certificates, licences, registrations, and permits. In respect of the proposal, CASA will have a key role in management of air traffic and launches before they reach 100 kilometres in altitude.

1.6.8 Harbours and Navigation Act, 1993

Notices to Mariners ('NOTMARS') within South Australian Waters are issued by the Marine Team of the Department for Infrastructure and Transport ('DIT'). Where a NOTMAR also needs to apply outside of South Australian waters, the Australian Hydrographic Office ('AHO') will be informed who will coordinate the process under the *Navigation Act, 2012*, as set out in the following Section.

1.6.9 Navigation Act, 2012 (Cth)

The Australian Hydrographic Office ('AHO') is responsible for providing Australia's national charting service under the *Navigation Act, 2012* (Cth). They promulgate maritime safety updates to charts and publications, including NOTMARS.

The *Navigation Act, 2012* promotes safety of life at sea, safe navigation, prevention of pollution of the marine environment and ensures that Australian Maritime Safety Authority ('AMSA') has the necessary power to carry out inspections of vessels and enforce national and international standards. The Act provides for the authority and responsibility for operational activities stipulated in the Act. AMSA has the power to issue prohibition and improvement notices. They may direct with written notices that a vessel does not enter, or use any port, or specified ports, in Australia or the exclusive economic zone of Australia. A person who is given this direction under the Act must comply.

AMSA is responsible for promoting maritime safety, protection of the marine environment. Their main responsibilities include developing maritime safety and environmental protection standards to promote the responsible operation of ships and safety of seafarers. They provide the systems that aid safe marine navigation. AMSA can issue navigational warnings as the NAVAREA X Coordinator, in addition to notices to mariners and notifying the public in social media.

1.6.10 Space (Launches and Returns) Act 1988 (Cth)

The *Space (Launches and Returns) Act 2018* (Cth) establishes a regulatory framework to reflect and facilitate the rapidly developing local space industry in Australia. The legislation attempts to strike a reasonable balance between encouraging innovation and entrepreneurship, and the need to ensure safety of space activities.

The key provisions of the Act include:

- A launch facility licence is required to operate a launch facility on Australian soil.
- A launch permit is required to launch a space object from Australia.
- Certain insurance and financial requirements must be met to grant a licence or permit.
- A framework for liability for damage caused by Australia space objects.
- A framework for the investigation of accidents.

1.6.11 Space (Launches and Returns) Rules 2019 (Cth)

The *Space (Launches and Returns) Rules 2019* (Cth) explains the application requirements for space activity approvals, including the requirements for launch facility licences and launch permits. The requirements include the provision of information about the applicant, emergency plans, environmental considerations, technology security and design engineering plans and specifications. All requirements must be met before the relevant Minister can grant an approval.

1.7 Purpose and Description of the EIS process

The Minister for Planning may declare a project or proposal a Major Project under Section 46 of the *Development Act 1993*, where it is determined that such a declaration is necessary for the proper assessment of a development, that is more complex in nature than is anticipated or contemplated in the Development Plan, and where the Project is considered to be of major economic, social or environmental importance.

The proponent made a submission to the Minister for Planning seeking a declaration that the application should be considered a Major Project under the Act (refer letter from Masterplan SA Pty Ltd dated 15 April 2019 (**Appendix A**)).

On 29 August 2019, the then Minister for Planning, Minister, the Hon Stephen Knoll MP, declared the Whalers Way Orbital Launch Complex a Major Project pursuant to Section 46 of the *Development Act 1993* (refer letter from Minster for Planning dated (**Appendix B**)).

Section 46 of the Act ensures that matters affecting the environment, the community, or the economy to a significant extent, are fully examined and taken into account in the assessment of a proposal.

On 21 November 2019, Southern Launch submitted an initial application to the, then, Department of Planning, Transport and Infrastructure. This preliminary application detailed the proposal and provided the basis for the development of Assessment Guidelines (refer letter from MasterPlan SA Pty Ltd dated 21 November 2019 (**Appendix C**)).

The State Planning Commission (the "Commission") is responsible for setting the level of assessment required in relation to the assessment of a Major Project. In this case the Commission determined the application should be subject to the preparation of an Environmental Impact Statement ("EIS"). As required, the Commission has issued Guidelines for the preparation of the EIS (refer Guidelines dated 23 July 2020 (**Appendix D**)).

The Guidelines state that:

> *'due to the nature of proposal, the need for a broader assessment and investigation of the following is required, specifically:*
>
> - *The strategic and economic benefits of establishing an Orbital Launch Complex.*
> - *Impact upon the Biodiversity Area of Jussieu Peninsula to Coffin Bay Peninsula, which contain a large tract of remnant native vegetation and fauna habitat, currently managed under a Native Vegetation Heritage Agreement*
> - *Impacts on the Thorny Passage Marine Park and the broader marine environment from the disposal of spent (discarded) launch vehicles.*
> - *Impact upon threatened fauna and flora species.*

- *Impact on sites, objects and areas of significance to Aboriginal people.*
- *Noise impacts on sensitive receivers, including people, terrestrial species and marine mammals.*
- *Impacts to air quality (amenity and public health) in the region due to construction and operational activities, including launch combustion and any on-ground fuel burning.*
- *Compliance with International obligations, National legal obligations and consideration of National security, information, equipment and processes (including sea dumping).*
- *Quantified risk and hazard analysis, including proposed prescribed activities, public and workplace safety, emergency response strategies and requirement for restricted and exclusion zones.'*

The proponent is required to prepare an EIS in accordance with the Assessment Guidelines and should describe what the proponent wants to do, what the environmental effects will be and how the proponent intends to manage the Project.

The Assessment Guidelines identify 17 principal Issues/Impact topics required to be addressed in the EIS, and the level of assessment required - standard, medium or critical level assessment.

For clarity, the EIS is structured, to the extent possible, specifically in alignment with the Assessment Guidelines.

The Assessment guidelines identified the Issue/Impact topics as follows:

- Effect on conservation values.
- Effect on native vegetation.
- Effect on native fauna.
- Hazard risks.
- Economic effects.
- Noise and vibration impacts.
- Visual and amenity tourism impacts.
- Effect on the physical environment, water and air quality.
- Effect on communities.
- Introduced plant and animal species.
- Security and safety.
- Effect on cultural heritage values.

- Spent discarded launch vehicle management.
- Transport and access.
- Construction and operational environmental management.
- Land use effects.
- Planning and environmental legislation and policies.

Following the preparation of technical reports to support the application, it became apparent that the Noise and Vibration Impact assumed a higher level of importance than assumed in the guidelines. This is on the basis that the data contained within the Noise and Vibration Assessment provides a key baseline for the assessment of the impact of the proposal on fauna.

In order for the assessment contained within the EIS to 'flow' logically, the assessment sections have been slightly reordered from the manner in which they are set out in the Assessment Guidelines, as follows:

- Effect on Native Vegetation.
- Noise and Vibration Impacts.
- Effect on Native Fauna.
- Introduced Plant and Animal Species.
- Effect on Conservation Values.
- Effect on the Physical Environment, Water and Air Quality.
- Economic Effects.
- Land Use Effects.
- Transport and Access.
- Visual Amenity and Tourism Impacts.
- Effect on Cultural Heritage Values.
- Effect on Communities.
- Planning and Environmental Legislation and Policies.
- Hazard Risks.
- Security and Safety.
- Spent (Discarded) Launch Vehicle Management.
- Construction and Operational Environmental Management.

Following preparation of the EIS, the Commission will release the document for public and agency comment (for at least 30 business days) and conduct a hearing at which the public may make representations. Advice as to the date and timing of these steps will be advised by the State Planning Commission.

At the conclusion of the public consultation process the proponent will prepare a response to the representations and may amend aspects of the Project and the EIS.

The response document will be released for public information.

The Minister, with advice from Plan SA, will consider the public submissions, Agency comments, the final EIS and the proponents' response to submissions, and prepare an Assessment Report. The Assessment Report is a public document.

The Governor of South Australia, on the advice of the Minister for Planning, will subsequently make a decision on the proposal. This decision will be notified in the Government Gazette and on the SA Planning Portal.

The decision is final and cannot be appealed under the *Development Act, 1993* by the proponent or any third party.

Figure 1.1, extracted from the Assessment Guidelines document, illustrates the steps involved in the assessment of a Major Development.

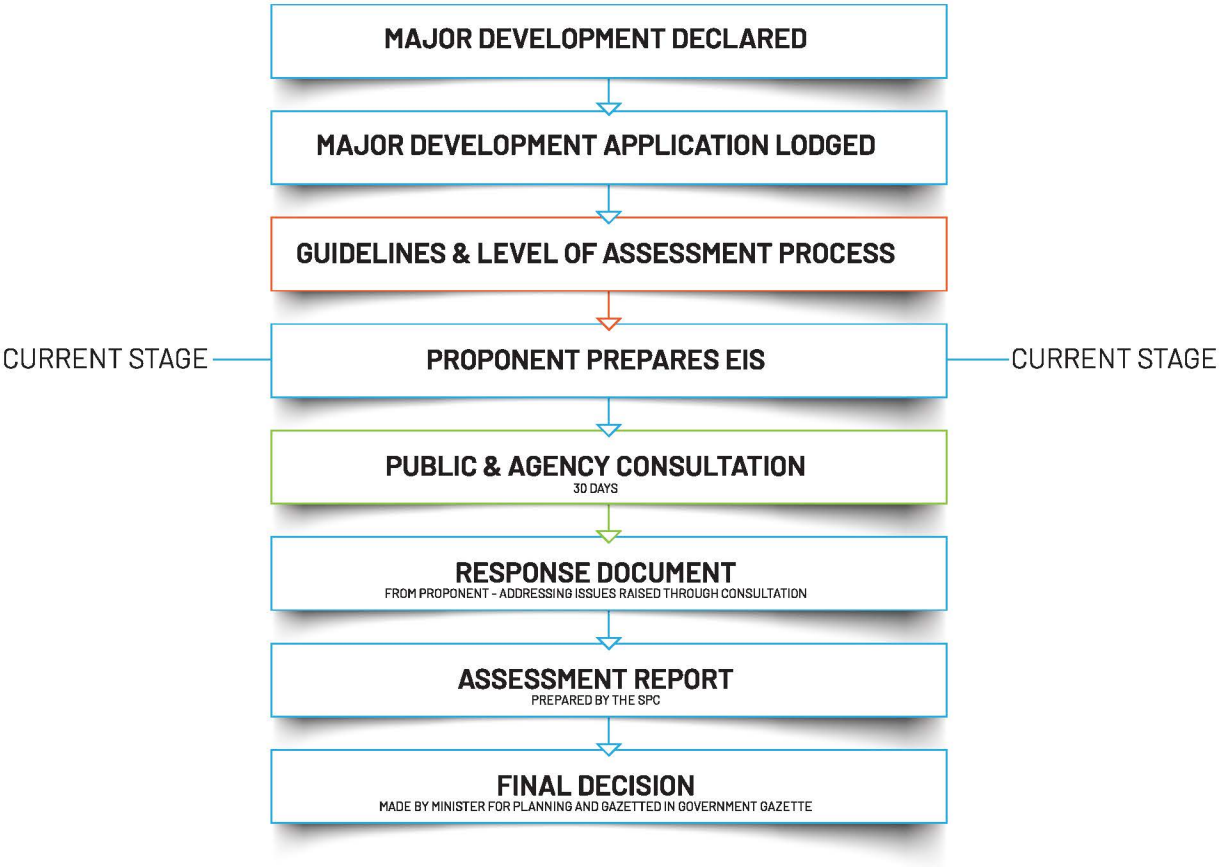

FIGURE 1.1

STEPS INVOLVED IN THE ASSESSMENT OF A MAJOR DEVELOPMENT

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2 PROJECT JUSTIFICATION

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2.0 PROJECT JUSTIFICATION

2.1 Project Objectives and Market Requirements

Advances in satellite technologies have enabled cheaper nano- and micro-satellites in Low Earth Orbit ('LEO'), typically at an altitude of 1,000 kilometres above sea level, to undertake operations that were historically only possible using large spacecraft operating in Geostationary Earth Orbits ('GEO'), typically 36,000 kilometres above sea level. This satellite technology advancement has revolutionised the space industry, advancing the number of missions these smaller satellites undertake and significantly reducing the size of the rockets needed to get them into orbit.

CubeSats (nanosatellites) are now being put into LEOs around the North and South Poles of the Earth in what are known as Polar and Sun Synchronous Orbits (SSO). These are now replacing the much larger satellites that need large rockets, orbiting around the Earth's equator in GEO orbits. The new CubeSats can image the Earth multiple times every day and provide higher resolution, time critical, commercial information to farmers, emergency services, transport operators and general consumers when compared to their GEO predecessors.

Most commercial rocket launch pads in use today were built in the 1960's and 1970's. These facilities were purpose built, each designed to only operate a single manufacturer's rockets and predominantly launching large GEO satellites. To support these orbits most of the facilities were built as close to the Earth's equator as possible to maximize the inertial velocity imparted on the launch vehicle through the Eastward rotation of the Earth and minimise any on-orbit manoeuvres required to shift the satellite orbit plane (inclination) given the additional satellite fuel required to perform the operation.

Physically, the revolutionary shift from GEO to LEO Polar and SSO orbits represents a 90-degree shift in orbit inclination (**Figure 2.1**). Few of the current launch pads throughout the world are capable of easily and safely launching a rocket into these Polar or SSO orbits without the satellites expending a prohibitively large amount of fuel to shift the orbit inclination.

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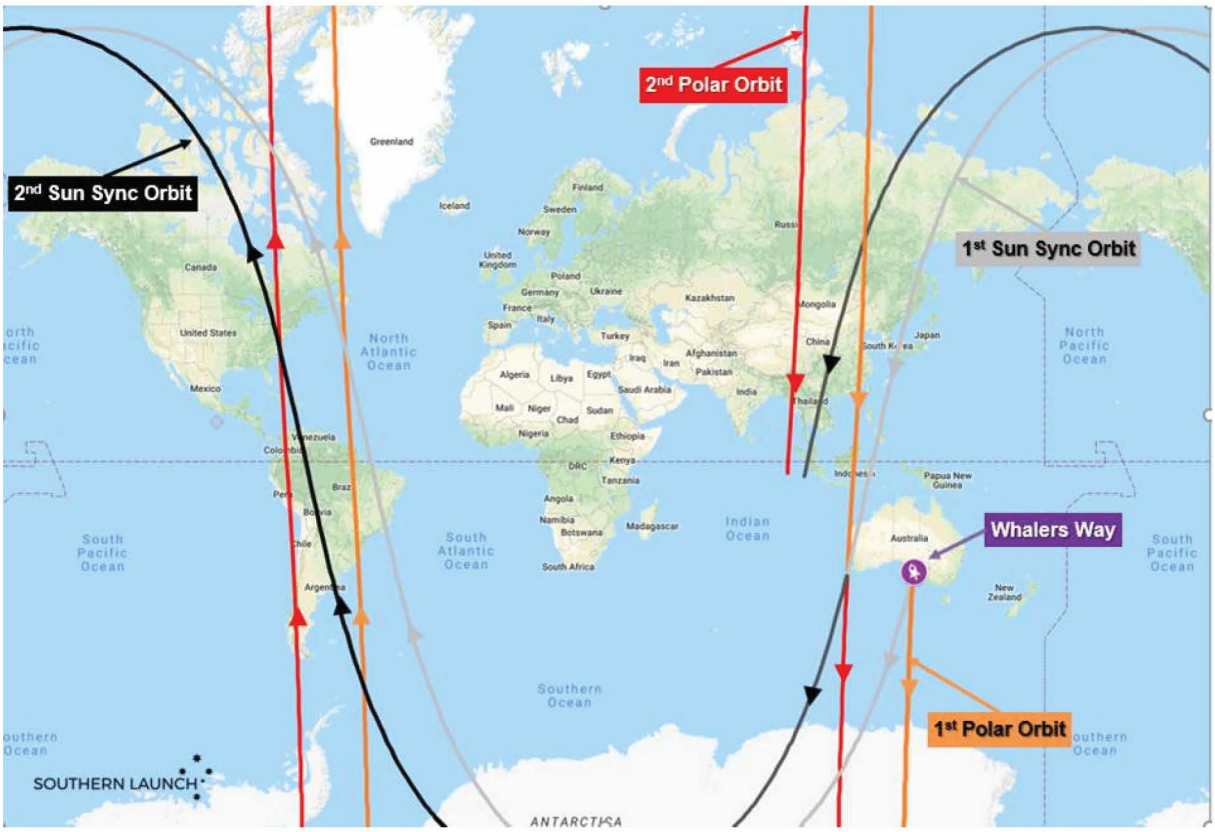

FIGURE 2.1

POLAR ORBIT (LEO)

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However, different satellites are now needed that can look for bush fires, monitor crops for farmers and help find stranded ships at sea. These modern satellites, called 'CubeSats', weigh several kilograms to a few hundred kilograms each and can cost in the order of several hundred thousand dollars to a few million dollars to build. This is orders of magnitude less than larger GEO satellites. Several companies are now building CubeSats here in Australia. These small satellites need to have visibility over the whole Earth and so are launched into what is known as Polar orbits that go around the North and South Poles while the Earth spins around on its axis. Because these new CubeSats are smaller and only go several hundred kilometres into space, the rockets that launch them are also smaller.

Due to technological advancements, these small satellites can do many of the tasks bigger satellites have historically performed, as well as many new capabilities such as supporting the Internet of Things (IoT) and global 5G internet from space. At least half of these small satellites are anticipated to go into Polar Orbit, instead of around the equator.

The market to launch the estimated 6,200 small satellites needed between 2017-2026 is US $30.1 billion and has spawned the creation of over seventy-five (5) companies worldwide that are developing new, micro- and small-lift rockets. With half the market going into large and small rockets respectively, the estimated market Southern Launch can address, is therefore approximately US $15.05 billion.

With small satellites being far cheaper to manufacture and launch into orbit, the market driver is the time it takes from manufacture to deployment in orbit, not the price per kilogram to orbit as has historically been the case. This has spawned what is called Just-In-Time ('JIT') space access, where a dedicated micro- or small-lift rocket is used to launch small satellites into orbit. The Whalers Way Orbital Launch Complex has been conceived specifically for these micro- and small lift rockets enabling them to launch and operate far more economically than the larger Geostationary satellites.

2.2 Typical Launchers and Launch Systems

Several existing launchers presently provide ride-share launch opportunities where smaller satellites share the cost of a rocket launch with a primary, large satellite. These have a number of major drawbacks to the ride-sharing small satellites:

- the costs are very high relative to the cost of the satellite itself;
- change of launcher if a vehicle becomes unavailable is complex as satellites payload interfaces need to be adapted;
- orbits are predetermined by the requirements of the large satellite; and
- the primary payload will determine the schedule and may cause delays for any ride-sharing satellites.

As this is a major issue for NewSpace companies. there is a growing demand for dedicated launch systems compatible with the increasing small satellite market.

Worldwide, a large number of organisations are working to develop small satellite dedicated launchers, with the objective to have launch costs of less than 75,000 USD per kilogram.

Southern Launch is proposing to take advantage of this emerging market by developing a launch facility at Sleaford, south of Port Lincoln. This launch facility would be made available to third-party rocket manufacturers who would be responsible for securing their own payloads. Numerous clients have been identified whose launch vehicles are at an advanced stage of development, who are all very keen to use the proposed WWOLC to operate from.

While some launch service providers are looking for a launch site for their maiden flights, looking further ahead, all customers have recognised the incredible potential of the proposed Whalers Way location for regular commercial launches, and the cost effective and efficient services offered them by Southern Launch's complete launch service solution.

To reduce supply chain lengths, many of the rocket companies are looking to relocate their assembly and manufacture facilities to Australia, creating local, high technology jobs and growth. It is expected that key aspects of rocket manufacture could be located to the industrial sites surrounding Port Lincoln, Adelaide and around Australia more broadly. This will create a new space industry related economy within South Australia and strengthen Australia's sovereign manufacturing base.

Expected growth in the number of small satellites in shown graphically in **Figure 2.2** and **Figure 2.3**.

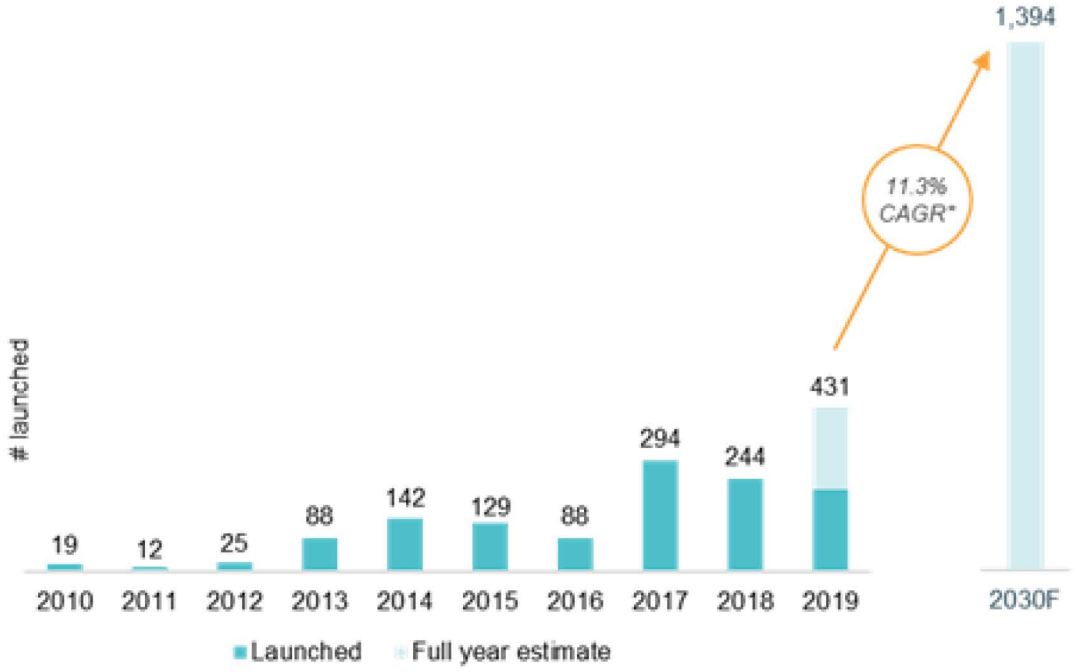

FIGURE 2.2

EXPECTED NUMBER OF SMALL SAT CONSTELLATIONS

SOURCE: SSTL

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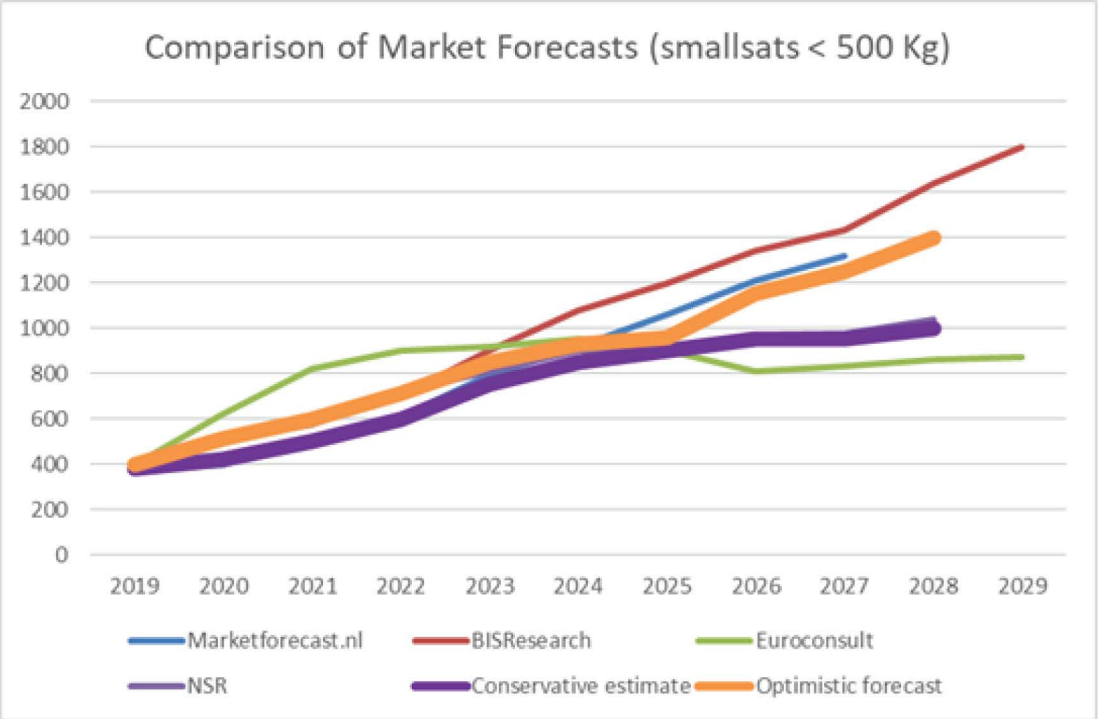

FIGURE 2.3

FORECAST OF NUMBER OF SMALL SATELLITES TO BE LAUNCHED OVER THE NEXT FEW YEARS

SOURCE: NSR, BRYCE

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FIGURE 2.4

FLIGHT TRAJECTORY OUT OF WHALERS WAY

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2.3 Project Benefits

2.3.1 Direct Economic Benefits

In order to understand the potential impacts of the proposed launch activities, Southern Launch commissioned the SA Centre for Economic Studies ('SACES') to undertake an economic impact analysis.

The SACES report is contained in **Appendix N**.

Should the proposed launch facility be successfully established in South Australia it is highly possible that there will be spin-off benefits with one or more launch vehicle manufacturers relocating either final assembly, or their full manufacturing operations, to South Australia. It is not possible to assess the likelihood of this occurring and so these potential impacts are not included in the main analysis, however they are estimated by SACES and included in Appendices of their report.

Approach

The gross economic impact of Southern Launch's proposed activities on the South Australian economy has been assessed using an input-output (IO) model. The methodology employed involves estimating the total direct and indirect employment and gross state product ('GSP') arising from the production operations and sustainment investment activities. GSP is the state equivalent to gross domestic product.

Findings – impact of the launch facility

It is noted that time has elapsed since the preparation of the SACES report. The impact years in the SACES report were based on an earlier timescale of the development proceeding into construction and subsequent operation. Thus, the years outlined below should be read as 2020/2021 being the first year of operations, and subsequent years being the relevant number of years after operations commence (for example 2025/2026 would be the sixth year of operations).

The estimated gross direct and production impact of Southern Launch's own operation would be to increase employment by 20.1 FTE positions in 2020/21, the first year of operations. In this first year with substantial activity contracted out (such as for safety and environmental assessments) direct employment only accounts for around 40 per cent of the total. By 2025/26 (year six) the impact is expected to reach 59.6 FTE positions.

There are also one-off employment impacts in 2020/21 (year one) and 2021/22 (year two) as a result of the construction of the launch facility, with an expected impact of 9.1 FTEs in 2020/21 (year one).

There will be on-going impacts from 2021/22 (year two) onwards associated with the spending by visitors associated with the launches, which are expected to result in a gross increase in employment of 6.9 FTEs in 2021/22 (year two).

The average gross impact on employment over the ten-year analysis period (including one-off impacts and increased business visitors) is expected to be 59.7 FTE positions.

The estimated gross on-going impact on economic activity of Southern Launch's on-going operations would be to decrease real GSP by -$0.3 million in 2020/21 (year one), the first year of operations due to the loss Southern Launch is expecting to record in that year being greater than the expected GSP impact from its operations. In the following year with the first launches occurring, the gross impact on GSP from Southern Launch's on-going operations is expected to be $3.5 million and will increase in the later years of the analysis period.

There are also one-off impacts in 2020/21 (year one) and 2021/22 (year two) as a result of the capital expenditures associated with establishing the launch facilities.

There will be on-going impacts from 2021/22 (year two) onwards associated with increased business visitor nights associated with staff of launch vehicle manufacturers both prior to and associated with the launches, with an expected annual contribution to GSP of $0.9 million in the first year of launches. Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP (including the impact of capital works) has a present value of $35.4 million in 2018/19 values. If consumption impacts from workers at Southern Launch and its supply chain are included then the average employment impact would be 76.2 FTE positions, with the present value of the impact on GSP being $53.4 million in 2018/19 values (see **Appendix A** of the SACES report).

Potential spin-off impacts

These potential impacts only relate to the operations of the launch facility itself and its associated supply chain. As noted above there is the potential for the existence of the launch facility to attract one or more of the launch vehicle operators using the facility to establish either a final assembly and testing facility, or a full launch vehicle manufacturing facility. If this does occur it will significantly increase the benefits for the state from the launch facility.

Should a final assembly and testing facility be attracted to South Australia then there would be an additional increase in on-going employment of 142 FTE positions once it is operational (assumed to be from 2022/23 (year three))

The estimated gross on-going impact on economic activity of a launch vehicle manufacturer establishing their final assembly and testing operations in South Australia would be to increase real GSP by $20 million a year once it is operational.

Assessed over the full ten-year analysis period using SA Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $90.2 million in 2018/19 values. As was the case with the employment impacts, this likely somewhat understates the potential impact of final assembly of a launch vehicle as its activities are only captured in eight (8) of the 10 years of the analysis period.

The potential impact of a launch vehicle manufacturer being attracted to South Australia is still larger, with on-going employment in the manufacturer and its South Australian supply chain expected to be 568 FTE positions once the manufacturing facility were fully operational (assumed to be from 2023/24 (year four)). This additional economic activity of a full manufacturing facility should it be attracted to South Australia, would increase real GSP by $79 million per year once it was fully operational.

Assessed over the full ten-year analysis period using SA Treasury's recommended real post-tax discount rate of 7.0 per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $318.4 million in 2018/19 values. As was the case with the employment and economic activity impacts, this likely somewhat understates the potential impact of final assembly of a launch vehicle as the full manufacturing operations are only captured in eight (8) of the 10 years of the analysis period.

2.3.2 The South Australian Space Industry

In September 2017, the South Australian Government created the South Australian Space Industry Centre ('SASIC') to drive space industry innovation, research and entrepreneurial development.

The SASIC will support space entrepreneurs, create an incubator for space projects and an environment where new space technologies can be rapidly developed. The SASIC will build on the work done by the previous Space Industry Office at Defence SA, which developed the first space strategy of any jurisdiction in Australia. It will also support South Australia's emerging space industry by providing grant funding (the Space Innovation Fund) of up to $1 million every year to young space entrepreneurs, along with new and existing space start-ups.

The growth of space and sustainable defence industries in South Australia plays a key role in the State's economic development. The main capabilities and expertise are concentrated on Earth observation, satellite communications and space-based position, navigation, and timing. These space enabling services support activities across a variety of sectors including communication, environmental monitoring, and mapping.

The space industry contributes to the development of other priority sectors for South Australia including defence, agriculture, mining, and tourism, as well as services for the community such as health and education.

Southern Launch's Whalers Way Complex will create a 'centre of gravity' attracting both local and international rocket and satellite manufacturers to South Australia. This will create more technology related jobs in Australia. It is internationally recognised that for each space-associated job, eleven other work opportunities are created.

Rocket manufacturers will rely on Australian sourced components and services from Adelaide, Port Lincoln, and the wider Australian supply chain. Over time, it is expected that some companies will relocate some, if not all, of their manufacturing into the State thereby generating new jobs for local Australians.

2.3.3 Tourism

As it is developed, the facility is expected to become a significant tourist attraction in the region. In the later stages of the Project, the WWOLC will enable the public to observe launches and view the facilities. These will have a direct benefit for the facility and the surrounding region. Additionally, launches will be able to be viewed from a variety of locations further north of the site. It is anticipated that launches in the early stages of operations of the facility will attract significant numbers of visitors to the region.

2.3.4 Education

Southern Launch intends to work closely with the education sector, including school and tertiary education facilities. Southern Launch is investigating the establishment of a programme by which Australian schools will be able to sponsor dedicated rocket payloads on a competitive basis.

Every company that launches from Whalers Way will be requested to undertake a number of public outreach activities at local communities and schools as appropriate. This will provide an opportunity for engagement with the community and education on the facility, the launch process and the launch vehicles.

2.4 Summary of Arguments to Support the Proposal

This section summarises the detailed investigations and analysis of the environmental, social and economic impacts of the proposal contained in **Sections 7** to **Section 23** of this EIS.

2.4.1 Environmental Impact

Flora

The Project will require clearing 23.76 hectares of native vegetation for construction including launch pads, access tracks and associated laydown areas. The Project Area has been refined during the design phase to reduce the amount of native vegetation to be cleared in areas of lower condition rating as far as practicable.

A Bushland Assessment Method (BAM) assessment has determined scores for the condition of vegetation be cleared. Launch Site A and the Access Roads had the highest condition score of 74.53 and the Access Roads had the highest average score of 65.53. The lowest condition score was at Infrastructure Site D which had a score of 30.66. The scores are largely influenced by partial clearing, weed invasion and species richness.

The clearance of 23.76 ha will be offset through a biodiversity offset program developed in accordance with NVC guidelines. Construction and operation of the Project will be managed in accordance with a CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising appropriate management measures.

The clearance of 23.76 hectares to enable the Project to proceed has been balanced with the need to undertake the Project, and the lack of suitable alternative sites on which the impacts would be less. As is detailed in **Section 4**, a rigorous site selection process has determined that there is a strong correlation between sites which meet critical selection requirements and the presence of remnant native vegetation.

Following a review of marine conditions, it is considered that the proposal should not have a material impact on marine vegetation.

It is considered that the proposal appropriately accords with the mitigation hierarchy in respect of the loss of native vegetation.

Fauna

During field surveys a total of 34 fauna species were recorded on the land. This included 28 bird species, four (4) mammal species, and two (2) reptile species.

One native mammal species was recorded throughout the Project Area being the Western Grey Kangaroo (*Macropus fuliginosus*).

Three (3) exotic mammal species listed as Declared Pests under the LSA Act were recorded:

- Domestic Cat (*Felis catus*) tracks were observed frequently;
- European Rabbit (*Oryctolagus cuniculus*), which is an introduced pest species common in all states, was widespread and common; and
- Red Fox (*Vulpes vulpes*) was observed from numerous scats.

Two (2) reptile species were confirmed. The Shingleback Lizard (*Tiliqua rugosa*) is common to the Project Area habitat types and was commonly observed. The Mallee Heath Dragon (*Ctenophorus chapmani*) was common and widespread. Numerous skinks (not able to be identified) were noted.

Of the 30 bird species recorded one was a Declared Pest under the LSA Act, namely, the Common Starling (*Sturnus vulgaris*). Four (4) of the bird species were associated with the cliffs in the south, and four (4) were associated with inland vegetation. The remaining species were common and widespread.

Acoustic energy from in-air noise does not effectively transfer across the sea surface meaning that most of the noise is reflected off the water surface. Therefore, noise and vibration impacts are unlikely to result in impacts on Marine fauna.

In respect to impacts on the Australian Sea Lion (ASL) and Long Nosed Fur Seal (LNFS) when above water, criteria presented by Southall et al. (2007) for noise impacts on pinnipeds above water suggest that there would be no temporary hearing loss for pinnipeds at sound pressure levels below 140 dB.

Sound pressure levels of 140 dB would not be experienced anywhere other than the launch site and will decrease significantly as proximity to the launch site increases. Therefore, due to their distance separation, no impact is anticipated on the hearing of ASL or LNFS on Liguanea Island, or LNFS hauled-out at Cape Wiles.

Conservation

Design buffers have been applied in the Project Area footprints of each facility and access roads in order to limit indirect impacts to vegetation, flora and fauna in the vicinity.

A 5.0 metre vegetation clearance buffer has been applied to the Project Area footprint for fire safety purposes. All buildings and infrastructure are sited with a minimum 5.0 metre setback from the Project Area boundary, and in some instances up to 20 metres from the boundary dependant on the form of batters.

All roads have a 3.0 metre buffer applied to each side of the road; however, this may increase to 6.0 metres on one side of the road, dependent on the bends in roads and terrain encountered. This is also provided to allow for the addition of power and water easements.

Signage and exclusion barriers/bunting will be installed around areas of known fauna habitat prior to the commencement of any construction works in or within 200 metres of these areas. This includes identification and fencing (or marking of buffer areas) around protected species nests that are known in the area.

Revegetation is to occur through natural regeneration as well as through assisted planting to create a vegetated buffer between the disturbance footprint and adjacent values. Plantings (tube stock and seed) to consist of native species analogous to adjacent vegetation community.

Chemicals

The manufacture, transport and storage of rocket propulsion chemicals are controlled by legislation and established protocols. Storage on site will occur in accordance with legislative requirements in bunded areas and vessels in appropriate containers for the particular substance being stored.

The design of the launch sites, where the majority of chemicals will be stored grades the site to retention basin which are 'blind' and do not discharge to the environment. This means that in the event of a failure of both a storage vessel and localised bunding, the spill would remain contained within the perimeter of the site area, and even in the unlikely event it reached the retention basin, would be capable of either being managed in-situ or decanted from the basin.

Rocket propellants will not be stored on site for extended periods, being transported to site shortly before a planned launch and any excess being disposed immediately following the launch.

Contamination

As described above, the design of the proposed development has had specific regard to the management of potentially contaminating substances. Appropriate management techniques will be incorporated in respect of the transport, storage and usage of all chemicals and substances with the potential to cause contamination or harm.

2.4.2 Social Impact

Public Safety

Over many decades, the global space launch industry has developed protocols dictating the safety procedures and standards required for launch site licensing. The Australian Space Agency is the Australian space launch regulator and places ensuring public safety as the primary consideration prior to approving a proposed rocket launch event. Together the Australian Space Agency and the space launch industry cater for, inter alia, system failures whilst the rocket is on the ground and in flight to orbital height. Public safety, property and the environment are all strenuously safeguarded.

Southern Launch is committed to adopting these existing, time proven protocols and procedures and seek all approvals from the respective regulators before undertaking a rocket launch event.

The primary method of preserving public safety is through the implementation of appropriate buffer zones to exclude people when the launch is taking place. The proposed launch sites are ideally located in this regard, as appropriate buffer zones can be achieved without a requirement to exclude people from adjacent freehold allotments or terrestrial publicly accessible locations, such as public roads and beaches.

Local Residents

An advantage of the Whalers Way Launch Site is that dwellings are located within the planned Exclusion Areas, so no one will need to be evacuated during launches. The nearest inhabited dwelling is positioned some 3.0 kilometres from the nearest launch site.

The operation of the proposed facility will cause material impacts on residents in the locality for very brief periods when a launch takes place. These material impacts will primarily be confined to noise impacts which will last for approximately 60 seconds. Some additional minor impacts such as light spill and increased vehicular traffic will also occur, however should be negligible having regard to the separation between the launch sites and the nearest dwellings, and the proposed trajectory of the vehicles.

Outside of the actual launches, the level of impact of the proposal will be limited, with the principal impact being an increase in vehicular traffic on the roads leading to the site. Having regard to the separation between the launch sites and the nearest dwellings, it is considered that noise, light spill, and air quality impacts will be minimal. The key identified impact is static engine tests, which similar to launches will only occur for a short period of time, and occur at ground level, meaning that there is intervening topography and vegetation to limit direct noise propagation to sensitive receivers than in the case for actual launches.

Public access and recreation

The development will result in some limitations when compared to the current level of public access to the allotment containing the site. However, appropriately managed public access will still be able to occur when there is no operational reason to exclude public access. Additionally, the allotment will be able to support managed tourism access and should support the growth of 'space tourism' where visitors come to observe launches and visit the facilities outside of active operations. These arrangements offer the ability to rehabilitate areas of the site which have been impacted by the existing public access arrangements.

Existing access for terrestrial camping

The nature of the activities proposed is likely to result in some limitations on camping on the allotment containing the site. This is a function of the nature of the proposed operations, which has specific safety and security requirements. The exact nature of such limitations will be determined as detailed design and operational planning for the proposal proceeds.

It is noted that the allotment containing the subject site is a privately owned freehold allotment, and as such public access is at the discretion of the landowner and there has never been a guarantee that such access to the site would continue in perpetuity.

Access to the adjoining beach

Access to the Fishery Bay Beach will not be impacted by the proposal.

Bushfire Risk

Southern Launch's Bushfire Prevention Plan is part of its Emergency Management Plan. The Emergency Management Plan has been developed with input from relevant agencies including the Country Fire Services, South Australia Police and the South Australian Ambulance Service. Comprehensive fire-fighting equipment is proposed to be installed on site and staff appropriately trained in the safe use of the equipment. This equipment will always be ready and available for every launch. Following every launch, a rapid assessment of the area surrounding the launch site and below the terrestrial trajectory will be undertaken to ensure that no fires have been ignited. In the event of a rocket failure on the site, a response will within minutes to immediately seek to control any sources of ignition.

Fire safety management plan

In addition to an overachieving Emergency Management Plan which covers all operations at the site, a specific plan for each launch will be developed relating to management of fire safety risks with input from relevant agencies. These specific plans will be tailored to the level of risk from particular vehicles, the meteorological conditions at the anticipated time of launch and the specific response required in the event of a failure.

Training and Employment

The facility will create significant opportunities for employment and training in the local community. The proponent is committed to the employment of a local workforce wherever possible and ensuring that local contractors and suppliers have access to opportunities associated with the Project.

The high-technology, high skill nature of the proposal will provide direct benefit to the local community through greater employment, training, and upskilling opportunities.

Additionally, the proponent is seeking to offset the impacts of the proposal through significant environmental rehabilitation works on the allotment containing the site. These works will also present further opportunities for employment and training.

Shipping and airlines

Rocket launches are regulated by the Australian Space Agency above 100 kilometres in altitude and regulated by the Civil Aviation Safety Authority below 100 kilometres in altitude. Maritime operations are regulated by the Australian Maritime Safety Authority. With safety as a priority, Southern Launch will work with these regulators to ensure that proposed operations from the site are done in accordance with Australia's airspace and maritime Acts.

Launch operations will be designed with input from commercial air and maritime companies to minimise the effect on commercial air and maritime operations.

Recreational Fishing

Recreational fishing along the Whalers Way coastline will be restricted during the lead up to, and during launch operations. Exclusion areas will be put in place using existing maritime notice procedures.

Outside of these times access to recreational fishing areas in the vicinity of the site will continue uninterrupted by the proposed development.

Farming

The proposed development is not anticipated to have a material impact on primary production uses in the locality. Having regard to the separation of the launch sites from surrounding primary production land and considering the trajectory of rockets southwards over the ocean, the level of impacts on farming operations in the region is anticipated to be limited.

No material impacts on crops are anticipated.

In respect of impacts on farm and domesticated animals, given the large distance between the proposed launch site and the adjacent primary production sites, we expect the noise to be greatly attenuated and last for a short duration. We anticipate that the noise would be similar in intensity and duration to a low flying light aircraft occurring infrequently.

Impact on new development

The proposed development should not result in limitations on the future development of other land in the locality, including the site of the proposed desalination plant, primary production land to the north of the site, public land at Fishery Bay Beach or sites in the locality that currently have dwellings, or have the potential to be developed in the future for dwellings.

Impact on mineral leases

A review of mineral leases on the allotment containing the site, nearby allotments and under the trajectory of launch vehicles has been conducted. This indicates that existing leases and licences are not subject or operations or high levels of exploration activity. Southern Launch will engage with the holders of leases and licences to develop suitable operational management arrangements.

2.4.3 Economic Impact

Employment and economy

The impacts of the proposal on employment and the economy of the region and South Australia more broadly are detailed in **Section 2.3.1** above.

Regional Development

Southern Launch has worked extensively with regional organisations during the planning stage of the development to identify economic opportunities as the Project proceeds. Southern Launch will continue to liaise closely with key regional organisations, stakeholders, and business groups to ensure that opportunities emanating from the proposed development are maximised.

Tourism

The proposal is anticipated to result in significant tourism opportunities for the region and South Australia. These will include visitors to the region to view launches, visitors seeking to explore and understand the facility and space industry.

These visitors are expected to stay a few nights in the Port Lincoln surrounds, eat at the local cafes, sample the local boutique produce and visit the local attractions.

As a highly novel industry which is only located in small number of locations around the world, the facility has the potential to draw significant numbers of people to South Australia and the local region.

Southern Launch will seek to work with local tourism organisations and operators to ensure that the potential benefits to the region area maximised. This will include seeking to facilitate the development of experiences associated with the facility.

2.5 Project Alternatives

Consideration has been given to alternatives to proceeding with the Project in its current form and location.

These have been considered on the basis of the following scenarios:

- Not proceeding with the Project;
- Proceeding with the Project in a different location; and
- Proceeding with the Project in a different form on the subject site.

It is considered that not proceeding with the Project will result in the removal of the direct, indirect, and induced impacts of the proposal, which are considered in this report. However, it will also result in the loss of the forecasted direct, indirect, and induced economic and social benefits accrued from the Project. In such a circumstance, the market for the launching of rockets and payloads as proposed will still exist and the economic benefit will be focused on locations where launch facilities exist or at those locations where new launch facilities are being developed. Having regard to there not being other advanced proposals for competing launch facilities within Australia, there is a high probability that, should the proposed project not proceed, the market for such launches will be met overseas.

Proceeding with the Project in another location would result in the removal of the direct, indirect, and induced impacts of the proposal on this locality and would result in these impacts occurring elsewhere. Similarly, the direct, indirect, and induced economic and social benefits would also move to the locality where the alternative site was located.

The site selection process, detailed in **Section 4**, has indicated that the supply of sites meeting the critical search criteria is extremely constrained, and that many of these potential sites present many of the same similarities and challenges. Undertaking the Project in a different location is therefore unlikely to materially reduce the environmental impact of the proposal, but merely relocate these impacts. It is moderately likely that other sites meeting critical search criteria would present a similar or higher level of environmental impact than the selected site. It is also likely that alternative sites with a lower level of environmental impact could have a higher level of interface and amenity impacts.

Alternative options and arrangements for proceeding with the Project on the subject site have been considered in detail during the design process. The design process has resulted in a significant reduction of the footprint area of the proposed development and is considered to have optimised design requirements with the minimisation of impacts to the extent reasonably possible whilst still achieving a facility that meets operational and commercial requirements.

Each of these scenarios are considered in further detail in the following sub-sections.

2.5.1 Not Proceeding with the Project

If the Project does not proceed, it is likely that the nature and use of the subject allotment will, at least in the short term, continue in the form that it is currently in. This would result in the site continuing to be largely covered with remnant vegetation, including the development footprint areas which are proposed to be cleared to accommodate the proposed development.

In not proceeding with the Project, the economic and other benefits of the Project will be lost to South Australia, and likely Australia, unless the Project occurs in another location, or another proponent seeks to undertake the Project on the subject allotment.

If another proponent sought to undertake the Project on the subject site, it is probable that the impacts would be materially similar to that of the proposed development. If the proposal occurred in another form, it is likely the impacts would be materially similar to those outlined in **Section 2.5.3**.

In respect of the Project occurring in another location in South Australia, or Australia, Southern Launch has undertaken a detailed site selection process across the whole of Australia for this space launch segment, which is detailed in **Section 4**. This site selection process has indicated that sites that support polar and sun-synchronous orbits are very constrained. Whilst the potential for a similar facility to be constructed on an alternative site along the southern coastline of Australia cannot be excluded, the fact that no serious competing proposals have emerged infers the level of complexity in locating a suitable site and proceeding through the design and approval process.

Having regard to their being no other competing proposals which have reached the stage of lodging an application indicates that if the Project does not proceed, there would be a significant time delay in achieving the capability to launch vehicles in the manner proposed to occur on the subject site.

If the Project does not proceed, the market for the launching of vehicles and payloads as proposed at the subject site will, most likely, be met by expanding existing alternative facilities, or by other proposed international sites currently progressing through the design and approval phase. As previously noted, at the present time, these alternative facilities are all located outside of Australia. The loss of this market share to other countries is likely to have a significant impact on the development of the commercial space industry in Australia, and the allied scientific and industrial sectors in both South Australia and Australia.

If the Project does not proceed, the economic benefits of the Project as outlined in the report in **Appendix N** and assessed in **Section 13** of this report will be lost to the Eyre Peninsula, South Australia and Australia. In practical terms, this represents the lost opportunity to establish as high-technology, high-skill industry which has the potential to catalyse significant multipliers in the education, logistics, technical and scientific and tourism sectors.

Not proceeding with the Project will result in the impacts on the site and surrounding areas from the proposed project not occurring. However, this would mean that the site will remain in its current use and condition, at least in the short term. The management of the site at the present point does result in adverse impacts on the environment, including the accumulation of waste, loss of vegetation through impacts from camping and recreational uses such as edge effects and vehicle and human trampling of vegetation. The Project offers opportunities to improve the management of the site, undertake rehabilitation projects and ongoing improvements and continuing to facilitate managed access to the site for tourism and recreational purposes.

2.5.2 Proceeding with the Project in a different location

If the Project were to proceed in a different location, the impacts and benefits of the Project would transfer to that location.

If the alternative site is located in South Australia, the local agglomeration benefits would transfer to service and regional centres proximate to that location, and in most cases, it is likely that the agglomeration benefits appurtenant to the nearest capital city would remain in Adelaide.

If the alternative site is located outside of South Australia, it is likely that the majority of agglomeration benefits would be lost to Adelaide and South Australia.

Having regard to impacts, the movement of the facility to another location would remove the direct, indirect and induced impacts on the subject allotment, however these impacts would transfer to the alternative location.

Southern Launch has undertaken an extensive site selection process across Australia which is outlined in **Section 4**. This process has indicated that the number of potential sites for a facility of this nature is extremely constrained. Further, critical requirements for sites to be located in immediate proximity to open ocean, and away from significant densities of sensitive receivers means that there are frequently strong commonalities in the characteristics of suitable sites. Most particularly, the majority of suitable locations identified included remnant native vegetation. This is unsurprising, as those areas which are devoid of vegetation have largely either been cleared by human activity or are in locations which are too remote to be viable. Those areas which have been cleared by human activity are more likely to have sensitive receivers or nearby publicly accessible locations which render them unsuitable.

The site selection process has indicated that there is a high probability that sites which pass critical site selection requirements will have significant remnant vegetation. Indeed, the final three (3) candidates from the site selection process were all in locations that were substantially covered by native vegetation, with the subject site being the only one that was located on freehold land. The other two (2) final candidates were located within National Parks.

Having regard to the site selection process, it is considered that there is a high likelihood that an alternative site would also have significant native vegetation and the impacts associated with the proposed development on the subject site would carry across to result in similar impacts on the alternative site.

If the development was to be undertaken on one of the other two (2) final candidates, it would also result in the clearance of native vegetation to provide site footprints, however, would do so within the boundaries of existing National Parks. As such, the environmental impacts would be consistent, however would be occurring on land devoted to environmental preservation and public enjoyment. Further to this, in such a case, the public would be excluded from accessing public land for a considerable period of the time during launch events, as compared to the proposal which is resulting in limitations on public access to a private, freehold site, to which there is no guarantee of ongoing public access.

In considering the high likelihood of suitable sites having remnant vegetation, the impacts associated with the proposed development on the subject site, would to the extent of the size of the development footprint, would be consistent. Whilst the extent of those impacts would vary based on the type of vegetation, its condition and the habitat it provides for fauna, the nature of the impacts would be similar to those assessed for the subject site. It is reasonable to assume that in some cases, particularly on sites where infrastructure and road connections are more limited than the subject site, that the impacts could potentially be greater than those assessed for the subject site.

Whilst it is possible that an alternative site which does not feature remnant native vegetation exists and was not identified by the site selection process, the exhaustive nature of site selection and identification undertaken indicates a strong correlation between cleared sites and proximity of sensitive receivers. If the critical selection criteria could be overcome in such a location, an increased density of sensitive receivers would likely result in additional interface and amenity impacts. A key benefit of the subject site is a low density of sensitive receivers in proximity reducing the potential for adverse amenity impacts generated by the proposal.

On balance, it is considered that if the proposal was undertaken in an alternative location:

- there is a moderate likelihood that an alternative location would involve publicly accessible land, for which additional impacts in respect of tenure, native title and loss of public access would exist;
- there is a high likelihood that the alternative location would also have significant remnant vegetation resulting in a range of environmental impacts similar to those resulting from the proposed development;
- where the environmental impact is lowered through the site being clear of remnant vegetation as site conditions are not conducive to the growth of vegetation, there is a high likelihood that the alternative location will be too remote to be viable; and
- where the environmental impact is lowered through the site being clear of remnant vegetation as a result of historical clearance, there is a moderate-to-high likelihood that the density of sensitive receivers in the vicinity of the site will result in the greater potential for adverse amenity impacts on those sensitive receivers and potential land use conflict.

2.5.2 Proceeding with the Project in a Different Form on the Subject Site

Consideration is given to whether the Project could proceed in a different form on the subject site. In regard to this possibility, a number of potential scenarios have been considered, as follows:

- the proposal involves only a single launchpad;
- the proposal consolidates more elements in a single location;
- the proposal seeks to remove non-site critical elements to a remote location; and
- increased alignment with areas currently excluded from the heritage agreement.

It is noted that the site footprint has been significantly reconfigured since the initial proposal. This has resulted in both a reduction in the size of the Project Footprint and a reconfiguration of the Project elements to locate more of the Project Footprint in degraded areas. The original project considered a Project Footprint in excess of 70 hectares. During the design process, this footprint has been reduced to approximately 35 hectares, with further reductions in footprint potentially being possible during detailed design.

A further reduction in Project Footprint could occur by reducing the number of launch pads from two (2) to a single launch pad. This would result in a reduction of approximately six (6) to eight (8) hectares of footprint. This represents approximately a 20-25 per cent reduction in Project Footprint.

Having regard to customers needing to occupy launch sites between two (2) weeks and four (4) weeks prior to a launch, a single launchpad is capable of supporting an absolute maximum of around 20 launches per year (allowing for a suitable period for maintenance and turnaround between customers). Based on the proposal for up to 36 launches per year, a single launchpad would reduce the capacity of the facility by over 40 per cent and remove the economies of scale achieved by having common infrastructure facilities serving multiple launch sites. It would also mean that the footprint area was larger for a given launch capacity than with the provision of multiple launch pads.

Such a configuration is likely to make the Project unviable.

An alternative configuration of the Project involves consolidating more of the Project elements in a single location on the site, rather than having them spread across the site. On review of this opportunity, there are limitations as to what can be achieved, as the locations of the launch pads are highly sensitive with respect to their location and orientation. The locations of the launch sites have been selected based on minimising environmental impacts whilst achieving requirements in respect of location and orientation.

The range control facility needs to be located remote to the launchpads so that it can be occupied during launches. The potential exists for the infrastructure site to be co-located with launch sites. However, the infrastructure site has been specifically located in an area of the site which has a low elevation and degraded vegetation, making it an efficient location and minimising the environmental impacts. It is considered highly likely that co-locating the infrastructure area with the launch pads would result in greater impacts on the environment.

The third alternative site development option considered was to locate the infrastructure site and range control on land remote to the site, which potentially was already cleared of vegetation and thus minimised footprint impacts. This option would require these elements to be located significantly further from the launch facility.

In respect of the infrastructure site, a pipeline for water supply between the selected sites and launch pads would be required, resulting in impacts from the construction of an underground or surface pipeline. The pipeline would potentially have to traverse other freehold land or public land and would then have to be routed through the subject allotment to the launch sites. The additional transport movements external to the site would result in additional impacts on the local road network and additional amenity impacts through increased vehicle movement. Furthermore, clearance of vegetation would be required to accommodate the pipeline and its construction. The inefficiencies resulting from the infrastructure site being located remote to the launch sites would be significant and would adversely impact the viability of the Project.

In respect to the range control facility, a remote location would not preclude the need for a facility adjacent the entrance to the site to provide suitable security and a barrier to site entry during critical launch periods. It is considered that the reduction in footprint resulting from the range control facility being located remotely would be limited by this ongoing requirement for a different built form element adjacent the site entrance.

Noting that the subject allotment has a Heritage Agreement which has existing areas of the site excluded, consideration was given to the extent to which existing excluded areas of the Heritage Agreement could be utilised. As the Heritage Agreement has been registered on the Certificate of Title for an extended period, the basis for the location of excluded areas is not fully understood. Whilst some of the excluded areas are logical and align with areas of the site which are degraded and have existing infrastructure, other areas are in the middle of the site on land covered by high-quality vegetation.

Following careful consideration, it was determined that seeking to utilise the existing excluded areas to a greater degree would not result in less impact as:

- a number of the existing excluded areas are covered by high quality vegetation;
- a number of the existing areas have no existing road access and would generate a requirement for additional clearance to create access roadways; and
- the existing excluded areas do not align with the configuration and orientation requirements, particularly of the launch sites.

In summary, it is considered that the site design process, which has been substantially informed by the ecological assessment of the site, has been appropriately refined to minimise the footprint and impacts to the maximum extent that is reasonably possible, having regard to the operational and design requirements of the proposal. It is not considered that an alternative site configuration which retains viability of the proposal can be reasonably achieved.

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3 PROJECT SITE & LOCALITY

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3.0 PROJECT SITE AND LOCALITY

This section describes the legal, physical, and environmental characteristics of the site, and describes the locality within which the site is situated.

For the purpose of clarity, the following terminology is used within this section and the report generally in reference to the subject land:

- the subject allotment – refers to the entirety of Allotment 101 in Deposited Plan 71437, including those areas outside of the influence of the WWOLC and the licence/lease agreements;
- the Project Site – refers to those portions of the subject allotment that are affected by the proposal and contained within the licence/lease agreements area; and
- the development/project footprint – refers collectively to all portions of the land subject to development and/or use, and include Launch Site A, Launch Site B, Infrastructure Site D, and Range Control Site E, and connecting roads and infrastructure.

References to each of the individual sites are clearly expressed using their respective titles, these being Launch Site A, Launch Site B, Infrastructure Site D, and Range Control Site E, as identified in the Site Plan – Development Concept depicted in **Figure 3.4**.

3.1 Project Site

The Project Site is located within the allotment on which the WWOLC is proposed to be located. The nature of the proposal means that only a very small proportion of the land on which the Project is developed will form the footprint of the physical project. The overwhelming majority of the land will remain undisturbed by the development of the WWOLC.

The WWOLC is proposed to be located at Sleaford, South Australia at the southern tip of the Eyre Peninsula in the area and on land locally known as 'Whalers Way'. The site is approximately 25 kilometres south-west of Port Lincoln.

Access to the site from Port Lincoln follows Proper Bay Road, Fishery Bay Road to Right Whale Road before entering the site.

The WWOLC is proposed to be undertaken on a portion of a freehold allotment formally described as Allotment 101 in Filed Plan 71437 Hundred of Sleaford and is the whole of the land described in Certificate of Title Volume 5993 Folio 374 ('the subject allotment').

A copy of the Certificate of Title Register Search for the subject allotment is contained in **Appendix I**.

A copy of Deposited Plan 71437 is contained in **Appendix J**.

The registered proprietor of the allotment is Theakstone Property Pty Ltd.

Southern Launch have entered into a Commercial Access License ('the License') with Theakstone Property Pty Ltd for specified purposes associated with the Southern Launch proposal. The License affords Southern Launch a Lease Option over the land and has been secured by a caveat over the land specifically dealing number 13272854 listed on the Certificate of Title under the Schedule of Dealings.

A copy of the caveat is contained in **Appendix K**.

The Project Site and the allotment in which it is located is shown on the Site Plan (**Figure 3.1**).

The relationship of the Project Site and allotment in which it is located to the other allotments in the immediate vicinity is shown on the Site Plan – Allotment Identification Plan in (**Figure 3.2**).

FIGURE 3.1

SITE PLAN

SOURCE: MASTERPLAN

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Subject Allotment
Council Boundary
Key Road Link

1	A101	D71437
2	S535	H510900
3	A1	D68673
4	A116	D84975
5	S519	H51900
6	A116	D84975
7	A102	D71437
8	A10	D66185
9	A51	D36683
10	A63	D79767
11	A5	D72567
12	A64	D79767

FIGURE 3.2

ALLOTMENT IDENTIFICATION PLAN

SOURCE: MASTERPLAN

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The subject allotment has an area of approximately 2,640 hectares and is accessed via Right Whale Road with the site and development footprint of the proposed orbital launch complex contained within a portion of the allotment having an area of approximately 1,200 hectares, located below the -34.923-degree line of latitude.

It should be noted the site does not include the Cape Willes radio station located in the south-eastern extent of the allotment.

The Project Site is also subject to a Heritage Agreement pursuant to the *South Australian Heritage Act, 1978*, registered on the Certificate of Title as Dealing Number 6456268 as Heritage Agreement HA 148. Under the above agreement the land is dedicated to the conservation of native vegetation and native fauna.

The Heritage Agreement, including the areas of the site excluded from the Heritage Agreement are detailed on the Site Plan – Existing Heritage Agreement in (**Figure 3.3**).

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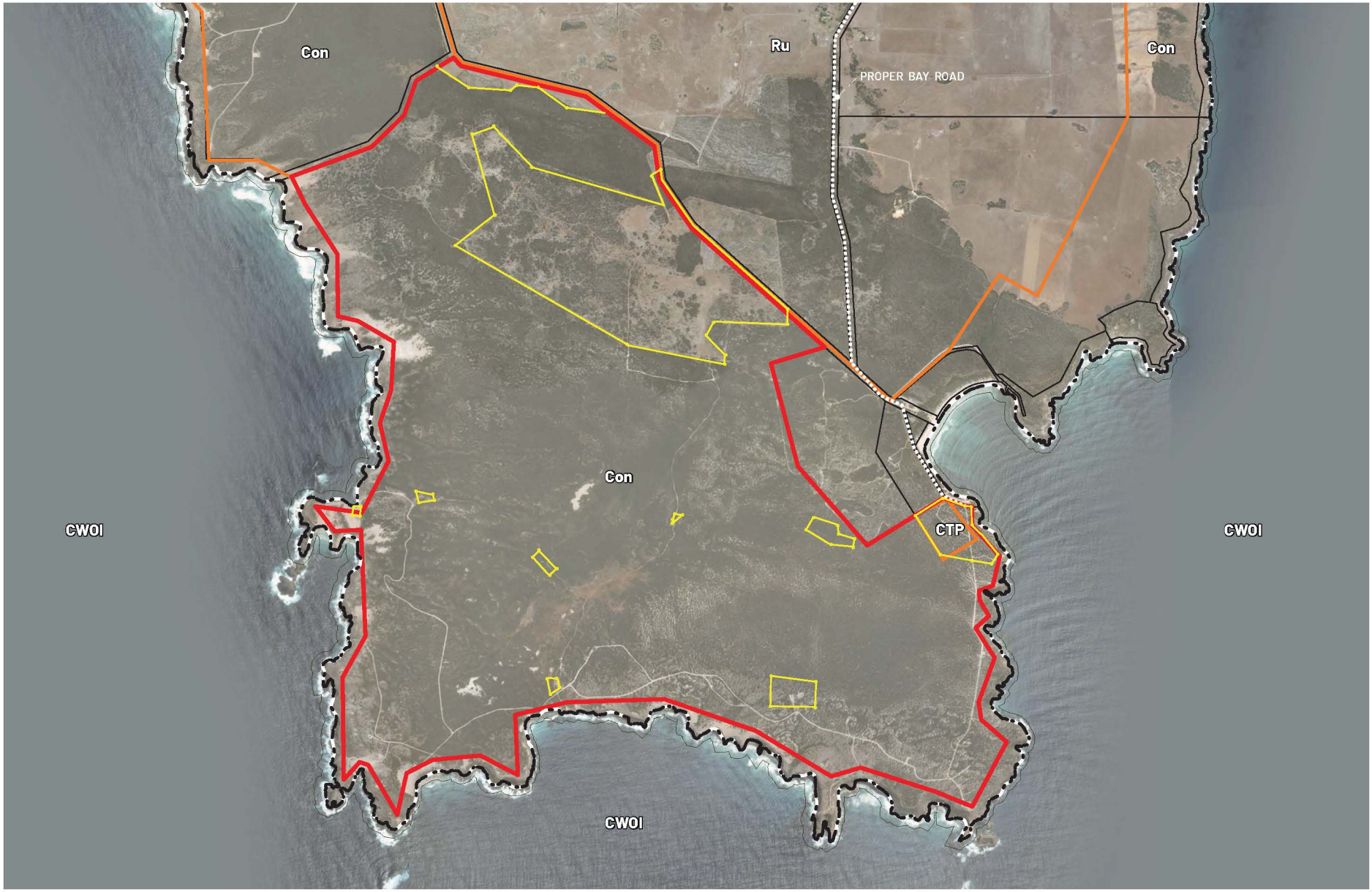

Subject Allotment
Zone Boundary
Council Boundary
Key Road Link

Con Conservation
CTP Caravan and Tourist Park
CWOI Coastal Waters and Offshore Islands
Ru Rural Dwelling

Existing Heritage Agreement Areas Excluded

FIGURE 3.3

EXISTING HERITAGE AGREEMENT

SOURCE: MASTERPLAN

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Heritage Agreement, HA 148, will require amendment to facilitate the Project.

A copy of the Heritage Agreement is contained in **Appendix L**.

The Project footprint involves the development of four (4) locations on the site together with the maintenance, upgrade and formation of existing new access roadways and a small length of new access roadway to connect those locations together and provide access.

3.2 Site Characteristics and Environment

Currently, the site is predominantly an undeveloped vegetated coastal area, punctuated by access tracks, open areas including car parking and picnic/camping areas together with supporting infrastructure such as tables, bins, signage, and fencing. Some of the main tracks are accessible by two-wheel-drive vehicles during good weather; however, the majority of the lower older roadways and tracks are only accessible to four-wheel-drive vehicles, with some only being accessible in good weather conditions.

Around the majority of the site, the coastal interface is in the form of cliffs of varying heights and rocky outcrops, with a few areas also having coved beaches. The nature of the coastal interface means that the majority of the coastline and adjacent areas is located in the adjacent coastal reserve, contained in Allotment 102, rather than the subject allotment.

The remnant vegetation on the site varies in form primarily based on the distance from the coastline and the nature of the ground conditions. Some areas appear to have been historically cleared, with varying degrees of regrowth evident. The use of the land for recreational and tourism purposes, including camping, is evident, with areas where vehicle access is resulting, or has resulted in degradation, and areas which accumulated rubbish is evident.

The character of the land could be summarised as a largely undeveloped vegetated coastal area, with a material degree of human modification to support access and passive recreational uses which have occurred over many years.

While the coastline surrounding the site is not located within the subject allotment, there is no access barriers between the subject allotment and the surrounding coastal reserve. In practical terms, the only manner in which the majority of the surrounding coastal reserve can be accessed is via the subject allotment or by sea.

The coastline surrounding the subject allotment is variable and includes coastal cliffs and ledges around much of the site, together with a number of bays and beaches. Much of the coastline is significantly exposed and is the subject of highly dynamic coastal activity.

3.3 Previous Site Development

Built form development on the site is limited, and principally involves structures associated with the historic tourist and recreational uses of the site.

Built form and site infrastructure includes (but is not limited to):

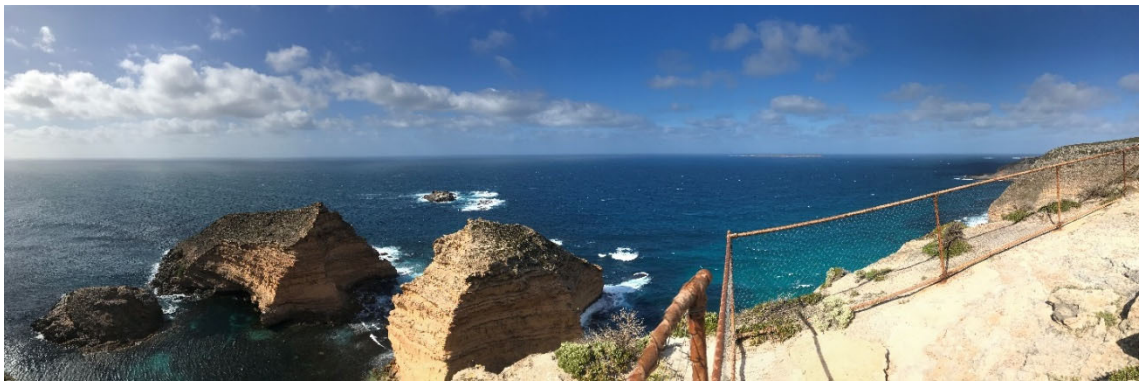
- the building at the site entrance;
- signage – directional and interpretive;
- fencing – notably in certain 'cliff edge' locations;
- toilets;
- rubbish bins;
- tables and seating;
- windmill, pump, and tank infrastructure;
- water piping; and
- a monument.

Much of the infrastructure on the site appears to have been developed many years ago, and conditions of buildings and infrastructure range from fair to poor. The condition of a number of the buildings, including ablutions is marginal as to whether they remain fit-for-purpose and safe.

The Cape Wiles HF Ocean Radar Site is located on the top of cliffs in the south-eastern corner of the site. The ocean radar acquires data related to ocean conditions with a range of approximately 200 kilometres. The equipment consists of several containers and two (2) arrays of whip type antennas located across the cliffs.

Examples of buildings and infrastructure currently existing on the site are shown on the following photographs.

Photograph 3.1: Looking south to monument.



Photograph 3.2: Looking south from Cape Wiles Lookout.

Photograph 3.3: Sinkhole.

Photograph 3.4: Looking south-east from southern coastal cliffs with Cape Wiles in background.

Photograph 3.5: Looking south-west from southern costal cliffs.

Photograph 3.6: Looking west from coast cliffs south of Site B.

Photograph 3.7: Coast cliffs at south-western extent of site.

Photograph 3.8: Theakstones Crevasse at north-western extent of site.

Photograph 3.9: Example of existing signage infrastructure.

Photograph 3.10: Example of existing signage infrastructure.

Photograph 3.11: Example of existing toilet infrastructure.

Photograph 3.12: Example of existing tourist infrastructure.

Photograph 3.13: Example of existing tourist infrastructure.

Photograph 3.14: Example of existing tourist infrastructure.

Photograph 3.15: Example of existing accumulated waste.

Photograph 3.16: Example of existing accumulated waste.

Photograph 3.17: Example of existing accumulated waste.

Photograph 3.18: Example of existing accumulated waste.

Photograph 3.19: Example of existing accumulated waste.

Photograph 3.20: Example of existing infrastructure at end of life.

Photograph 3.21: Example of existing access roadway conditions.

Photograph 3.22: Example of existing access roadway conditions.

Photograph 3.23: Example of existing access roadway conditions.

Photograph 3.24: Example of existing access roadway conditions.

Photograph 3.25: Example of existing access roadway conditions.

Photograph 3.26: Example of existing access roadway conditions.

Photograph 3.27: Example of existing access roadway conditions north of Site D.

Photograph 3.28: Example of existing access roadway conditions north of Site D.

3.4 Specific Development Locations

The nature of the WWOLC means that the overwhelming majority of the allotment containing the site will not be developed and will either remain in its current condition or be rehabilitated as part of the Project.

The development of the allotment is to occur on four (4) designated sites being two (2) launch sites (Site A and B), an infrastructure site (Site D) and a range control site (Site E). Other works are associated with access roadway upgrades.

The location of the designated sites within the overall site is shown on Site Plan – Development Concept (**Figure 3.4**).

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Subject Allotment
Zone Boundary
Key Road
Lease Boundary

CTP Caravan and Tourist Park
Con Conservation
CWOI Coastal Waters annd Offshore Islands
Ru Rural

SITE A Launch Facilities
SITE B Launch Facilities
SITE D Infrastructure
SITE E Range Control

Key Site Access
Radius 3120m to Site A Launchpad
Radius 2100m to Site B Launchpad

FIGURE 3.4

SITE PLAN - DEVELOPMENT CONCEPT

SOURCE: MASTERPLAN

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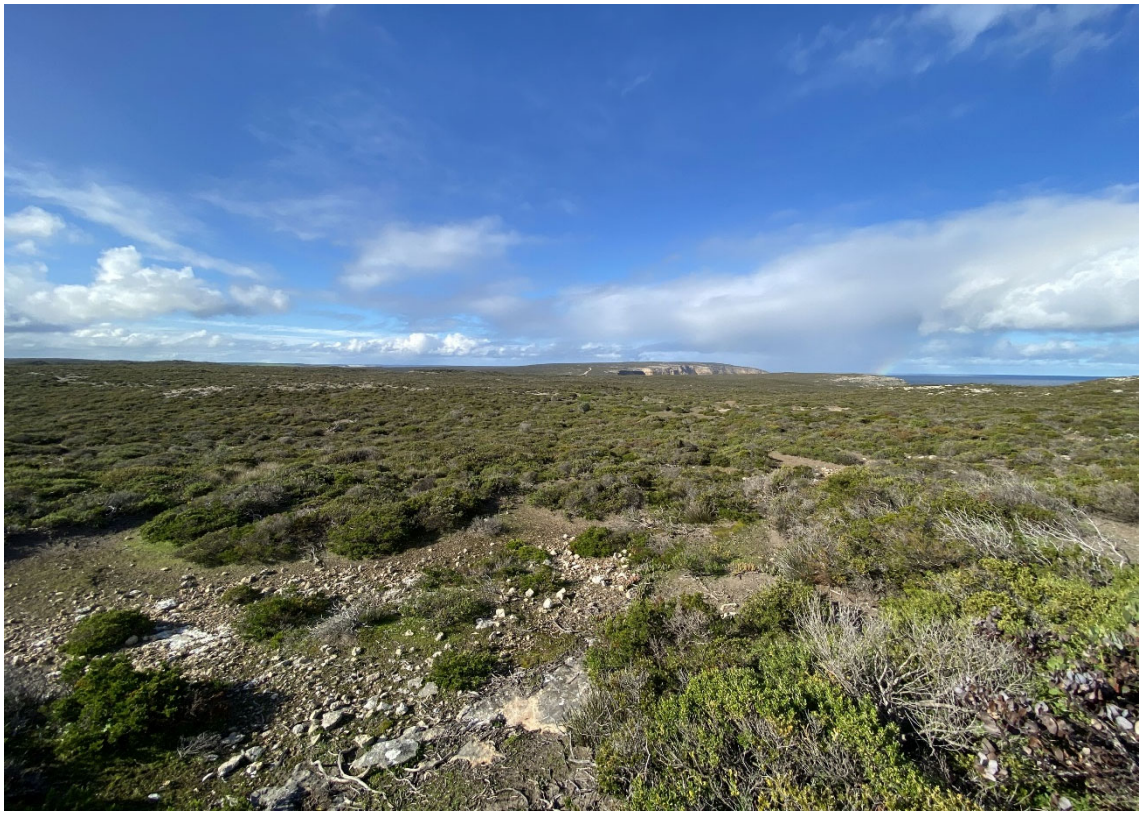
The following sub-sections provide additional descriptive and photographic detail of the four (4) designated sites.

3.4.1 Launch Site A

Launch Site A is located at towards the western end of the allotment, approximately 400 metres north of the coastline. The site is located immediately to the west of the existing access roadway that leads to the north-west extent of the subject allotment, and which currently provides access to Theakstones Crevasse.

The site is currently vegetated with typically low coastal vegetation covering a mix of sandy and rocky ground. The topography is relatively gentle with the land sloping downwards from north to south.

The following photographs detail the current conditions of Site A.



Photograph 3.29: Looking south-east across Site A.

Photograph 3.30: Looking north-west across Site A with Cathedral Rocks wind farm visible in distance.

Photograph 3.31: Looking east across Site A.

Photograph 3.32: Looking south from the southern extent of Site A.

3.4.2 Launch Site B

Launch Site B is located near the geographic centre of the Project Site approximately 350 metres from the coastline. The site is located immediately to the west of the existing access roadway that leads to the cleared area of the site where the existing bore and windmill are located.

The site is currently vegetated, with much of the vegetation being degraded. The site represents an area of the site where, and adjacent where, significant tourist and recreational activity has occurred over time. The topography of the site is relatively gentle with the land typically sloping downwards from south to north.

The following photographs detail the current conditions of Site B.

Photograph 3.33: Looking east across Site B.

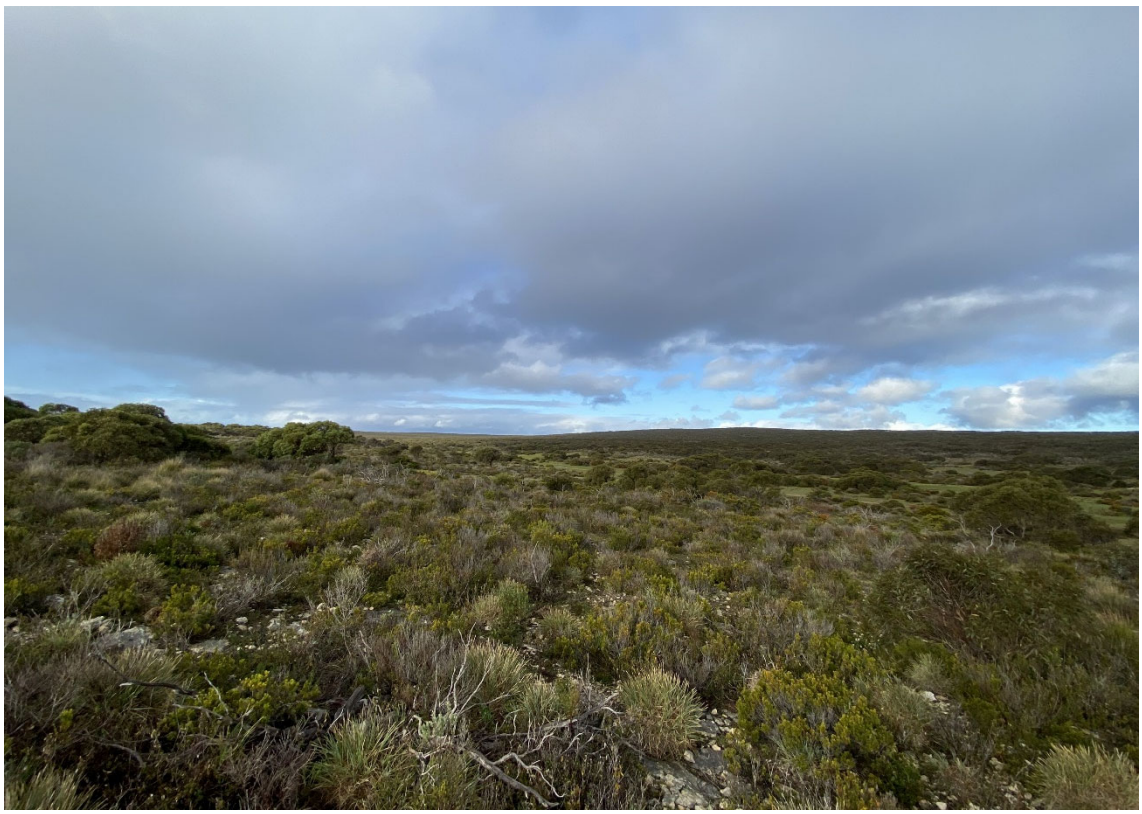
Photograph 3.34: Looking north-west from approximate centre of western boundary of Site B.

3.4.3 Infrastructure Site – Site D

The infrastructure site is located further north of Launch Site B in an open area, which is one (1) of the lowest areas of the site.

Much of the site has only low grassy vegetation. The extent and quality of vegetation increases at the fringes of the area, particularly as the elevation increases.

The following photographs detail the current conditions of Site D.



Photograph 3.35: Looking east across Site D.

Photograph 3.36: Looking north-east from approximate centre of Site D.

Photograph 3.37: Existing bore in centre of Site D.

Photograph 3.38: Looking north-east from southern extent of Site D.

3.4.4 Range Control Site – Site E

The range control site is located at the eastern extent of the site, near the entrance from the public road.

The site is located immediately to the west of the existing access roadway in an area of low shrubby vegetation. The topography of the site is gentle, with no material gradients observed.

The following photographs detail the current conditions of Site E.

Photograph 3.39: Looking east from location of Site E.

Photograph 3.40: Looking north from approximate centre of site.

3.5 Description of Locality

This section describes the nature and characteristics of the locality, including:

- existing land uses and activities;
- existing environment; and
- sensitive receptors.

The locality extends in all directions from the allotment containing the subject site and takes in land to the north and north-east and marine areas to the south, west and east including Liguanea Island, located approximately 5.0 kilometres to the south of the allotment.

The locality is defined by a range of factors, including:

- the extent of locations from which visibility of the allotment containing the site and the proposed development could be obtained;
- the extent of locations from where amenity and environmental impacts from the proposed development may occur;
- the marine areas surrounding the allotment containing the site; and
- the public roads along which access to the site will be obtained, extending back to the north towards Port Lincoln.

With the exception of the public roads, there is a close relationship between the proximity of a location within the locality to the allotment containing the site and the potential impact of the proposed development on that location.

Having regard to the extent of the locality, it is not a homogenous area, and the character of the locality is substantially different in different locations.

In broad terms, the locality transitions heading north of the subject site with an increasing proportion of cleared farmland used for a mixture of broadacre cropping and grazing, with both sheep and cattle in evidence on multiple properties. The land is gently undulating with areas only a few metres above sea level and high points to around 100 metres AHD in elevation evident.

Throughout the locality there are a range of European built form elements, including roads, infrastructure, fencing, farm buildings, water tanks, troughs and pipelines and a number of dwellings. Heading north of the site, the first 4.0 kilometres along the road towards Port Lincoln features dense roadside vegetation, which largely obscures vegetation beyond. Further north, open fields become more evident, initially punctuating roadside vegetation, and steadily becoming the predominant disposition of the land.

As the road turns east and then north again, a higher area provides views in multiple directions, over farmland to Sleaford Mere and the Lincoln Conservation Park in the east and over vegetated areas and farmland to the west. The Cathedral Rocks windfarm is a very significant visual element in the locality north of the subject allotment, due to its large scale and large number of installed wind turbines.

There is both a tension and juxtaposition between the vegetated areas and the cleared farmland and built form structures in the locality. Whilst there is a strong influence on character from the vegetation, there is no real feeling of remoteness. There is always a clear sense that human interventions on the land are in close proximity and that you remain only 30 minutes from a large city with a population of some 16,000 persons.

The level of amenity in the locality is best described as tending towards the higher end of moderate. It is positively influenced by good quality vegetation, coastal views and vistas combining the vegetated areas with sweeping vistas of the ocean, particularly from elevated locations. It is negatively influenced by primary production uses bringing the typical impacts of such uses, the limited but evident traffic movements on unsealed roads and the condition of some of the built form and infrastructure.

The extent and nature of the locality considered applicable to this assessment is shown on the Locality Plan (**Figure 3.5**).

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Subject Allotment

Key Road Link

ZONES:

Con	Conservation
CTP	Caravan and Tourist Park
CWOI	Coastal Waters and Offshore Islands
Ru	Rural
RuShs	Rural Shack Settlement Zone

FIGURE 3.5

LOCALITY PLAN

SOURCE: MASTERPLAN

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The areas comprising the locality is more specifically defined in the following terms:

- the immediate vicinity of the entrance of the allotment containing the site;
- the publicly accessible areas around Fishery Bay Beach;
- the land to the immediate north of the allotment containing the site;
- the area containing the Cathedral Rocks wind farm; and
- the road corridor leading back towards Port Lincoln.

The following photographs detail the current conditions of the locality in the vicinity of the entrance of the subject site.

Photograph 3.41: Looking east toward 'kiosk' at site entrance.

Photograph 3.42: Looking south through entrance gate on to subject site.

Photograph 3.43: Looking north from entrance to site along Right Whale Road.

Photograph 3.44: Right Whale Road, looking south back toward site entrance (out of view).

The following photographs detail the current conditions of the locality in the Fishery Bay Beach area.

Photograph 3.45: Intersection of Right Whale Road, looking south-east towards Fishery Bay Beach infrastructure.

Photograph 3.46: Fishery Bay Beach infrastructure.

Photograph 3.47: Fishery Bay Beach looking south-east.

The following photographs show the appearance of the land immediately north of the subject site:

Photograph 3.48: Looking north-east across cleared land north of subject site.

Photograph 3.49: Typical farm infrastructure and dwelling on cleared land north of subject site.

Photograph 3.50: Typical farm infrastructure and dwelling on cleared land north of subject site.

The following photograph shows the appearance of the Cathedral Rocks wind farm from the south:

Photograph 3.51: Looking north-west towards Cathedral Rocks windfarm.

The following photographs show the appearance of land further to the north east of the subject site.

Photograph 3.52: Looking south-west from elevated farmland with Cathedral Rocks windfarm in background.

Photograph 3.53: Looking south-east across elevated farmland west of Sleaford Mere.

The following photograph shows land further north on the land on the road leading back to Port Lincoln.

Photograph 3.54: Looking east across elevated farmland with Sleaford Mere and Lincoln National Park in background.

3.5.1 Land Use and Environment

The allotment containing the site, being the at the southern tip of Eyre Peninsula, is surrounded by the coast and sea to the south, east and west, and land to the north.

The locality has a very low density of human habitation with the closest habitable dwellings located to the east of the allotment containing site, being approximately 100 metres east of the shared allotment boundary.

The City of Port Lincoln is the closest settlement to the allotment containing the site situated some 25 kilometres to the north-east. The number of dwellings, typically on large primary production allotments, increases within closer proximity to Port Lincoln.

Further to the north, the areas of native vegetation give way progressively to grazing and cropping. The areas closest to the allotment containing the site display similar characteristics to that of the site including areas of remnant native vegetation, with varying levels of accessibility for recreational and tourism purposes.

The Cathedral Rocks wind farm comprising 33 wind turbines, is located on coastal land to the north-west of the site. The wind farm is the most substantial built form element in the area, with a high degree of visibility from a number of land and marine locations.

The State Heritage listed Former Fishery Bay Whaling Station is located on land abutting the north-eastern boundary of the site.

Fishery Bay Beach, located to the east of the entrance to the subject site, features toilet facilities and interpretative signage at a dedicated carpark, and enjoys significant recreational use.

The site candidate of the future desalination plant, proposed to supply water to Port Lincoln and the Eyre Peninsula, is located to the north-east of the subject site.

The following National Parks, Conservation Parks and Marine Park are located within the vicinity of the Project Area:

- Thorny Passage Marine Park located approximately 500 metres south of the Project Area.
- Sleaford Mere Conservation Park located approximately 8.0 kilometres north-east of the Project Area.
- Lincoln National Park located approximately 8.0 kilometres north-east of the Project Area.
- Lincoln Conservation Park located approximately 13 kilometres north of the Project Area.

The location of the parks is listed above shown on the Locality Plan – Parks (**Figure 3.6**).

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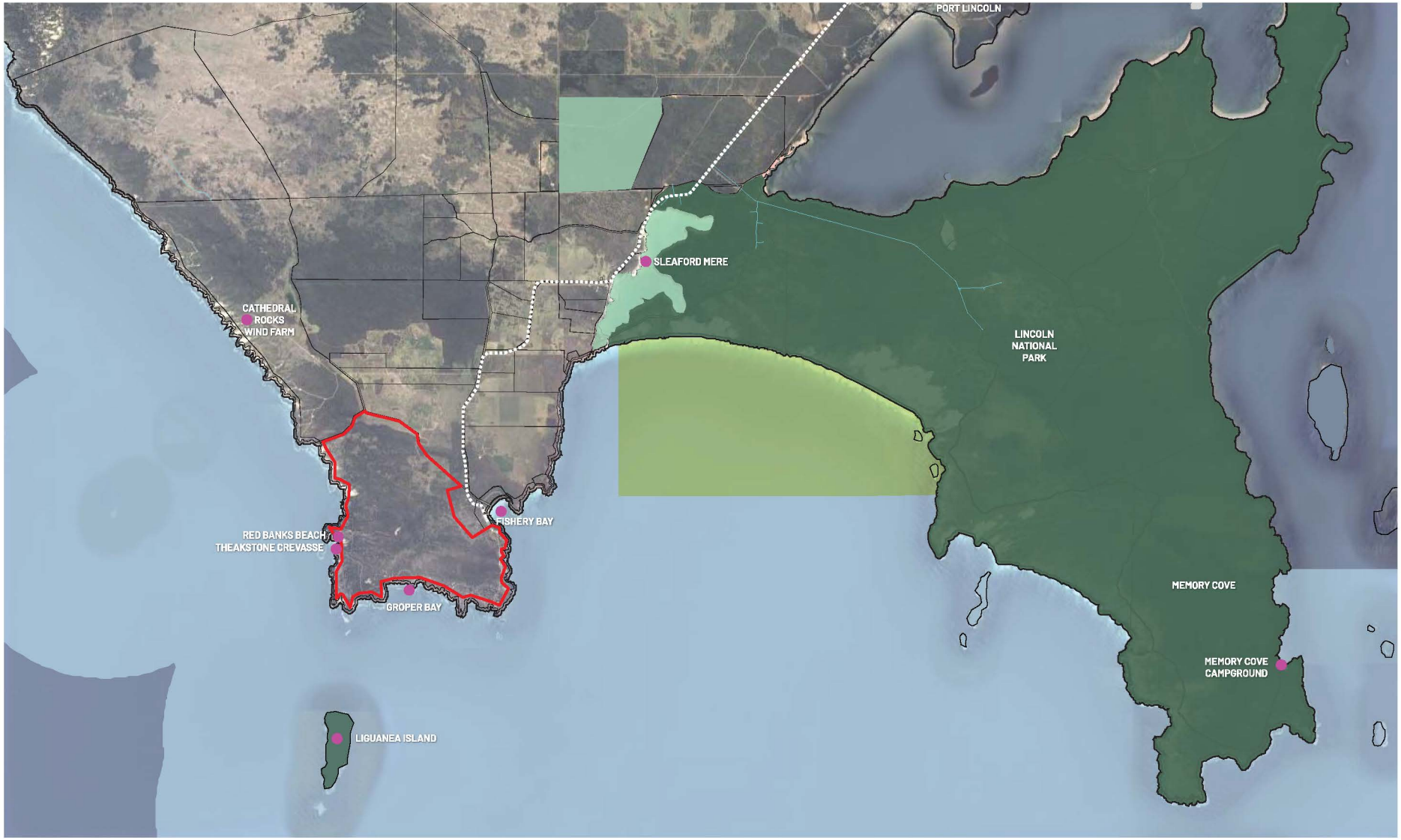

Subject Allotment
Key Road Link
National Park
Conservation Park
Sanctuary Zone
Marine Park

FIGURE 3.6

LOCALITY PLAN - PARKS

SOURCE: MASTERPLAN

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The character of the locality is influenced by the relationship to the coast, the extent of parks and the reducing extent of human impact towards the southern end of the Eyre Peninsula. The increasing extent of remnant native vegetation is evident proceeding in a southerly direction, particularly along the final few kilometres of public road before reaching the site entrance.

Notwithstanding the significant natural character, the influence of human activity on the locality remains apparent through the scattered dwellings, farm buildings, roads and tracks, infrastructure and signage. The Cathedral Rocks windfarm is a significant built form element from any location where it is visible.

The presence of infrastructure supporting the Lincoln National Park and other recreational facilities such as the Fishery Bay Beach reinforces a character of a predominantly natural environment, but one (1) within proximity of significant human settlement.

This character continues onto the site. Whilst, as described above, the character of the site is predominantly that of a vegetated, undeveloped site at the coastal margin, the extensive infrastructure and evidence of use and degradation of the subject site clearly reinforces the character of a managed natural site rather than unspoilt wilderness.

3.5.2 Sensitive Receivers

A sensitive receiver is considered to be a place that is sensitive to environmental nuisance from noise, dust, odour, light or smoke, and may include dwellings, public and community buildings, schools, commercial businesses, and parks and reserves.

The locality has a very low population density. The closest habitable dwelling is located to the east of the allotment containing the site, with two (2) dwellings being located in sites approximately 100 metres east from the boundary of the allotment containing the site.

Further dwellings are located to the north of the site, typically in the vicinity of the public road, but in most cases, set back several hundred metres from the road itself.

In considering the setback of sensitive receptors from the WWOLC facility, this is best defined as the setback from the launch sites, as these are the facilities which will generate adverse amenity impacts which have the potential to generate land use conflict with the sensitive receptors. The nearest dwelling is located over 3.0 kilometres from Launch Site B, with all other dwellings in the locality a greater distance than this. The distance of Launch Site A from the nearest dwelling is over 4.0 kilometres.

The closest urban centre is Port Lincoln approximately 25 kilometres to the north-east of the site. Port Lincoln has a population of approximately 16,000 persons. Port Lincoln is considered to be too remote from the site to be considered a sensitive receiver.

The Cathedral Rocks Wind Farm is approximately 8.0 kilometres to the north-west of the site and whilst it constitutes strategic infrastructure, it is not considered to be a sensitive receptor as the site is unoccupied.

All launches from the site will be in a southern direction, over the ocean and away from the sensitive receivers.

The Range Control Site is located approximately 300 metres away from the nearest dwelling. This site has a significantly limited potential to generate adverse amenity impacts, and for the purpose of determining appropriate setbacks is considered to constitute a use similar to that of an office building.

3.6 Zoning of Allotment Containing Subject Site and Locality

The terrestrial land in the allotment containing the subject site and the surrounding locality is located in the District Council of Lower Eyre Peninsula. The District Council of the Lower Eyre Peninsula is in Phase 2 of the rollout of the Planning and Design Code under the *Planning, Development and Infrastructure Act, 2016* with operation of the Code having commenced.

Marine areas of the Locality are located outside of Council areas and are in Phase 1 of the rollout of the Planning and Design Code under the *Planning, Development and Infrastructure Act, 2016* with operation of the Code having commenced.

Whilst the operation of the Code has commenced for all of the land forming the site and locality of the proposed development, it is noteworthy that the Project was declared, and continues to be assessed pursuant to the *Development Act, 1993*.

For this reason, this EIS considers, to the extent it is relevant to the assessment of the proposal, policy in both the last Lower Eyre Peninsula Council Development Plan – Consolidated on 12 July 2018 and policy in the Planning and Design Code.

The zones of the allotment containing the subject site under the Development Plan is shown on Site Plan – Development Plan (**Figure 3.7**).

The zones of the allotment containing the subject site under the Code is shown on the Site Plan – PD Code (**Figure 3.8**).

The sub-zones of the allotment containing the subject site under the Code is shown on the Site Plan – PD Code Sub-Zones (**Figure 3.9**).

The zones of the locality of the allotment containing the subject site under the Development Plan is shown on the Locality Plan – Development Plan (**Figure 3.10**).

The zones of the locality of the allotment containing the subject site under the Code is shown on the Locality Plan – PD Code Zones (**Figure 3.11**).

The sub-zones of the locality allotment containing the subject site under the Code is shown on the Locality Plan – PD Code Sub-Zones (**Figure 3.12**).

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Subject Allotment
Zone Boundary
Council Boundary
Key Road Link

CP	Caravan & Tourist Park
CstCon	Coastal Conservation
PrPro	Primary Production

FIGURE 3.7

SITE PLAN DEVELOPMENT PLAN

SOURCE: MASTERPLAN

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Subject Allotment
Zone Boundary
Council Boundary
Key Road Link

Con	Conservation
CTP	Caravan and Tourist Park
CWOI	Coastal Waters and Offshore Islands
Ru	Rural Dwelling

FIGURE 3.8

SITE PLAN
PD CODE ZONES
SOURCE: MASTERPLAN

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Subject Allotment
Zone Boundary
Council Boundary
Key Road Link

Dwelling Dwelling
VEx Visitor Experience
Features

FIGURE 3.9

SITE PLAN
PD CODE SUB-ZONES
SOURCE: MASTERPLAN

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Subject Allotment
Zone Boundary
Key Road Link

CP Caravan & Tourist Park
CstCon Coastal Conservation
CstSe Coastal Settlement

PrPro Primary Production
WP Water Protection
Features

FIGURE 3.10

LOCALITY DEVELOPMENT PLAN

SOURCE: MASTERPLAN

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Subject Allotment
Zone Boundary
Key Road Link

ZONES:

Con	Conservation
CTP	Caravan and Tourist Park
CWOI	Coastal Waters and Offshore Islands
Ru	Rural
RuShs	Rural Shack Settlement Zone

FIGURE 3.11

LOCALITY PD CODE ZONES

SOURCE: MASTERPLAN

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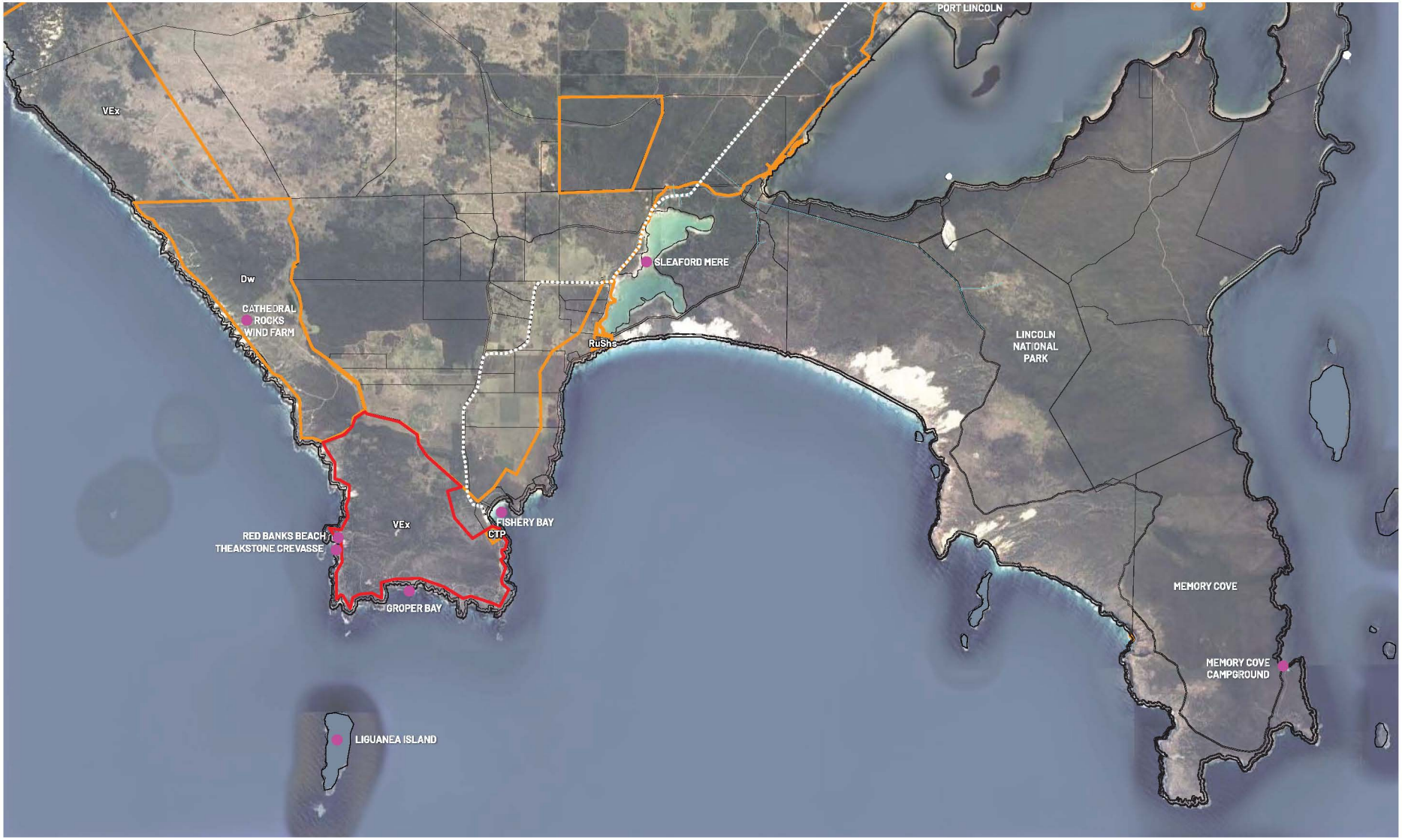

Subject Allotment

Zone Boundary

Key Road Link

SUBZONES:

Dwelling	Dwelling
RuShs	Rural Shack Settlement Zone
VEx	Visitor Experience

FIGURE 3.12

LOCALITY PD CODE SUB-ZONES

SOURCE: MASTERPLAN

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4 SITE SELECTION PROCESS

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4.0 SITE SELECTION PROCESS

4.1 Site Selection Background

Whalers Way was identified as the preferred location of the launch complex through an extensive review of potential locations across Australia, undertaken by Southern Launch.

The most critical criteria for site selection were natural geography that safeguards the public during any launch events to the south, close to a sizeable service centre for logistics support, yet remote enough to minimise any risks or hazards associated with rocket launching.

The fundamental requirement to suitable launch sites is an inability for launched vehicles to pass overpopulated land. In essence, this key constraint means that orbital launch sites need to be located in immediate proximity to the coast, without any populated land (including individual sites containing dwellings or other forms of human occupation), between the launch site and the water. Having regard to orbital launch facilities around the world, immediate proximity to open ocean is a common locational factor of almost all facilities.

On the basis of these fundamental constraints, the southern coast of South Australia, with its lack of major population centres and limited density of major air routes or maritime transportation routes to its south, provided an attractive potential locational search area for suitable launch sites.

4.2 Site Selection Criteria

The key site characteristics for an appropriate site included a suitably large area, topography suitable for the various structures and facilities required to be constructed on the land, along with the associated amenities and facilities for the workforce in a suitably configured environment. The activities on the site are required to be appropriately secured, both physically and electronically, and be supported by a range of services including but not limited to electrical, communications, mechanical, hydraulic, fire and security.

The remoteness and proximity to the coast described in the previous section needs to be balanced against the need to supply and provide a logistic connectivity to a high technology operation staffed by a highly educated and skilled workforce. Proximity to a large service centre with suitable accommodation and services are also of importance.

The site selection process was based on a weighted multi-criteria analysis, which involved review of 16 locational criteria for the proposed facility. The criteria include some which are critical and essential, delivering a binary outcome, and for which a failure to meet the criteria will immediately rule a site out of contention. Other criteria are non-binary, where a failure to meet the criteria will not necessarily rule a site out of contention but will make a site more challenging or complex.

These criteria will ultimately affect the viability of the site, particularly if it scores poorly on multiple criteria. In respect of many of the non-binary criteria, some form of mitigation may be available, however, the mitigation may also affect the viability of the site.

The 16 selection criteria analysed for each site are set out in **Table 4.1**.

Table 4.1: Location Selection Criteria

CRITERIA	DESCRIPTION
Latitude	Be between -30- and -40-degrees latitude.
Coastal	Be on the coast with unhindered open ocean due south.
Weather	Be able to support year-round rocket launches with no regular extremes of temperature.
Environment	Assessed as not having an unreasonable impact on environmental values, including threatened species.
Population	All human population needs to be a safe distance away from the proposed facility.
Workforce	An educated workforce needs to be within one (1) hour drive of the facility to help support operations.
Air Traffic Controllers	Have low commercial air traffic in the vicinity so that rocket launches can occur frequently without disruption.
Shipping Lanes	Have low commercial shipping in the vicinity so that rocket launches can occur frequently without disruption.
Large Harbour	In the close vicinity of a commercial harbour to facilitate delivery of rocket hardware and propellants via ship.
Large Airport	In the close vicinity of a commercial airport to facilitate air delivery of fragile satellites.
Existing Roads	Have suitable roads to the area and preferably through the area.
Mainland	Be connected to the Australian mainland to simplify transport and logistics.
Location Security	Be a peninsula or similar that enables the construction of only one (1) physical boundary (fence) to protect people.
Land Size	The available land must be greater than 500 hectares to facilitate at least two (2) launch pads.

CRITERIA	DESCRIPTION
Critical National Infrastructure	Not have any critical national infrastructure within the proposed launch area.
Launch Trajectories	Support launches from 60 degrees with respect to the equator out to 180 degrees.

4.3 Multi-criteria Analysis Weighting

Of the criteria set out in **Table 4.1** the following criteria are critical criteria, for which a failure to meet one (1) or more will almost always rules a site option out of contention:

- Latitude;
- Launch Trajectories;
- Coastal Access;
- Weather;
- Land Size;
- Critical National Infrastructure;
- Population; and
- Environment.

Of these criteria, latitude, launch trajectories, coastal access, weather, land size, critical national infrastructure and population are relatively easily assessed based on the location and disposition of the land, meteorological conditions and the location of existing infrastructure and population.

Environmental impact requires a more detailed assessment of individual sites. Whilst a basic understanding of environmental values can be gained from a high-level review of a site, a detailed understanding can only be gained from a more detailed ecological investigation, including on-site investigations. Accordingly, a high-level environmental assessment was developed to enable an initial assessment of environmental values to determine if site candidates could progress to further investigation being undertaken. This process made the assessment of candidates more challenging, as it meant that environmental risk could not be totally eliminated during the initial assessment process.

Of the criteria set out in **Table 4.1** the following criteria are non-critical criteria, for which a failure to meet one (1) or more will lower a site in ranking, but not necessarily rule it out of contention:

- Workforce/Population;

- Air Traffic Corridors;
- Shipping Lanes;
- Large Harbour;
- Large Airport;
- Existing Roads;
- Location Security; and
- Mainland Australia.

These criteria relate to the servicing of the site from a logistics and workforce perspective, and to the operational and security requirements of the site. It is important that the site is within commuting distance, defined as one (1) hour, from an appropriately sized service centre. Ideally such a service centre will be of a sufficient size that it has a broad range of facilities, services and skills including accommodation, banking, government, trades and general engineering, logistics, transport, health, and education. As launch operations will occur over weeks or months, proximity to a larger service centre obviates the need for the site to be self-contained in respect of its workforce and servicing. The benefit of this approach is two-fold, reducing the operational cost of the site, and thus improving its viability; and in maximising the economic impact of the proposal to the local area, versus a 'fly-in, fly-out' operational arrangement.

4.4 Broad Site Selection

The broad site selection process began by overlaying the critical constraints on the whole of the Australian continental land mass.

Queensland and Northern Territory was immediately excluded as a launch trajectory to the north to service polar orbits would overfly neighbouring countries such as Indonesia, Papua New Guinea or the Solomon Islands.

Tasmania was immediately excluded due to not being contiguous with the mainland, not having a large (1million+ population centre) and the majority of its south facing coastline being south of -40 degrees latitude.

Kangaroo Island was not immediately excluded given its proximity to Adelaide, frequent ferry services and extent of southern coastline with low population density; however, was considered likely to be marginal based on limited airport facilities and its limited population and services.

Subsequently, two (2) criteria were applied to the mainland, occluded areas, and remote areas. The application of these criteria is detailed on Site Selection – Constraints (**Figure 4.1**).

OPTIONS

OCCLUDED

REMOTE

FIGURE 4.1

SITE SELECTION CONSTRAINTS

SOURCE: MASTERPLAN

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4.4.1 Occluded Areas

Occluded areas are those where the launch trajectories are too limited to provide for a viable operation. Typically, this is due to a populated land mass being located under the trajectory of the launch vehicle following launch.

Having regard to mainland Australia, and moving from east to west, consideration was given to coastal land beginning at the Queensland/NSW border. The majority of the east coast was deemed unsuitable due to launch trajectories to the south being impacted, either by New Zealand or by mainland Australia further to the south. Ultimately locations along the east coast were deemed to have such a limited arc of suitable launch trajectory to the south that they would not present a viable launch solution to customers.

Areas between Sale and Warrnambool are occluded, principally by Tasmania.

In South Australia, areas covering most of the south-east and extending up Gulf St Vincent and Spencer Gulf are occluded by land and population further south within South Australia. An area on the mid-western Eyre Peninsula is occluded by the southern tip of the Eyre Peninsula.

4.4.2 Remote Areas

Following elimination of the occluded sites, consideration was given to the remaining areas of coastline to those which were too remote to be viable.

Some broader launch trajectories are available in the vicinity of the NSW/Victoria border, extending as far west as Sale. Areas evaluated further east of Sale, extending to the south coast of New South Wales were considered to be too remote to large population centres, infrastructure and airports.

Further to the west, areas extending across the Nullarbor Plain from a location around 150 kilometres west of Ceduna to a location around 150 kilometres east of Albany were considered to be too remote on the basis that they were a considerable distance from large population centres and had very limited infrastructure and airport access.

4.5 Site Candidates Identified

The broad analysis described above resulted in five (5) discrete areas remaining as search areas for suitable site options, as follows:

- Sale, Victoria;
- South-east South Australia/Western Victoria;
- Southern Eyre Peninsula, South Australia;
- Western Eyre Peninsula/West Coast, South Australia; and
- Albany, Western Australia.

A more granular search was undertaken in each of these locations to identify specific site candidates. The more granular process involved looking at remote sensing data of land adjacent the coast to identify sites which met suitable buffer distances from populated land, including dwellings and land and buildings with other human occupation. Also surveyed were existing transport connections to sites to consider existing levels of accessibility.

Ultimately, the search process turned up only a very small number of candidates. The vast majority of land would fail and be eliminated for one (1) of two (2) reasons:

- As a single dwelling or other human occupation of land would remove land from being a suitable candidate. Even in areas with low population density, hundreds of square kilometres of land could be removed from consideration through a small number of dwellings. For many areas, existing public roads were located within several kilometres of the coast, meaning that required buffer distances could not be achieved without a need to close public roads whenever a launch was scheduled to take place.
- In areas of very low population density, there was often a significant distance, sometimes tens of kilometres of contiguous remnant vegetation between the coast and the nearest existing transport connections. These areas were typically considered unsuitable based on the impact of proposals on environmental values and the cost of constructing infrastructure to connect suitable sites to existing infrastructure and transport connections.

Following extensive search within the five (5) identified areas, a set of potential candidates was identified for further consideration:

- RAAF Base East Sale (VIC);
- Kangaroo Island (SA);
- Albany (WA);
- Cape Douglas (SA);
- Portland (VIC);
- Cape Jervis (SA);
- Ceduna (SA);
- Mid Eyre Peninsula (SA); and
- Port Lincoln (SA).

The location of the selected sites is shown on Site Selection – Candidates (**Figure 4.2**).

1	ALBANY	4	PORT LINCOLN	7	CAPE DOUGLAS
2	CEDUNA	5	KANGAROO ISLAND	8	WARRNAMBOOL
3	MID EYRE PENINSULA	6	CAPE JERVIS	9	RAAF BASE EAST SALE

FIGURE 4.2

SITE SELECTION CANDIDATES

SOURCE: MASTERPLAN

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In some cases, the candidates were specific sites, whereas in other cases they are discrete search areas comprising several potential sites.

4.6 Analysis of Site Candidates

Following the identification of the site candidates, a more detailed investigation was undertaken to review the critical criteria. Whilst the broad review looked at the critical issues (such as trajectories) in overarching detail, with the selection of specific site candidate locations, a further analysis could be undertaken to determine if critical constraints existed at a fine-grained level.

A key test in this regard was a further review of launch trajectories based on actual launch pad locations and looking at the actual location of human occupied locations including dwellings, primary production land, public roads, publicly accessible coast, and beaches.

This process rapidly resulted in the majority of the site candidates being eliminated, with the core reasons for each candidate's elimination being detailed below:

4.6.1 RAAF Base East Sale (VIC)

The East Sale search area was initially focussed on potential shared use of the RAAF base, and subsequently broadened to include areas further to the east of Sale. Further review indicated that the region is a significant population centre with high population density, extensive public road network and a significant number of dwellings in peri-urban areas.

The RAAF Base is significant national infrastructure and unsuitable for shared use.

Launch trajectories to the south are partially occluded by Tasmania, limiting range of launches available and market attractiveness of site.

The site candidate was removed from consideration due to occluded launch trajectories, critical national infrastructure, and population.

4.6.2 Kangaroo Island (SA)

As highlighted above, Kangaroo Island was retained in consideration notwithstanding it not being contiguous with mainland Australia.

Locations on the southern coastline of Kangaroo Island were reviewed. A significant proportion of the coastline was excluded on the basis of existing remnant vegetation, distance from existing transport connections. A potential site was identified on the south-eastern coast of the Dudley Peninsula.

On further review the launch trajectories of this site were limited by southern projections of Kangaroo Island further to the west and considering this limitation in the context of the various other limitations of Kangaroo Island, the site candidate was removed from consideration.

4.6.3 Albany (WA)

A site to the west of Albany, located within the West Cape Howe National Park was identified. This site is evaluated in further detail in the following section.

4.6.4 Cape Douglas (SA)

Cape Douglas in the south-east of South Australia presented a number of site candidates adjacent the coast that did not have significant remnant native vegetation. This was in contrast to the majority of search areas where significant extents of native vegetation were located immediately adjacent the coast.

On further review, the proximity of human population and a significant public road in close proximity to the coast, significantly limited the suitability of these sites. In most locations public road closures would have been required to support launches. Additional review of launch trajectories indicates that Tasmania would result in material occlusion which would limit the suitability of the site to customers.

The site candidate was removed from consideration due to a combination of population and occluded launch trajectories.

4.6.5 Portland (VIC)

Land on a peninsula west of Portland was evaluated and scored relatively highly in respect of proximity to workforce and services and limited environmental impacts. The site was more marginal in respect of population, and whilst suitable buffer distances were capable of being achieved, a relatively high population density in the broader area would have made mitigating effects on the surrounding community and achieving a suitable level of site security more difficult.

On further review of the launch trajectories, it was determined that the easterly location of the site with reference to Tasmania made the limitations on launch trajectories significant enough to make the site unviable.

The site candidate was removed from further consideration due to occluded launch trajectories.

4.6.6 Cape Jervis (SA)

The coastline between Cape Jervis and Victor Harbor was evaluated for suitability, given its proximity to Adelaide and relatively low population density for an area located so close to a capital city.

On further review, launch trajectories were substantially occluded by Kangaroo Island so as to make the site unviable.

The site candidate was removed from further consideration due to occluded launch trajectories.

4.6.7 Ceduna (SA)

A potential site was identified to the west of Ceduna and additional consideration was given to coastal areas extending approximately 150 kilometres to the west of Ceduna.

On further review, launch trajectories were substantially occluded by the southern extent of Western Australia, Kangaroo Island, Tasmania, and projections of Western Eyre Peninsula. Whilst none of these occlusions was significant enough to rule out the site, or area, as a candidate individually, when combined, they would have had a material impact on the viability of the site.

When combined with the limitations of the west coast of South Australia from a service and logistics perspective and with many of the sites containing remnant native vegetation, the site and broader area was removed from further consideration.

4.6.8 Mid Eyre Peninsula (SA)

Sites in the vicinity of Baird Bay were evaluated.

On further review, launch trajectories were substantially occluded by the southern extent of Western Australia and the southern projection of the Eyre Peninsula, so as to make the site unviable.

The site was also marginal in terms of proximity to workforce, services, and airport facilities.

The site candidate was removed from further consideration due to occluded launch trajectories.

4.6.9 Port Lincoln (SA)

The Port Lincoln search area consisted of the southern extent of the Eyre Peninsula, to the south of the city of Port Lincoln.

On detailed review of constraints, two (2) potential sites emerged, being the Lincoln National Park and the Whalers Way site.

Both of these sites are evaluated in further detail in the following section.

4.7 Comparison of Suitable Candidates

Following the detailed review, three (3) site potential site candidates remained.

- Port Lincoln (SA) – Southern Tip of Eyre Peninsula:
  - Lincoln National Park; and
  - Whalers Way.
- Albany (WA):
  - West Cape Howe National Park.

Of these three (3) sites, only the Whalers Way site is located on freehold land, with the two (2) National Park sites both being public land that is dedicated for conservation purposes.

All three (3) of the sites were considered suitable from a launch trajectory perspective, were in suitable proximity to service centres, workforce, logistics and transport facilities. It was considered that discounting environmental, ownership and public access considerations, all three (3) of the sites could present suitable candidates.

Whilst the nature of the proposed facility results in only a small portion of the site being developed for the footprint of the facility, the proposed use has a more significant impact in terms of requiring the exclusion of people from a larger area of the site in the period leading up to, and during launches. Careful consideration was given to whether it was appropriate to pursue national park sites, where the proposal would result in the exclusion of people from public land for a material proportion of the year, in addition to direct and indirect environmental impacts.

It was determined that the national park sites would not be considered further unless the Whalers Way site was specifically excluded.

4.8 Selection of Southern Eyre Peninsula Site

The Whalers Way site was a large, contiguous allotment, directly adjacent the coast, held as freehold land, located in close proximity to Port Lincoln. The site had no dwellings or other human occupied facilities located on it and the closest dwellings were located an appropriate distance away to allow suitable buffer zones to launch sites to be established within the allotment.

The site was largely covered with remnant vegetation, however previous recreational uses had resulted in some degraded areas of vegetation. The site was the subject of a Heritage Agreement; however, some areas of the site were specifically excluded from the agreement.

The site was surrounded by a narrow coastal reserve, however, much of this was inaccessible cliffs and coves. Further, the overwhelming majority of the coastal reserve is only accessible from the subject site.

Preliminary environmental review indicated that the vegetation covering the site was similar in nature to that found in the Lincoln National Park. Having regard to the reasons for not further considering national park sites outlined above, the decision to preference Whalers Way over Lincoln National Park, and West Cape Howe National Park was confirmed, and Whalers Way became the prime candidate.

It is noted that whilst Whalers Way is substantially covered by remnant native vegetation, the extent of vegetation decreases heading north, with cleared farming land increasing in prevalence moving northwards.

Further consideration was given to whether a suitable site could be found to the north of Whalers Way, thereby avoiding the need to locate the facility on a site with a significant amount of remnant native vegetation.

This consideration involved mapping the constraints in the vicinity of the Whalers Way site.

The constraints are shown on Locality Plan – Constraints (**Figure 4.3**).

The constraints plan shows that to the north east and east are located a significant number of occupied dwellings, a beach accessible to the public, an area zoned for tourist accommodation and a site candidate for a proposed desalination plant. To the north-west is the Cathedral Rocks wind farm and electricity transmission infrastructure. Further north is a bore field providing water supply to the Eyre Peninsula.

Following the identification of these constraints, three (3) hypothetical sites were developed to which the buffer distance and range of launch trajectories applicable to the Whalers Way site were applied. The buffer zone and launch trajectories over land were then reviewed to determine their intersection with human occupied sites and infrastructure.

Three (3) hypothetical sites were identified:

- Immediately to the north of the Whalers Way site;
- Approximately 4.0 kilometres to the north of the Whalers Way site; and
- Approximately 1.0 kilometre north-east of the Whalers Way site.

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Subject Allotment
Zone Boundary
Key Road Link

Con Conservation
CTP Caravan and Tourist Park
CWOI Coastal Waters and Offshore Islands
Ru Rural

RuShs Rural Shack Settlement Zone
Critical Infrastructure
Public Spaces

Dwellings
State Heritage Place
Cape Willis Radio Station
Features

FIGURE 4.3

LOCALITY PLAN CONSTRAINTS

SOURCE: MASTERPLAN

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4.8.1 Hypothetical Site 1

The first hypothetical site is detailed on Locality – Constraints – Hypothetical Site 1 (**Figure 4.4**).

The buffer area and trajectories of this site intersects with the Cathedral Rocks wind farm. The trajectories and buffer also intersect the Whalers Way site, meaning that it would need to be cleared for launches.

The hypothetical site was deemed unacceptable.

4.8.2 Hypothetical Site 2

The second hypothetical site is detailed on Locality – Constraints – Hypothetical Site 2 (**Figure 4.5**).

The buffer area and trajectories of this site intersects with the Cathedral Rocks wind farm, three (3) dwellings, the Caravan and Tourist Park Zone and the Fishery Bay beach. The trajectories and buffer also intersect the Whalers Way site, meaning that it would need to be cleared for launches.

The hypothetical site was deemed unacceptable.

4.8.3 Hypothetical Site 3

The third hypothetical site is detailed on Locality – Constraints – Hypothetical Site 3 (**Figure 4.6**).

The buffer area of trajectory of this site intersects with two (2) dwellings, the Caravan and Tourist Park Zone, the Fishery Bay beach and the site candidate of the then proposed desalination plant. The trajectory and buffer also intersect the Whalers Way site, meaning that it would need to be cleared for launches.

The hypothetical site was deemed unacceptable.

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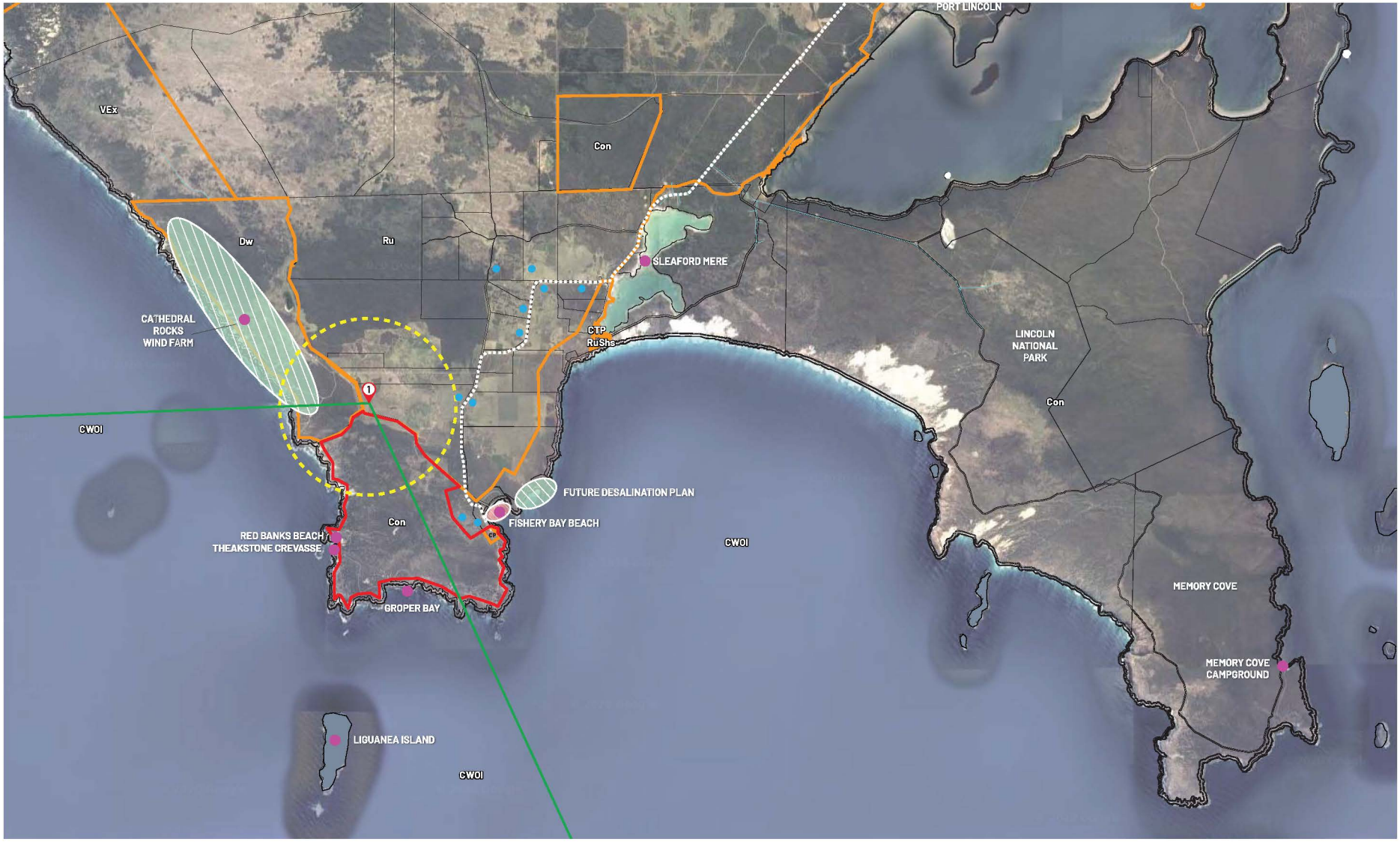

Subject Allotment
Zone Boundary
Dwellings
Key Road Link

Con Conservation
CTP Caravan and Tourist Park
CWOI Coastal Waters and Offshore Islands
Ru Rural

RuShs Rural Shack Settlement Zone
Critical Infrastructure
Public Spaces

Hypothetical Site 1
Radius 3120m to Hypothetical Site 1
Trajectory

FIGURE 4.4

LOCALITY PLAN - CONSTRAINTS HYPOTHETICAL SITE 1

SOURCE: MASTERPLAN

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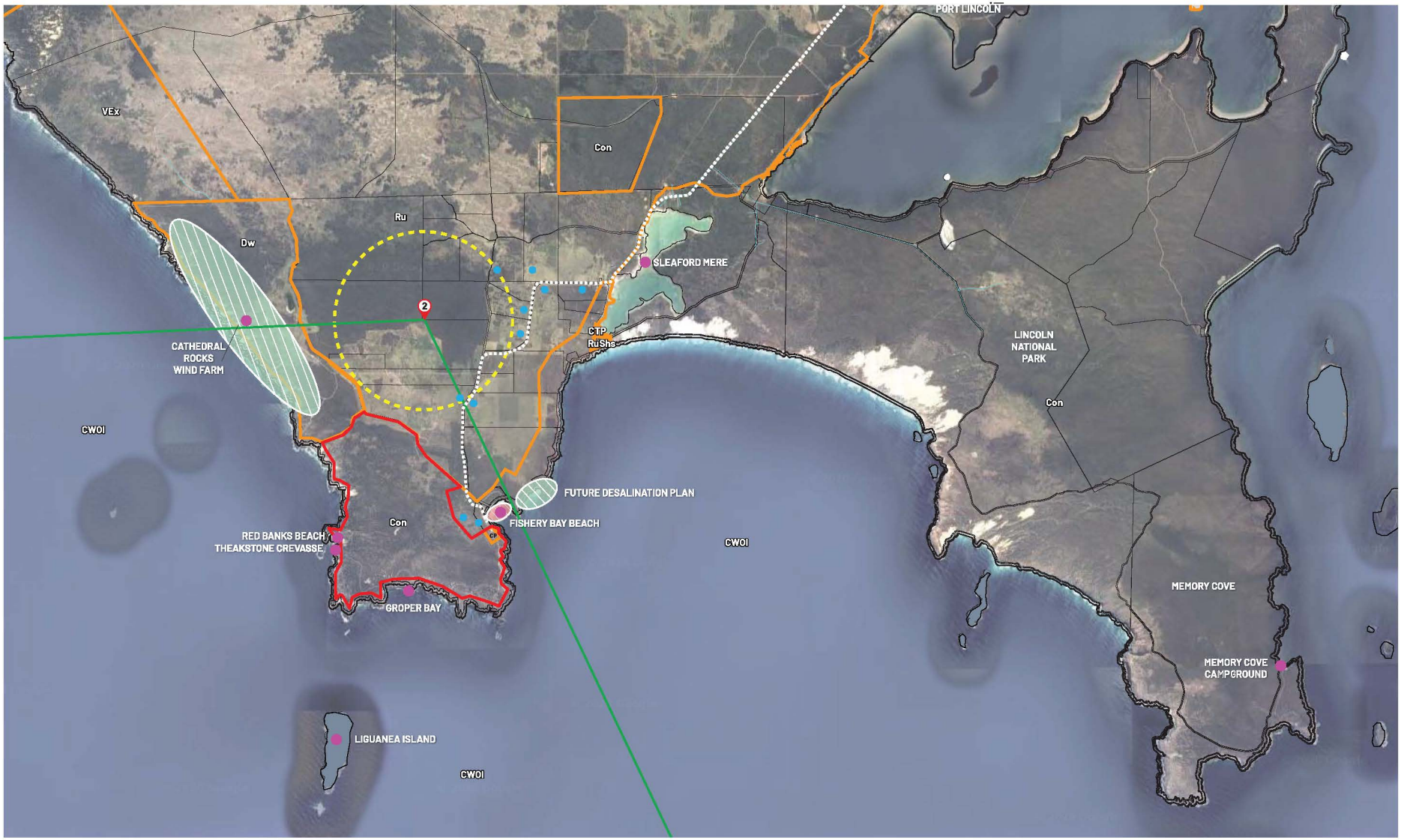

Subject Allotment
Zone Boundary
Dwellings
Key Road Link

Con Conservation
CTP Caravan and Tourist Park
CWOI Coastal Waters and Offshore Islands
Ru Rural

RuShs Rural Shack Settlement Zone
Critical Infrastructure
Public Spaces

Hypothetical Site 2
Trajectory

FIGURE 4.5

LOCALITY PLAN - CONSTRAINTS HYPOTHETICAL SITE 2

SOURCE: MASTERPLAN

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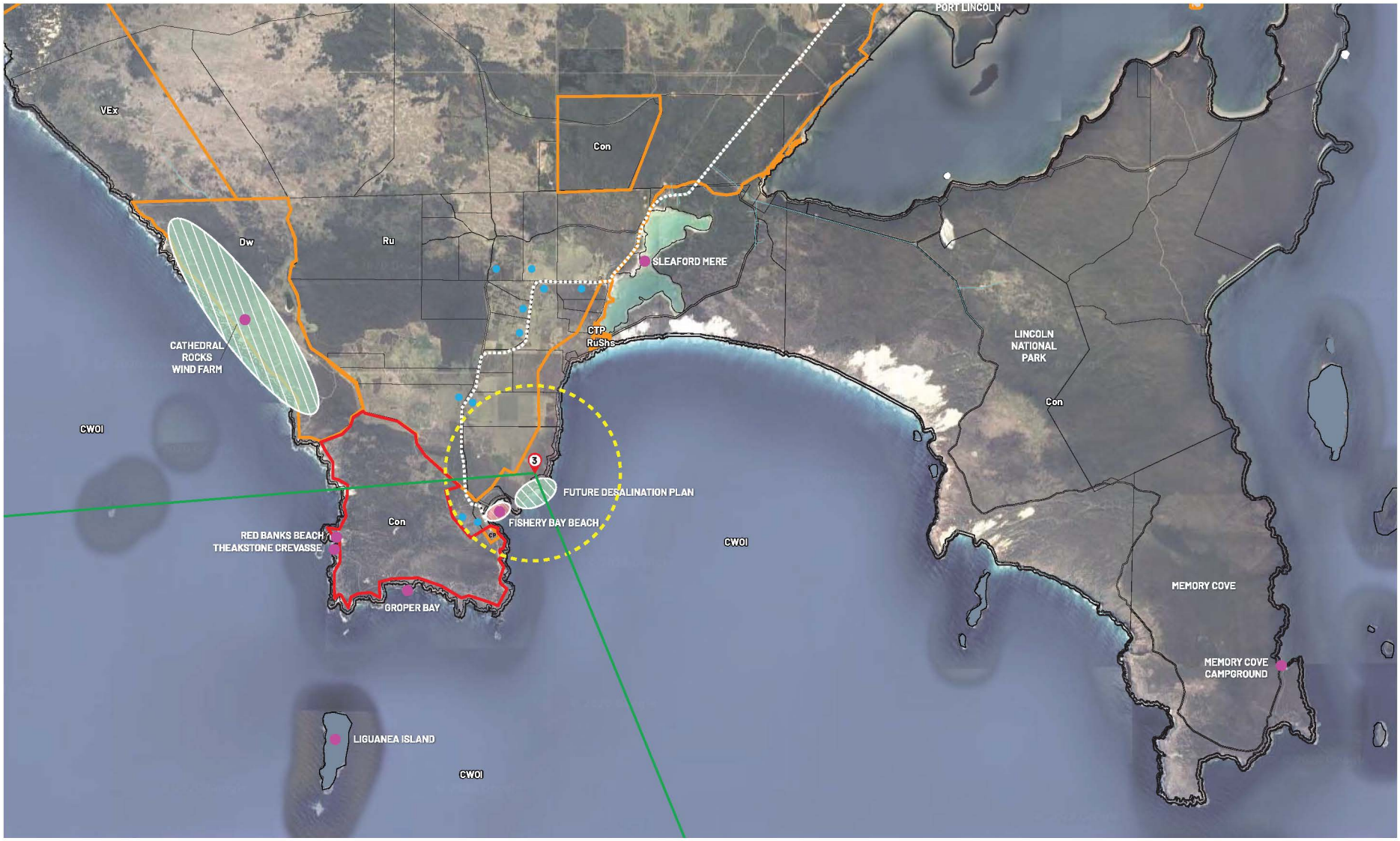

Subject Allotment
Zone Boundary
Dwellings
Key Road Link

Con Conservation
CTP Caravan and Tourist Park
CWOI Coastal Waters and Offshore Islands
Ru Rural

RuShs Rural Shack Settlement Zone
Critical Infrastructure
Public Spaces

Hypothetical Site 2
Radius 3120m to Hypothetical Site 2
Trajectory

FIGURE 4.6

LOCALITY PLAN - CONSTRAINTS HYPOTHETICAL SITE 3

SOURCE: MASTERPLAN

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4.8.4 Further Consideration of Hypothetical Sites

Further consideration was given to whether any site could be found that did not have trajectories or buffer zones which intersected the Cathedral Rocks wind farm, occupied dwellings, the Caravan and Tourist Park Zone, Fishery Bay Beach or the site candidate of the proposed desalination plant. An analysis of the required buffer distance, together with the separation between the Cathedral Rocks wind farm and the nearest dwellings indicated this was not possible without reducing the buffer zone and, therefore limiting the size and type of vehicles which could be launched.

In all cases, any site to the north would require the Whalers Way site to be cleared to enable launches to proceed. It was ultimately concluded that alternative sites on the Southern Eyre Peninsula which met selection criteria did not exist. As such, the proposed site position within Whalers Way was selected as the preferred option.

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5 PROJECT DESCRIPTION

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5.0 PROJECT DESCRIPTION

In respect of the WWOLC project, this section describes the:

- Nature of the Project.
- Location and nature of all buildings, structures, and infrastructure in relation to the key elements of the site, as follows:
  - Launch Facility A;
  - Launch Facility B;
  - Infrastructure Facility (Site D);
  - Range Control Facility (Site E); and
  - General site infrastructure.
- Construction materials and processes as relevant.
- The operational and management procedures for the activities to be undertaken on the site.
- Construction staging and timing.
- Construction management.

5.1 Project Overview

The WWOLC project is proposed to establish a multi-user rocket launch facility that will service the growing demand for the launch of domestic and international vehicles for Polar and Sun Synchronous orbit satellite insertion.

The complex will be designed to launch the latest technology 'smallsat' satellites which are typically weighted between several kilograms ('cubesat') to a maximum of several hundred kilograms. Consequently, the launch vehicles (rockets) will also be relatively small (in comparison to earlier satellite launch vehicles and heavy-lift rockets), typically being in the range of 10 to 30 metres tall.

It is expected the of operation of the WWOLC will accommodate in the order of one (1) rocket launch per two (2) months, increasing over time to one (1) rocket launch per fortnight to a maximum of 36 launches per year. Whilst several weeks of preparation will be involved in preparing for a launch, the actual launch itself, from ignition to orbit, will take approximately 45 minutes. Of this time, the launch will only result in impacts on the terrestrial site and locality for a period of up to three (3) minutes.

The WWOLC is proposed to be developed in stages over time in response to emerging market opportunities and conditions.

The current proposal represents the initial development of the complex and is the subject of this EIS. It comprises two (2) separate rocket launching sites and supporting infrastructure.

The proposed layout of the site is shown on the Site Plan – Development Concept (**Figure 5.1**).

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Subject Allotment
Zone Boundary
Key Road
Lease Boundary

CTP Caravan and Tourist Park
Con Conservation
CWOI Coastal Waters annd Offshore Islands
Ru Rural

SITE A Launch Facilities
SITE B Launch Facilities
SITE D Infrastructure
SITE E Range Control

Key Site Access
Radius 3120m to Site A Launchpad
Radius 2100m to Site B Launchpad

FIGURE 5.1

SITE PLAN DEVELOPMENT CONCEPT

SOURCE: MASTERPLAN

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The main elements of the initial development are outlined in **Table 5.1**.

Table 5.1: Project Elements.

ELEMENT	DESCRIPTION	TIMING
Launch Site – Site B	A rocket launch facility sited and designed to support small lift launch vehicles with sizes from micro to larger conventional (less than 10 tonnes up to approximately 60 tonnes).	Stage 1 - 2021
Range Control Facility – Site E	A permanent range control facility which will provide facilities for launch control, range control, security, office, administration, and visitor facilities.	Stage 2 - 2022
Infrastructure Site – Site D	Infrastructure facilities including a dam, magazine, and ancillary storage facilities.	Stage 3 – 2022/2023
Launch Site – Site A	A rocket launch facility which will predominantly be utilised for larger launch vehicles (greater than 30 tonnes to up to approximately 100 tonnes).	Stage 4 - 2023
Access Upgrades	Existing access tracks will be upgraded as required to provide appropriate, all-weather access to each of the sites. New access connections will be provided to connect the sites to the existing and upgraded access tracks.	Progressively from the commencement of the Project.
Supporting Infrastructure	• Diesel and/or Hydrogen Fuel Cell Powered Generators. • Helicopter Pad(s). • Water Tanks. • Water Capture and Treatment Systems associated with each site. • Lightning Rods. • Anemometer Towers. • Engine test stands. • Propellant (Liquid, Hybrid and Solid) Storage. • Secure Block Houses. • Blast Walls. • Bunding (for Blast Wave Deflection). • Installation of Fibre Optic and Satellite Communication Systems. • construction of internal access roads. • visitor viewing area and interpretative facilities.	Progressively from commencement of project as each launch site is developed.
Temporary facilities required during construction	• Temporary concrete batching plant. • Temporary site and construction offices and facilities. • Temporary laydown areas. • Temporary access tracks.	At the commencement of each stage of construction.

Additional non-conventional launching facilities as a component of the ultimate development of the WWOLC are currently under investigation and may be sought on the site; however, these will form subsequent phases of development and will be subject to a further application and assessment at the appropriate time. Non-conventional launch facilities do not form part of the current application considered in the EIS.

The design development of the site layout and launch sites originally provided candidates for up to six (6) launch sites having regard to key site selection criteria, including buffer distances, exclusion zones, extent of native vegetation, accessibility, and topography. Following further detailed review and investigation, the two (2) selected launch sites have been confirmed and form the proposal.

5.1.1 Proposal Plans

The physical footprint of the proposed WWOLC together with the buildings, structures, and ancillary elements it set out on proposal plans prepared by WGA and Greenway Architects.

The proposed project elements are detailed on the proposal plans contained in **Appendix M**.

The following plans comprise the proposal plan set:

Launch Sites, Infrastructure Site & Range Control

•	Overall Site Plan	DR-CC0001 Rev C	10/12/2020;
•	Site A Sheet 1 of 2	DR-CC0002 Rev B	21/08/2020;
•	Site A Sheet 2 of 2	DR-CC0003 Rev B	21/08/2020;
•	Site B Sheet 1 of 2	DR-CC0004 Rev B	21/08/2020;
•	Site B Sheet 2 of 2	DR-CC0005 Rev B	21/08/2020;
•	Site D	DR-CC0006 Rev B	21/08/2020;
•	Site E	DR-CC0007 Rev B	21/08/2020;
•	Site A – Preliminary Earthworks	DR-CC0010 Rev B	21/08/2020;
•	Site B – Preliminary Earthworks	DR-CC0011 Rev B	21/08/2020;
•	Site D – Preliminary Earthworks	DR-CC0012 Rev C	10/11/2020;
•	Site E – Preliminary Earthworks	DR-CC0013 Rev B	21/08/2020;

Access Upgrades

•	Overall Site Plan	DR-CC0100 Rev B	10/12/2020;
•	Site Plan Sheet 01	DR-CC0101 Rev A	21/08/2020;

•	Site Plan Sheet 02	DR-CC0102 Rev A	21/08/2020;
•	Site Plan Sheet 03	DR-CC0103 Rev A	21/08/2020;
•	Site Plan Sheet 04	DR-CC0104 Rev A	21/08/2020;
•	Vertical Alignment Sheet 1	DR-CC0105 Rev A	21/08/2020;
•	Vertical Alignment Sheet 2	DR-CC0106 Rev A	21/08/2020;
•	Vertical Alignment Sheet 3	DR-CC0107 Rev A	21/08/2020;

Buildings

•	Cover Sheet	A0.00 Rev 2	20/08/2020;
•	Assembly Building – Ground Floor Plan	A3.01 Rev 2	20/08/2020;
•	Assembly Building – First Floor Plan	A3.02 Rev 2	20/08/2020;
•	Assembly Building – Roof Plan	A4.01 Rev 2	20/08/2020;
•	Assembly Building – Elevations	A8.01 Rev 2	20/08/2020;
•	Assembly Building – Sections	A9.01 Rev 2	20/08/2020;
•	Assembly Building – 3D Views 1	A20.01	20/08/2020;
•	Assembly Building – 3D Views 2	A20.02	20/08/2020;
•	Water Deluge Tank – Plan & Elevation	A3.03 Rev 1	20/08/2020;
•	Maintenance Building – Floor & Roof Plan	A3.03 Rev 1	10/07/2020;
•	Maintenance Building – Elevations & Sections	A8.02 Rev 1	10/07/2020;
•	Maintenance Building – 3D View	A20.04	20/08/2020;
•	Range Control – Plan and Elevations	A3.05 Rev 2	20/08/2020;
•	Range Control – Perspectives	A9.02.2021	20/08/2020;
•	Range Control – 3D Views	A20.03	20/08/2020;

Detail of each of the elements of the Project are set out in the following sub-sections. Where details contained within proposal plans is expressed in figures in the following sections, the proposal plans in **Appendix M** prevail to the extent of any inconsistency.

5.2 Launch Sites – Site A and Site B

Two (2) launch sites are proposed containing a range of elements and structures and will provide integrated, and largely self-contained facilities for the assembly, preparation, staging and launch of the various vehicles to be launched from the WWOLC.

Each of the two (2) launch sites will contain a similar range of elements and structures, with the configuration of each varying in response to the prevailing conditions at each site, and the need for Site A to cater for larger launch vehicles than Site B.

The launch sites are essentially rectangular in shape, oriented in a generally north-south direction, with the launch pad located near the southern end of the site and the assembly building located near the northern end of the site. A dam is located adjacent the lower end of each launch site, being at the southern end of Site A and the northern end of Site B.

Each launch site has two (2) connections to the access roadways external to the sites, one (1) at the northern end and one (1) at the southern end. The locations of the access points to the sites are based on the topography of the immediate vicinity of the launch site and the proximity of access roadways external to the sites themselves.

The perimeter of each launch site will be fenced, with gates located at the access points, and additional emergency egress gates located around the perimeter. The extent of fencing will include the dam, which will also be separated by fencing from the remainder of the launch site.

Each launch site will have a clearance footprint which is larger than the site to accommodate batter slopes and enable suitable external access to the fencing and a nominal ten (10) metre width buffer beyond this. It is on this basis that the clearance envelopes for the site have been calculated. Notwithstanding the calculated clearance envelopes, these are conservative figures as the clearance required for each site will be minimised through the design and construction process, and it is likely that the final clearance envelopes can be reduced from those indicated on the proposal plans, in the EIS and the supporting technical reporting.

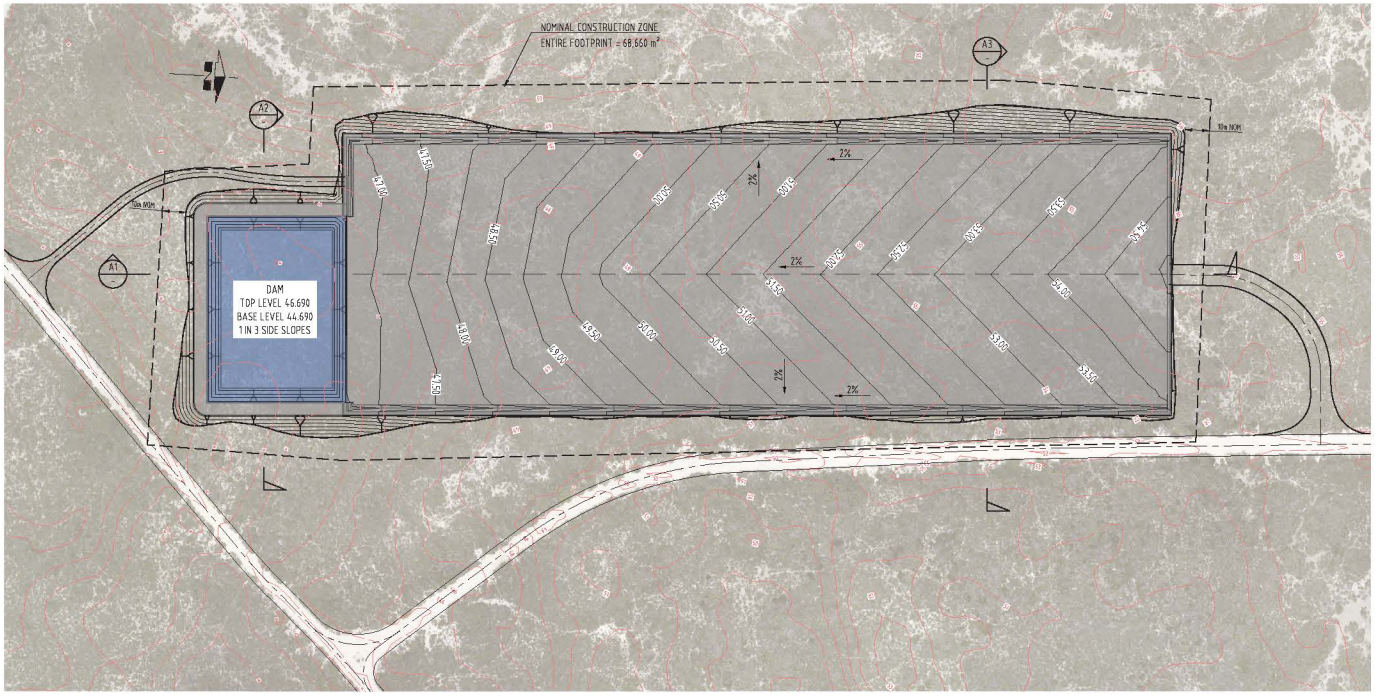
A key criterion in the selection of each of the launch sites was to ensure that the requirements for earthworks can be minimised, including the requirement for external batters to create a level area for each site.

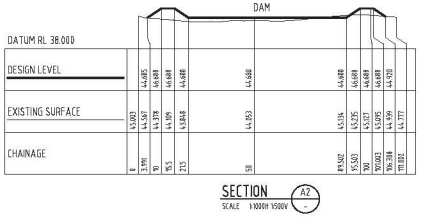
The clearance footprint of Launch Site A is shown in the Site A – Preliminary Earthworks Plan (**Figure 5.2**).

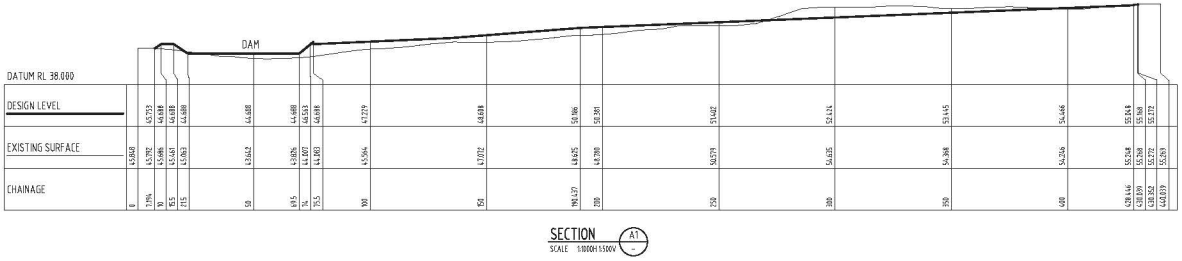
The configuration Launch Site A is shown in Site A – Configuration (**Figure 5.3**).

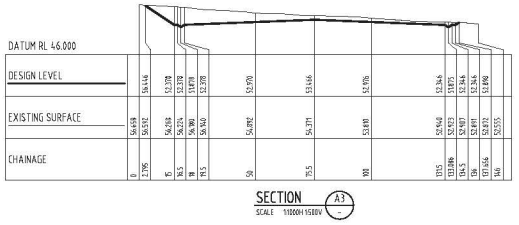
The clearance footprint of Launch Site B is shown in the Site B – Preliminary Earthworks Plan (**Figure 5.4**).

The configuration Launch Site A is shown in Site B – Configuration (**Figure 5.5**).









DESIGN VOLUME (TO FSL)		
ZONE	CUT m3	FILL m3
AREA 'A'	31883	30279

NOTE: DETENTION BASIN YET TO BE SIZED AND INCLUDED IN VOLUMES

FIGURE 5.2

CLEARANCE FOOTPRINT - SITE A

SOURCE: WGA

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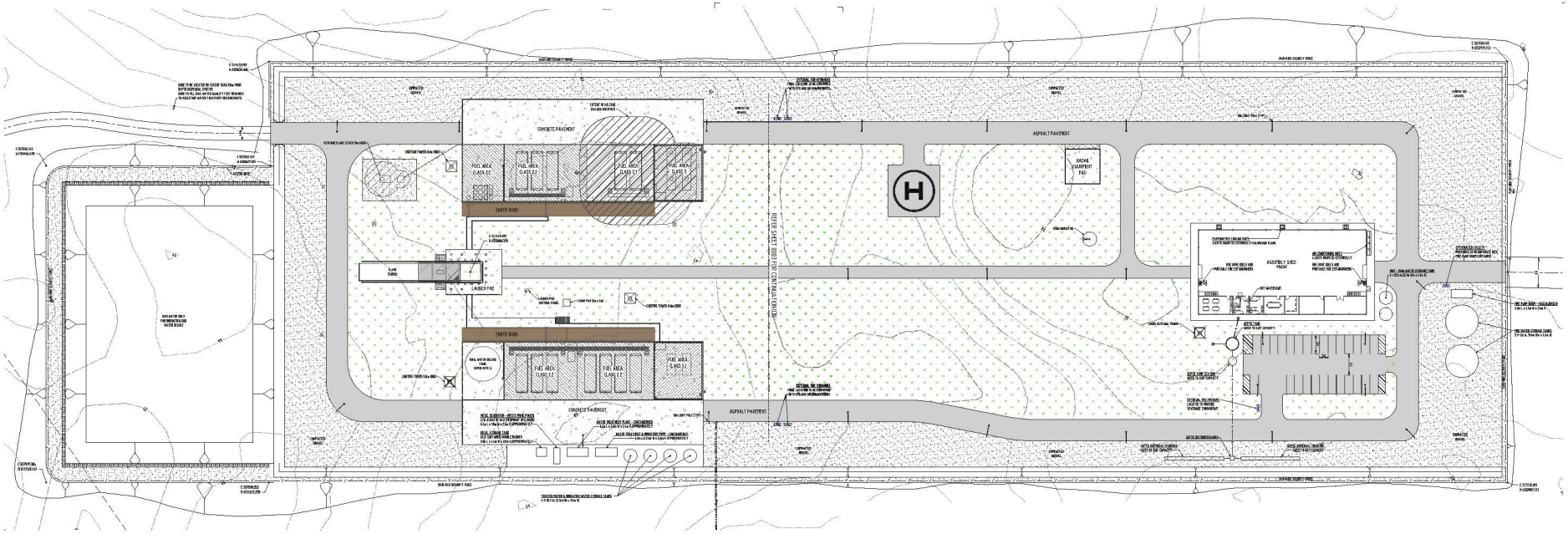

FIGURE 5.3

CONFIGURATION - SITE A

SOURCE: WGA

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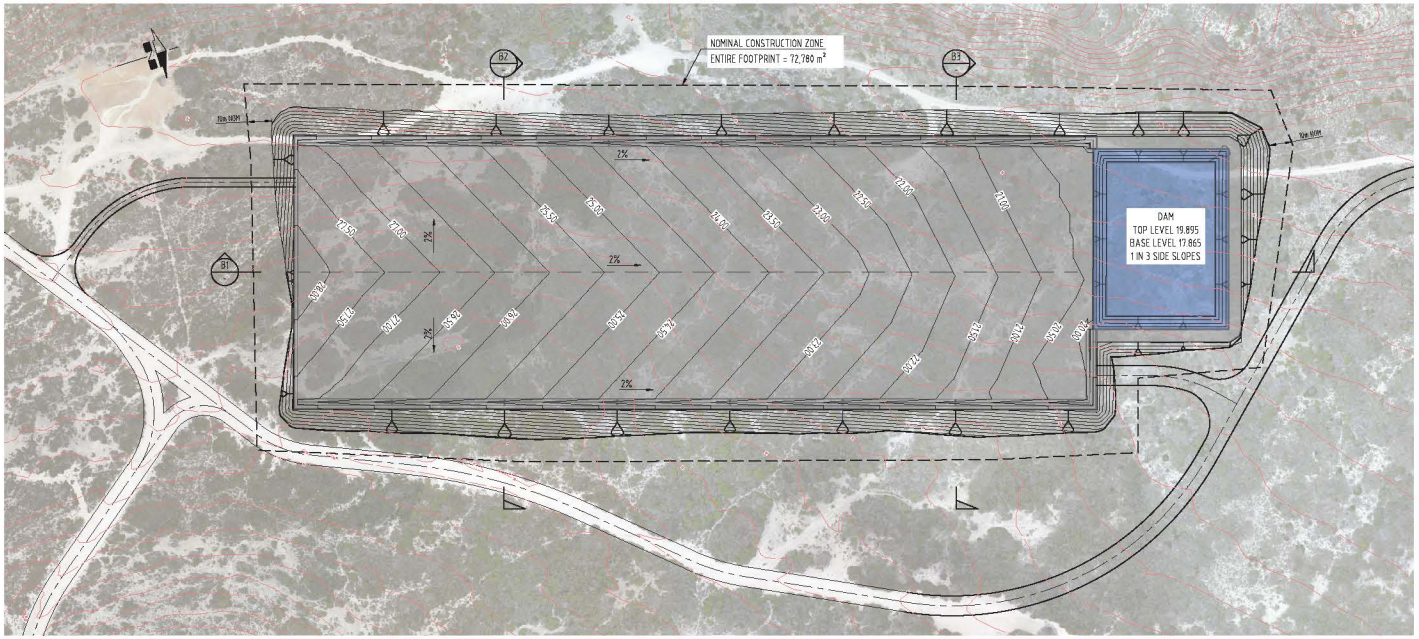
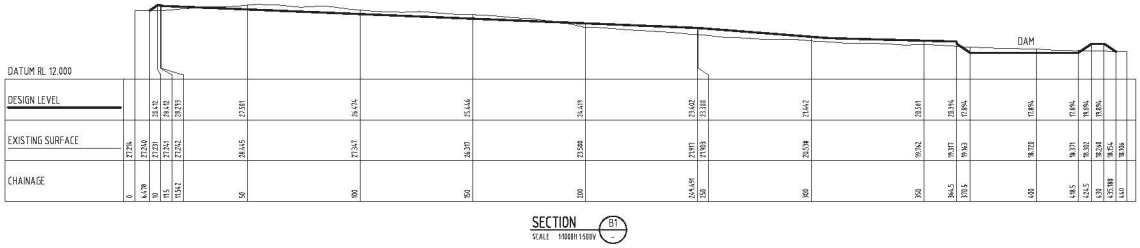
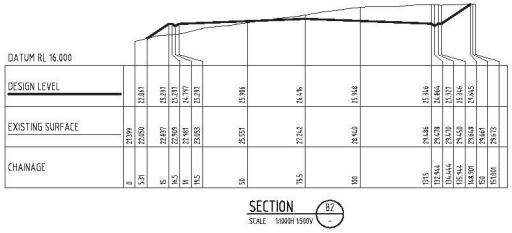




DESIGN VOLUME (TO FSL)		
ZONE	CUT m3	FILL m3
AREA 'B'	52295	52044



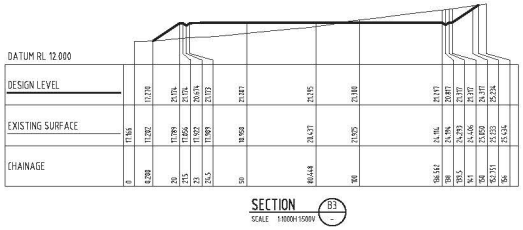


FIGURE 5.4

CLEARANCE FOOTPRINT - SITE B

SOURCE: WGA

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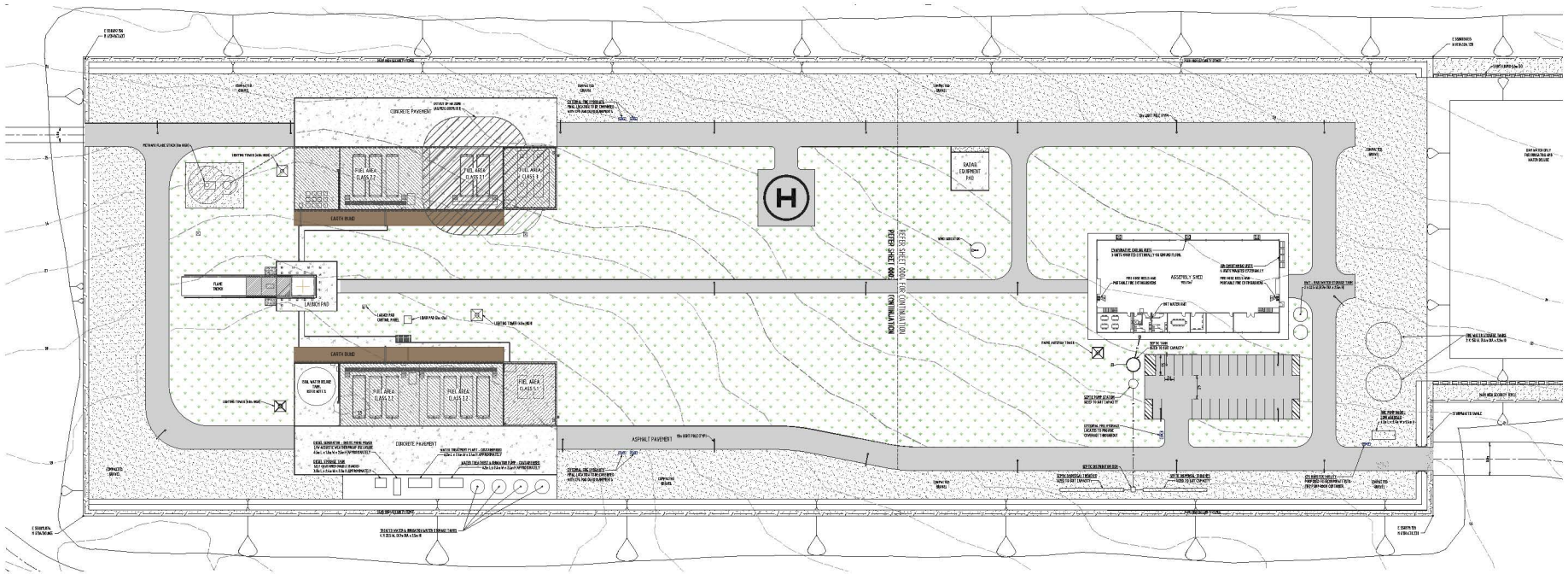

FIGURE 5.5

CONFIGURATION - SITE B

SOURCE: WGA

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The elements comprising each of the two (2) launch sites are described in the following sections.

5.2.1 Earthworks

Earthworks are required to prepare suitably level pads for each of the launch sites. These earthworks will involve cut and fill, and the importation placement and compaction of suitable material to create pads for the development of the launch facilities.

The level pad will have nominal slopes of two (2) per cent longitudinal and two (2) per cent lateral. The lateral slopes will be towards the centre of the sites, ensuring that all runoff is directed to the dam, and not allowed to enter the surrounding environment.

Batter slopes at the outer edges of the launch sites will blend the sites into the surrounding topography.

5.2.2 General Site Layout

Launch Site A is intended to cater for larger launch vehicles typically of greater than 30 tonnes up to approximately 100 tonnes.

The site is rectangular in shape measuring 350 metres by 120 metres (42,000 square metres) with an adjoining stormwater basin measuring 90 metres by 65 metres (5,850 square metres) at the downstream end of the site. The site contains a launch pad (with flame trench) at the southern end of the site and assembly building and car park at the northern end. A dam is located adjacent the southern end of the site. Nearer to and either side of the launch pad are two (2) bunded service areas containing fuel and oxidiser storage, waste tanks and diesel/hydrogen powered generator and associated fuel storage, and water treatment equipment. A helipad is located centrally and to one (1) side between the launch pad and assembly building. Access roads are proposed inside the perimeter of the site connecting all facilities and providing access to the external road system. Other infrastructure includes two (2) lighting towers, flare stack, radar pad, fire control equipment, septic tank, and pump, and launch control equipment.

Launch Site B is intended to cater for smaller launch vehicles typically of up to approximately 60 tonnes.

The site is rectangular in shape measuring 350 metres by 120 metres (42,000 square metres) with an adjoining stormwater basin measuring 90 metres by 65 metres (5,850 square metres) at the downstream end of the site. The site contains a launch pad (with flame trench) at the southern end of the site and assembly building and car park at the other end. A dam is located adjacent the northern end of the site. Nearer to and either side of the launch pad are two (2) bunded service areas containing fuel and oxidiser storage, waste tanks and diesel generator and associated fuel storage, and water treatment equipment. A helipad is located centrally and to one (1) side between the launch pad and assembly building.

Access roads are proposed inside the perimeter of the site connecting all facilities and providing access to the external road system. Other infrastructure includes two (2) lighting towers, flare stack, radar pad, fire control equipment, septic tank, and pump, and launch control equipment.

A more detailed description of the above elements follows:

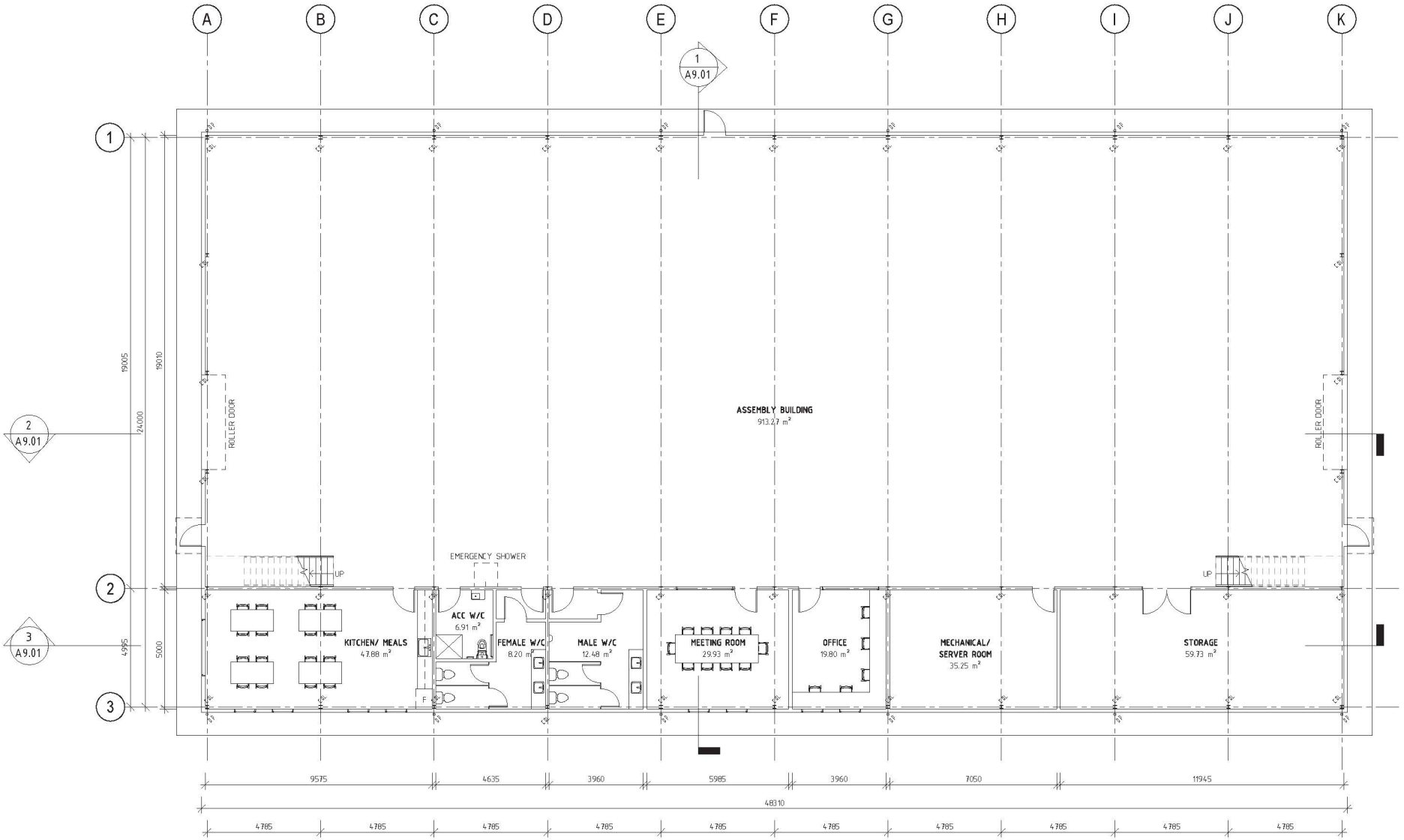
5.2.3 Assembly Building

Both Launch Site A and Launch Site B will feature an assembly building at the northern end of the site that will cater for the assembly of the launch vehicles after the transport of their components to the site.

The ground floor plan layout of the assembly buildings is shown on Assembly Buildings – Floor Plan (**Figure 5.6**).

The first-floor plan layout of the assembly buildings is shown on Assembly Buildings – First Floor Plan (**Figure 5.7**).

The elevations of the assembly buildings are shown on Assembly Building – Elevations (**Figure 5.8**).



1 GROUND FLOOR
1 : 100 at A1

FIGURE 5.6

ASSEMBLY BUILDING - GROUND FLOOR

SOURCE: GREENWAY ARCHITECTS

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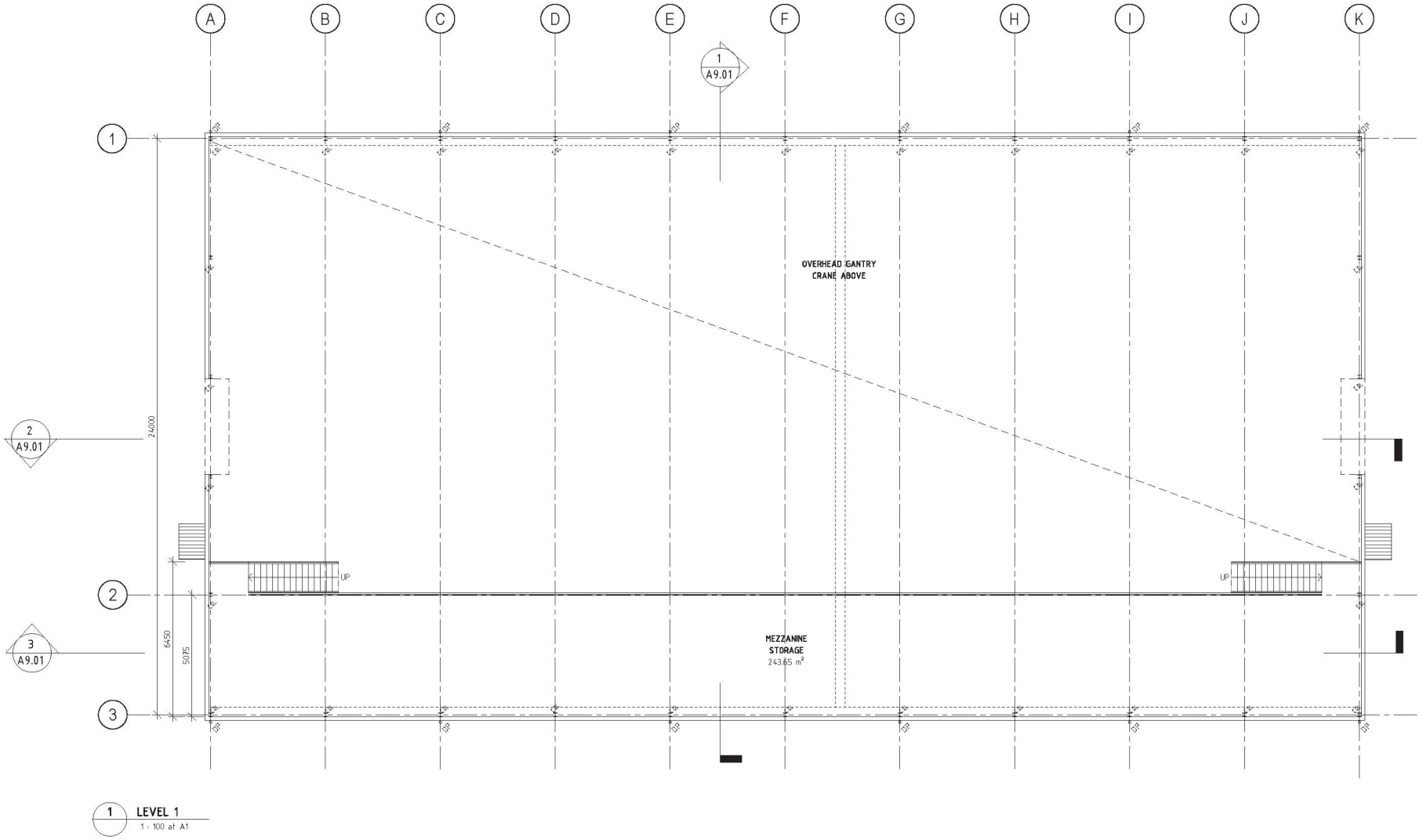

FIGURE 5.7

ASSEMBLY BUILDING - FIRST FLOOR

SOURCE: GREENWAY ARCHITECTS

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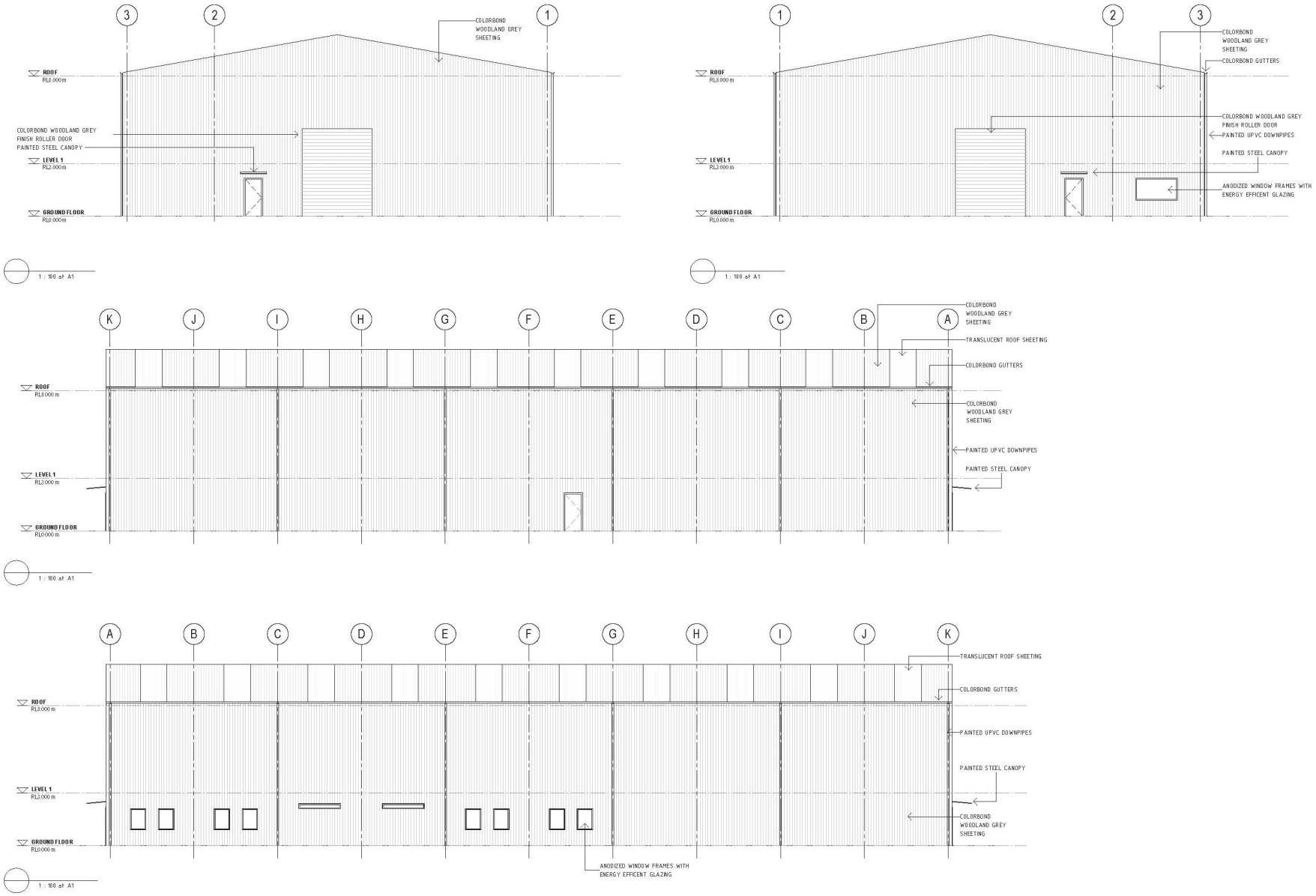

FIGURE 5.8

ASSEMBLY BUILDING - ELEVATIONS

SOURCE: GREENWAY ARCHITECTS

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The assembly buildings will be 48 metres in length and 24 metres in width with an eave height of 8.0 metres and an overall height of 11.0 metres. The buildings will have internal crane facilities and will allow the design vehicle to enter the building for internal unloading.

The bulk of the floor area of the buildings will accommodate the assembly of the launch vehicles, with internally partitioned office and amenities rooms down one (1) side. The building will have integrated facilities to allow for occupation by between 20 and 40 staff at peak periods with facilities including toilets and changing room facilities, kitchen facilities and offices.

Airconditioning and fire services will be provided. The buildings will be designed to maintain positive pressure for vehicle hygiene purposes.

5.2.4 Internal Access and Runway

The internal access, termed the 'runway' connecting the assembly building to the launch pad will be constructed in concrete and asphalt to allow for the transport of launch vehicles between the assembly building and the launch pad.

The runway will be approximately 200 metres in length and 5.0 metres in width.

5.2.5 Stormwater Capture and Detention Basin

A site stormwater system will capture and retain all stormwater on the site footprint. Water will be stored in a lined multi-function detention basin at the downstream end of the site. The detention basin will also be utilised for the storage of launch deluge water – a description of the water deluge system is provided in **Section 5.2.6**. Subject to meeting ongoing quality requirements, the basin will also provide water for irrigation and firefighting purposes.

The detention basin for Site A measures approximately 90 metres by 65 metres (5,850 square metres) with a capacity of approximately 6,380 cubic metres. The basin will have a nominal depth of 2.0 metres with 1 in 3 batter walls.

The detention basin will for Site B measures approximately 90 metres by 65 metres (5,850 square metres) with a capacity of approximately 6,380 cubic metres. The basin will have a nominal depth of 2.0 metres with 1 in 3 batter walls.

Both basins will be lined with geotextile lining and will be within the fenced enclosure of the whole launch site. The basins will also be covered with a floating geotextile cover to avoid presenting an artificial water source attractive to birds.

Upstream of each of the launch sites overland flows will either be captured and retained or intercepted and diverted around the site to the detention basin.

Captured stormwater will be utilised in the water deluge system which ameliorates acoustic impacts during the launch. The deluge system will result in significant demand for retained stormwater, through water being converted to steam during the launch process.

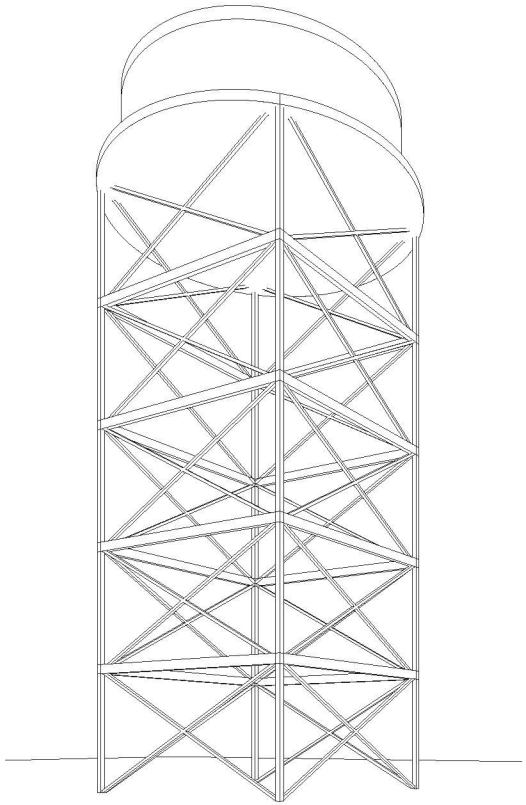
The basin will also be capable of being automatically refilled from the main dam at the infrastructure site on an as needs basis once the main dam has been developed.

5.2.6 Water Deluge System

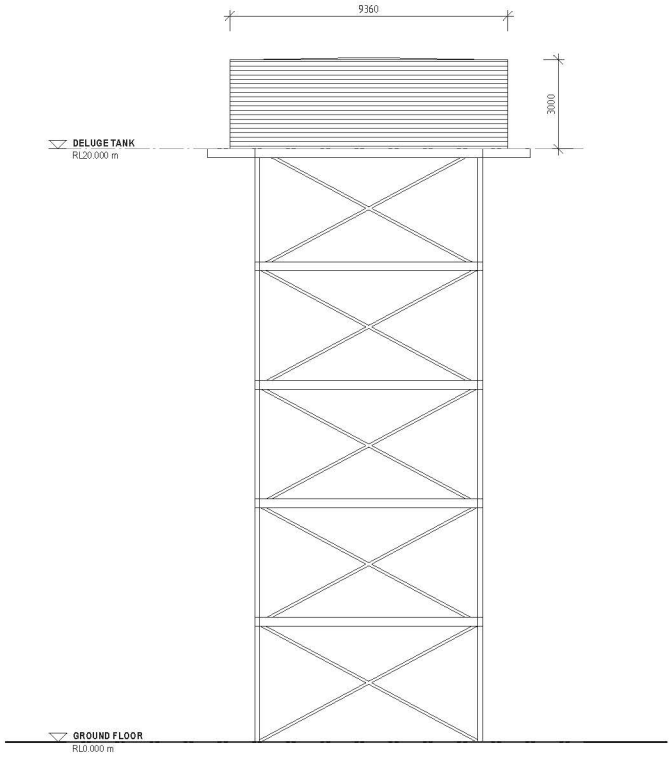
Water deluge is required to mitigate two (2) impacts resulting from a launch. Primarily, the water deluge system reduces noise effect by generating water droplets. The water droplets interact with the generated sound waves and convert them to heat energy through the water being turned to steam. The secondary impact is the heat generated by the launch vehicle. The water deluge reduces the heat impact on surrounding concrete and infrastructure, protecting it and extending its life.

The design of the water deluge system is to cater for 1,000 litres per second at 20 metres head with the water storage being in a 150,000-litre tank elevated on a 20-metre tower. Water is to be pumped into the tower over an eight-hour period prior to a launch with delivery by gravity operation.

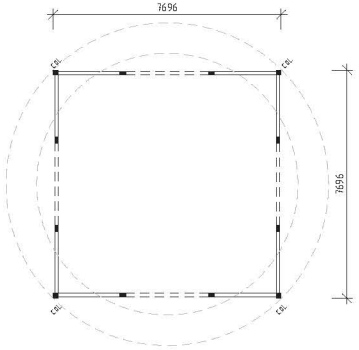
The plans and elevations of the elevated tank are shown on Water Deluge Tank (**Figure 5.9**).



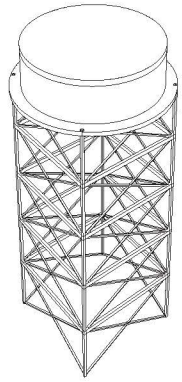
1 PERSPECTIVE AT GROUND LEVEL



2 NORTH ELEVATION



3 GROUND FLOOR
1 : 100 at A1



4 PERPSPECTIVE FROM ABOVE

FIGURE 5.9

WATER DELUGE TANK

SOURCE: GREENWAY ARCHITECTS

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The water deluge infrastructure is connected to the elevated tank and situated within the launch pad and flame trench. Infrastructure around the launch site will be in the form of a number of standing nozzles which release water in the required pattern.

The launch pad and surrounds are designed so the water generated during a launch flows into the flame trench. The water will be tested for contaminants. If the water is below required levels, it will be pumped into the detention basin. If the water tests above the required levels of contaminants it will either be treated prior to being pumped into the detention basin or it will be pumped into a truck for offsite disposal in accordance with relevant legislative requirements.

5.2.7 Launch Pad

The Launch Pad is to be constructed of reinforced concrete and will be designed to withstand the weight of a large rocket and associated support infrastructure together with enough durability to withstand the heat and thrust produced during launch. Support infrastructure includes vehicles used to transport the rocket to the pad, cranes used to lift the rocket into the vertical orientation, the "*pedestal*" upon which the rocket is seated and piping to deliver fuel and oxidiser to the rocket.

Subject to detailed construction design, the launch pad will be approximately 1.0 metre thick and could potentially require piles to counter the bending moment imposed by lifting a launch vehicle into place. Anchor bolts are to be designed and installed in the launch pad to allow for the launch pedestals to be secured in position. Those anchor bolts are to be of an appropriate size and are to be connected into the pad reinforcement to cater for the bending moment imposed by lifting a launch vehicle into place.

The launch pad will have removable sections over the flame trench. These will take the form of three (3) concrete platforms which can be craned into and out of position over the flame trench. Each platform is to be appropriately reinforced and supported by 250-millimetre-thick reinforced concrete. Each platform is to be wide enough to fit over the trench and 4.0 metres long. Each platform is to be securable in position to ensure the launch vehicle thrust does not lift it out of position.

5.2.8 Flame Trench

The flame trench will be approximately five (5) metres wide and 35 metres long. The trench will have a sump at the low point. Any liquid which remains in the flame trench after a launch needs to be collectable and able to be returned to the detention basin and not enter the surrounding environment. The water will be tested and disposed of as described in **Section 5.2.7** above. All deluge water over the launch pad will flow into the flame trench to ensure capture.

5.2.9 Launch Pad Lightning Rods

The launch site will be surrounded by up to four (4) large lightning rods, depending on analysis undertaken during detailed design. These will take the form of slender metal poles extending vertically from the ground. At roughly 35 metres tall these rods are a critical safety feature used to channel any lightning in the area away from the rocket and other infrastructure located on the launch pad, earthing it into the ground.

The rods are to be manufactured such that they can accommodate flood lights used to illuminate the pad during night operations. One (1) or more of the rods will hold an anemometer
to measure the wind speed prior to launch. The anemometer will most likely be placed atop a telescoping mast to raise the instrument to approximately 90 metres.

5.2.10 Propellant, Water Storage and Pumping

All the propellants used by the rocket during the launch will be located approximately 20 metres from the launch pad within designated storage tanks. Specially designed pumps and piping will remotely transfer the propellants from the tanks into the rocket before it is launched.

Located near the propellants will be large water tanks connected to automated firefighting equipment and the water deluge system.

A dedicated diesel generator and self-bunded diesel tank will be located within this facility and used to power the rocket during the pre-flight checks, propellant pumps during fuelling, and drive the water pumps during the launch event.

5.2.11 Blast Walls and Bunding

All of the above infrastructure will be placed behind reinforced concrete blast walls and earth bunds protecting it from any debris kicked up by the rocket exhaust or from any unexpected launch failure.

All liquid storage will occur in accordance with regulatory requirements for bunding, either in self-bunded vessels or with bunds being constructed around vessels. As a secondary level of protection, should bunding fail, runoff from the entire launch pad is directed to the retention basin, meaning that secondary failures will not extend past the basin and enter the surrounding environment.

5.2.12 Flare Stack & Cold Box

The flare stack will allow for the disposal of surplus fuels by burning off.

Surplus oxidisers will be disposed of though disposal into the cold box whereby they evaporate into the atmosphere.

The fuel and oxidiser requirements for launches can be accurately predicted, meaning the surplus quantities for disposal will be limited.

5.2.13 Utilities

Potable Water

All assembly activities associated with the proposed development are 'dry' and do not involve processes which require large quantities of potable water. Water demand will primarily be human requirements for kitchen, ablution, and hygiene purposes. The potable water demand is therefore sufficiently low that on-site capture and storage will be able to supply the majority of demand, with tanker augmentation as required.

Initially, potable water will be supplied by truck and stored on-site in tanks. To cater for up to 50 staff on site during peak periods, potable water will be stored in up to four (4) 25,000 litre water tanks located at each launch site.

Power

Power requirements for the proposed development are low. Initially, all power needs for the site will be provided by diesel or hydrogen powered generators located adjacent the fuel storage area of each launch site.

Ultimately as the entire site is developed, it is anticipated that the site will either have access to mains electricity or centralised on-site power generation with a system including solar and battery storage. Such infrastructure does not form a part of this proposal and would be subject to future assessment and approval as necessary at the time it is proposed.

Wastewater

The proposed use is not anticipated to generate large quantities of wastewater, which will predominantly derive from kitchen and ablution facilities. Site operations, other than the deluge water for the launches, the management of which is addressed separately, will have a low water demand and therefore low generation of wastewater. The site will have a package wastewater treatment system with the capacity to cater for the requirements of 50 people.

Either a soakage system or an aerobic system which irrigates onto landscaped areas of the launch site is anticipated to be used.

Fire

Initially, water for firefighting needs will be trucked in and stored in two (2) 150,000 litre tanks between the assembly building and the perimeter of the site. Fire hydrants, pumps and associated infrastructure will be distributed around the site as indicated on the site plan.

Once developed, water for firefighting needs will be supplied from retention main dam.

Irrigation

Areas surrounding the assembly building, launch pad and roadway will be landscaped with grasses and low shrubs and are to be irrigated. Native species will be utilised to minimise irrigation water demand and reduce the potential for non-indigenous species to spread into the surrounding environment.

Irrigation water will be sourced from the wastewater treatment system and supplied by the retention basin.

Lighting

Whilst the majority of launches are anticipated to occur in daylight hours, some launches will occur in low-light conditions or at night and, therefore, lighting of the launch facilities will be provided for both security and operational purposes.

The primary lighting of the launch pads will be located on top of the lightning rods.

Area lighting will also be provided from buildings and potentially towers of up to a maximum of 12 metres in height.

5.2.14 Pads – Heli, Lidar and Radar

The launch site will contain a helipad of asphalt construction and will include lighting, windsocks, and painting to the appropriate standard. The helipad provides for emergency access to the site and will not be used for regular transport and operational purposes.

The lidar and radar pads are to be concrete with access to electricity and comms. These facilities will allow for tracking of the vehicles post launch.

5.2.15 Camera Towers

Two (2) camera towers are to be 15 metres high and will provide for the capture of high-speed footage of launches for subsequent review and analysis.

5.2.16 Commercial Vehicle Access and Parking

Roads for commercial vehicles with the launch sites are to be designed to cater for vehicles sizes up to the 19 metre semi-trailer. Road widths and swept paths will meet relevant Australian Standards.

Heavy vehicle movements are expected to be very low, averaging as follows:

- Launch Vehicle Fuel delivery (three (3) per week).
- Oxidiser delivery (three (3) per week).

- Generator Fuel delivery (one (1) per week).
- Waste Pump Out (one (1) per week).
- Launch Vehicle transport to site (one (1) per week).
- Crane movements (three (3) per week).

Two (2) vehicle parking aprons for delivery vehicles, one (1) adjacent to the fuel bund and one (1) adjacent to the oxidiser bund, will be of concrete construction. The remainder of the access roads will be paved in asphalt.

5.2.17 Site Security and Fencing

The entire perimeter of the launch site including the retention basin is proposed to be fenced with 1.8 metres chain wire mesh topped with three (3) stands of barbed wire for a total height of 2.4 metres. Two (2) double gates are required for access control at the perimeter fence.

In addition, the flame trench will be separately enclosed by a 1.2 metre tubular steel edge protection fence. A portion of the edge protection fencing is required to be removable to allow the installation of a launch platform.

In addition to the physical security IP CCTV is to cover the site entrances and throughout the site. All buildings and structures will be alarmed.

5.2.18 Hard Waste

All waste is to be contained on-site in appropriate receptacles and trucked off-site by a licensed contractor in accordance with regulatory requirements.

Waste types are typical for an office structure and will include kitchen and office waste.

Waste fuels will be burnt off using the flare stack. Waste oxidisers will be disposed of in the cold box. Any materials which cannot be disposed of in the flare stack or cold box will be trucked off-site by a by a licensed contractor in accordance with regulatory requirements.

No waste will be disposed of on site.

5.2.19 Car Parking

The staff parking area is to be of asphalt construction to meet the relevant Australian Standards in respect of parking dimensions and number of disabled carparks.

A minimum of 25 parking spaces will be provided at each launch site.

5.2.20 Landscaping

Groundcover landscaping will be established over the unsealed areas of each launch site inside the access road which runs adjacent the fenced perimeter. This landscaping will be a mixture of appropriate native species with low water demand. This landscaping will function to reduce dust generation during windy conditions and stabilise the site.

The unsealed areas between the access roads and the fenced perimeter of the site will have a gravel surface which will function as a fire break between the facility and the surrounding vegetated environment.

5.3 Infrastructure Site – Site D

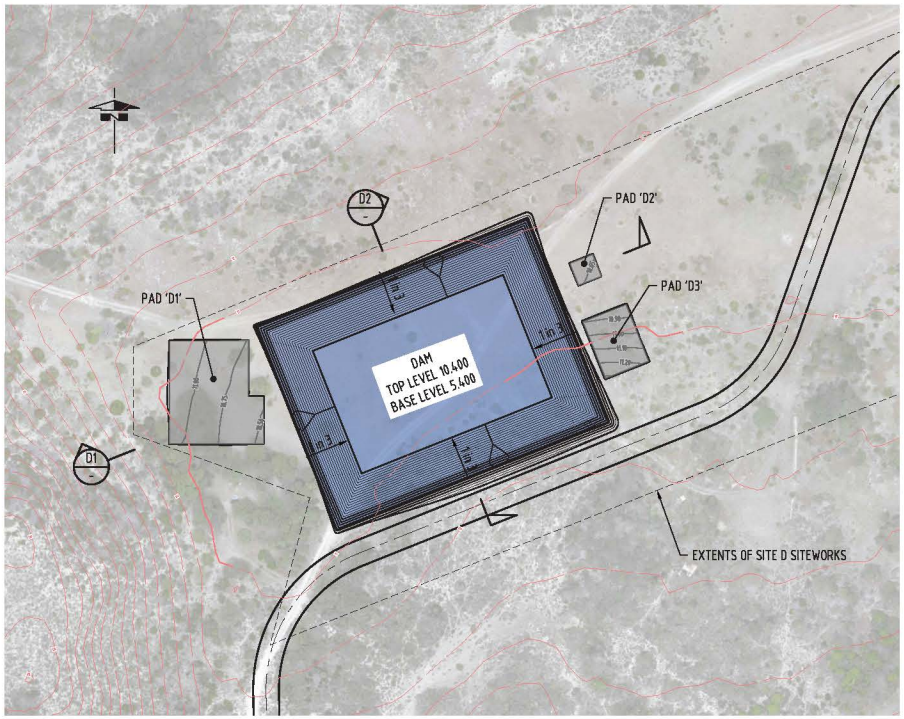
The Infrastructure Site is a construction compound proposed to accommodate activities and facilities that will support the construction and, subsequently, the on-going maintenance of the overall WWOLC facility.

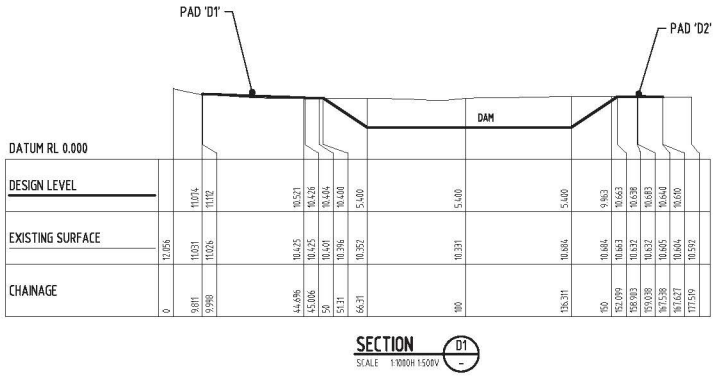
The Infrastructure Site will consist of the following:

- A quarry (to produce engineered pavement materials in the initial stage of the development), which will subsequently be converted to a water storage dam.
- Water storage dam – 30 megalitre capacity.
- Pump Station.
- Workshop/Maintenance Building.
- Provision for future Electrical Generation.
- A magazine for the storage of explosive compounds and other dangerous goods. This is in the form of a concrete pad. The storage will be in converted shipping containers or other such infrastructure which meet the required Australian Standards for explosive storage.
- The site will be enclosed by a 1.8-metre-high chain wire mesh fence topped with three (3) stands of barbed wire for a total height of 2.4 metres and a lockable double gate or as deemed necessary by the relevant regulator.

The clearance footprint of Infrastructure Site D is shown in the Site D – Preliminary Earthworks Plan (**Figure 5.10**).

The configuration Infrastructure Site D is shown in Site D – Configuration (**Figure 5.11**).





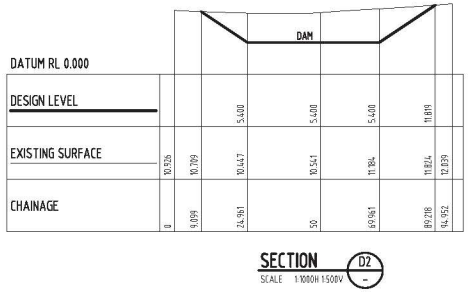


FIGURE 5.10

CLEARANCE FOOTPRINT - SIDE D

SOURCE: WGA

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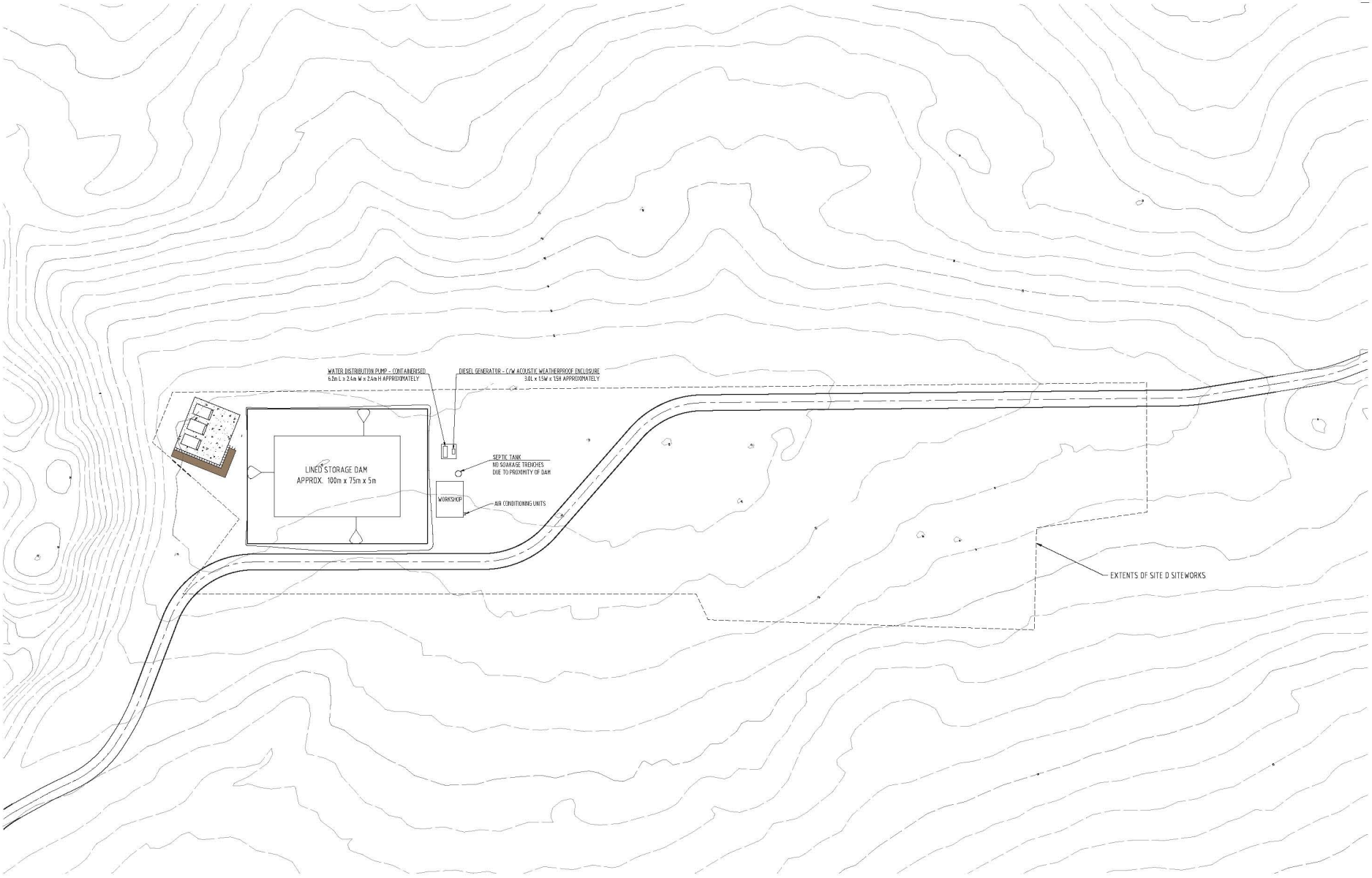

FIGURE 5.11

CONFIGURATION - SITE D

SOURCE: WGA

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The elements comprising each of the two (2) launch sites are described in the following sections:

5.3.1 Earthworks

Earthworks for Site D will principally involve the excavation of the dam. The material won from the excavation will be utilised as fill on the remainder of the sites and upgraded access roadways.

The dam will have side slopes at a 1 in 3 batter. The dam will have a base level of 5.4 metres AHD and a top level of 10.4 metres AHD.

Individual pads will be created for the magazine, workshop/maintenance building and ancillary structures to enable each building/structure to be matched to prevailing topographic conditions and the extent of earthworks to be minimised.

5.3.2 Dam

The location of the proposed dam has been identified to have suitable material for civil construction around the site.

The dam will measure approximately 100 metres long by 75 metres wide and have a nominal depth of 5.0 metres providing a capacity of 30 megalitres.

Sealing of the dam will be by polymer lining. The dam will be enclosed by a 1.8 metre chain wire mesh fence with three (3) stands of barbed wire for a total fence height of 2.4 metres. The dam will be bounded by a gravel roadway to allow for vehicle access for maintenance and connected to the main complex access roadway.

5.3.3 Pump Station

The water stored in the dam will be pumped directly to water storage on Launch Site A and Launch Site B and Range Control Site E.

It is proposed that above ground pipes will be used to connect the dam to each of the sites, with the pipes being located within the cleared access roadways.

5.3.4 Electrical Generation or Electrical Storage

Initially, once the dam is finalised, the site will have a generator sized to supply electricity to the pump station, workshop/maintenance building and magazine.

If future centralised power generation is developed, it is anticipated to be located in the infrastructure area. This development is not included in the current proposal and a separate approval would be sought at the time such a facility is proposed.

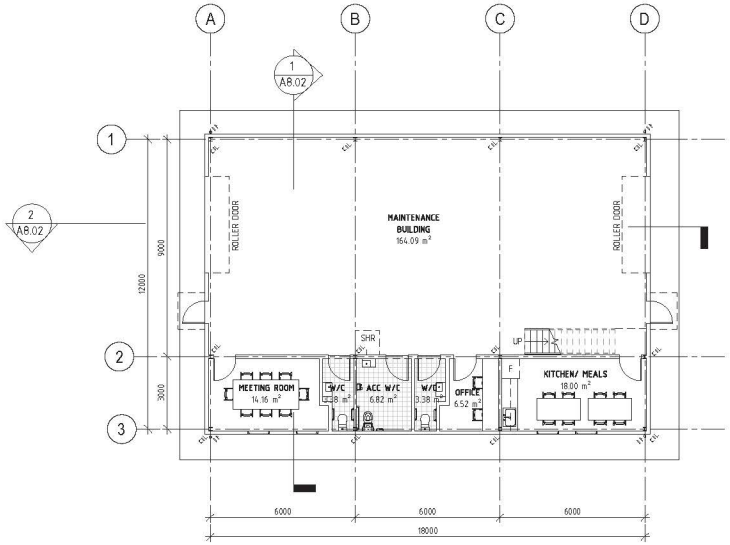
5.3.5 Workshop

The proposed workshop will be the base for site wide maintenance activities. These activities will be separate to those associated with launches and will involve maintenance and upkeep of site buildings, facilities, and roadways.

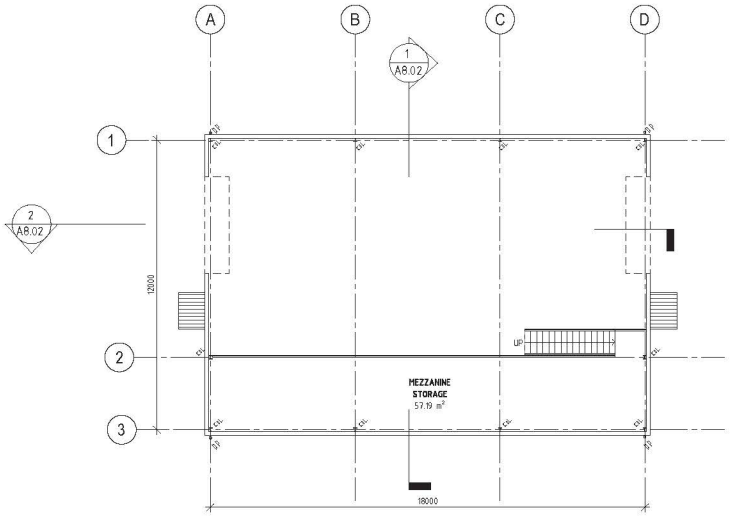
The workshop building will measure 15.0 metres by 10.0 metres with an internal clear height of 7.0 metres. The workshop will be a steel portal warehouse type structure on a reinforced concrete slab.

The floor plan layouts of the workshop/maintenance building are shown on Maintenance Building – Floor Plans (**Figure 5.12**).

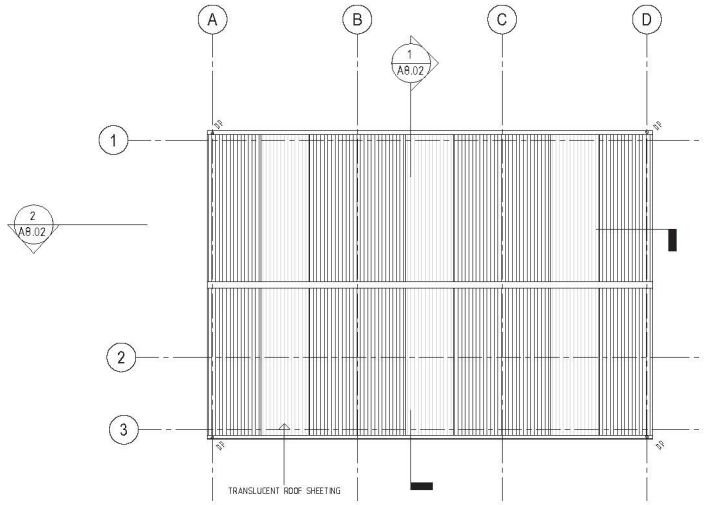
The elevations of the assembly buildings are shown on Maintenance Building – Elevations (**Figure 5.13**).



1 GROUND FLOOR
1 : 100 at A1



2 LEVEL 1
1 : 100 at A1



3 ROOF
1 : 100 at A1

FIGURE 5.12

MAINTENANCE BUILDING - FLOOR PLAN

SOURCE: GREENWAY ARCHITECTS

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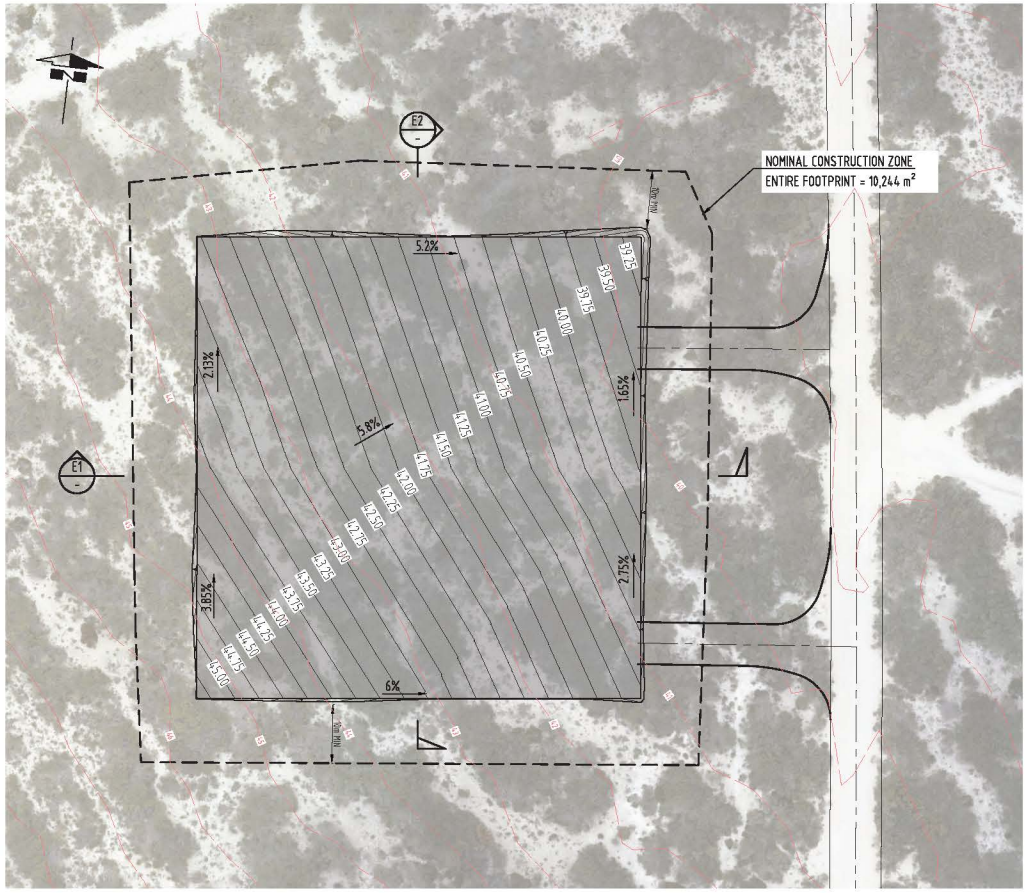

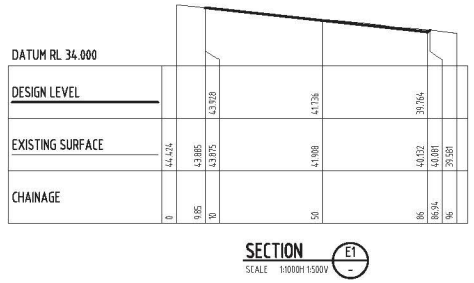

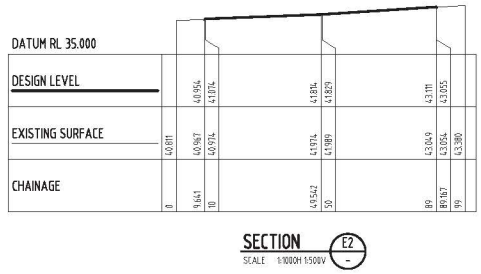

FIGURE 5.14

CONFIGURATION - SITE D

SOURCE: WGA

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The workshop will contain office, toilet, kitchen facilities for staff. The open areas of the shed will feature space to undertake maintenance and repair works associated with plant and infrastructure on the site which are non-launch vehicle related.

The workshop will cater to an estimated staff level of five (5) at the ultimate development of the site.

5.3.6 Magazine

The magazine will be in the form of a slab, on which equipment is stored in shipping containers.

The structure will have two (2) blast walls located adjacent to it.

The magazine site will be connected to the main complex access road via a gravel access road.

5.4 Range Control Site – Site E

The Range Control Site will accommodate the range control building to house the operational, security and emergency services of the complex which will oversee all operations on the site. The facility will also incorporate facilities catering to visitors to the site.

The site is located adjacent the main entrance to the facility and will provide perimeter security services to the WWOLC facility as a whole.

The clearance footprint of Range Control Site E is shown in the Site E – Preliminary Earthworks Plan (**Figure 5.14**).

The configuration Range Control Site E is shown in Site E – Configuration (**Figure 5.15**).

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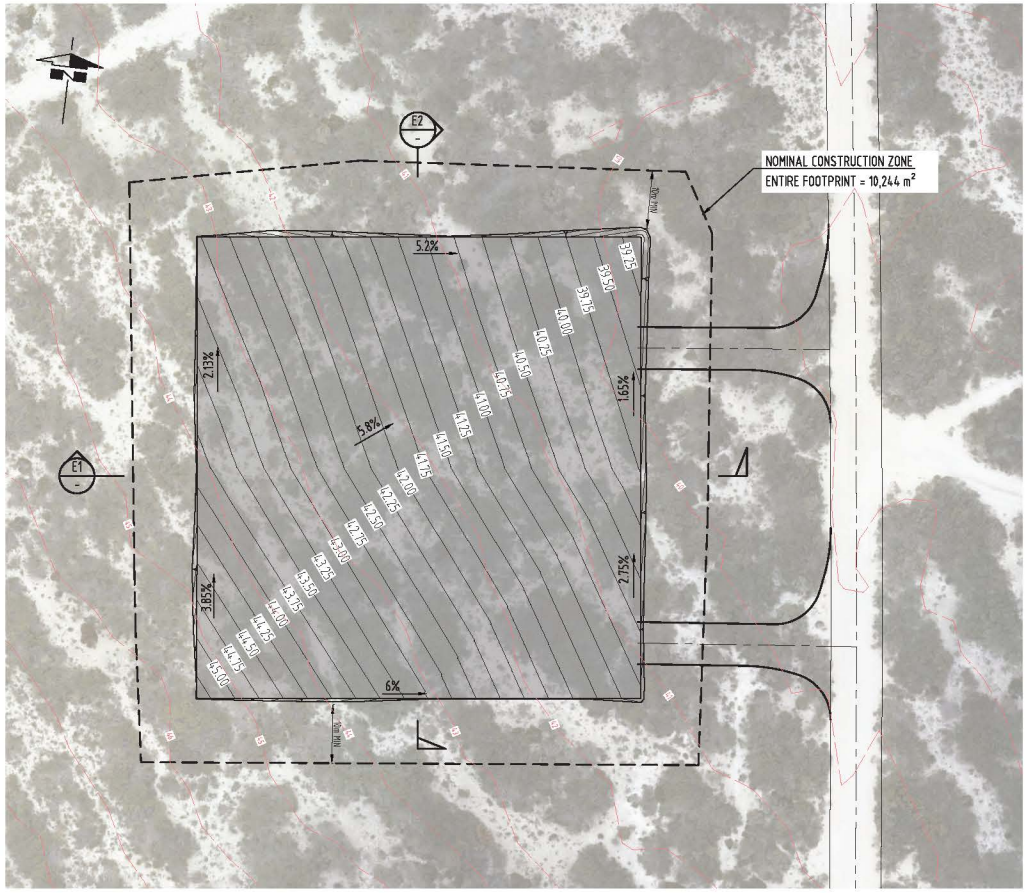

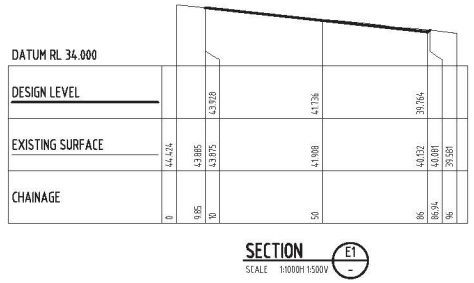

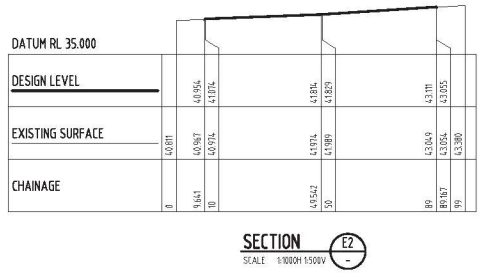

FIGURE 5.14

CONFIGURATION - SITE D

SOURCE: WGA

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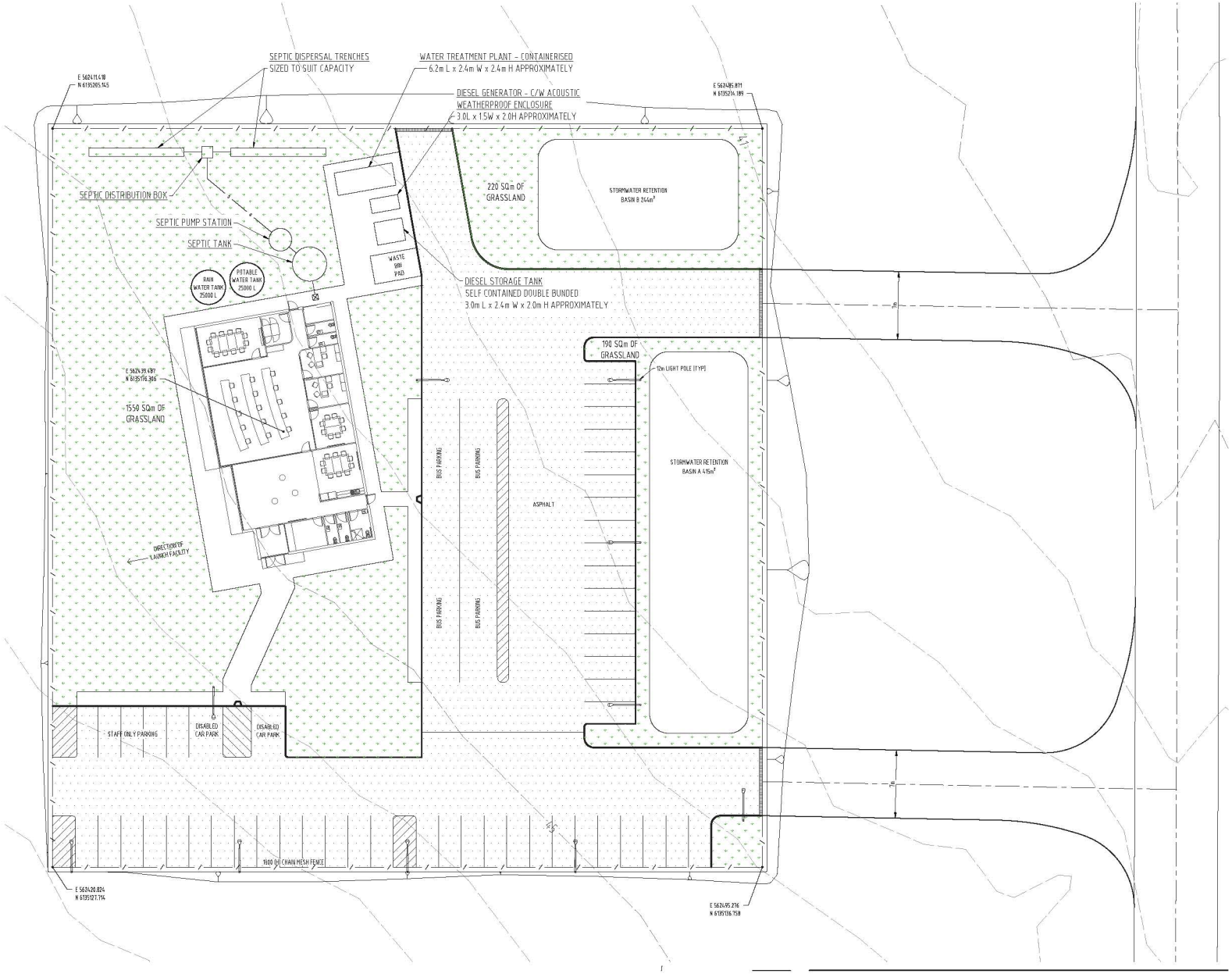

FIGURE 5.15

CONFIGURATION - SITE E

SOURCE: WGA

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The range control site is roughly square in configuration measuring approximately 55 metres long and 55 metres wide. The site is located on the western side of the existing access roadway near the entrance to the overall WWOLC site.

The southern and eastern portions of the site will feature two (2) stormwater detention facilities and a large car parking area. The car parking area features staff, visitor and bus parking areas, and has been configured in such a manner that it can also be utilised as a staging area in the event of an emergency.

The western portion of the site will feature the range control building.

The floor plan layouts and elevations of the range control building are shown on Range Control – Floor Plan and Elevations (**Figure 5.16**).

The building will be single storey measuring 25.0 metres by 12.0 metres and 6.5 metres in overall height. The building will be constructed of a mixture of colour coated steel and glazing and designed to complement both the character of the locality and enhance the launch experience for both staff and visitors. The building will contain integrated office accommodation, toilet facilities and kitchen facilities.

Perspectives showing the appearance of the range control building are shown on Range Control – Perspectives (**Figure 5.17**).

3D renders showing the appearance of the range control site and building are shown on Range Control – 3D Views (**Figure 5.18**).

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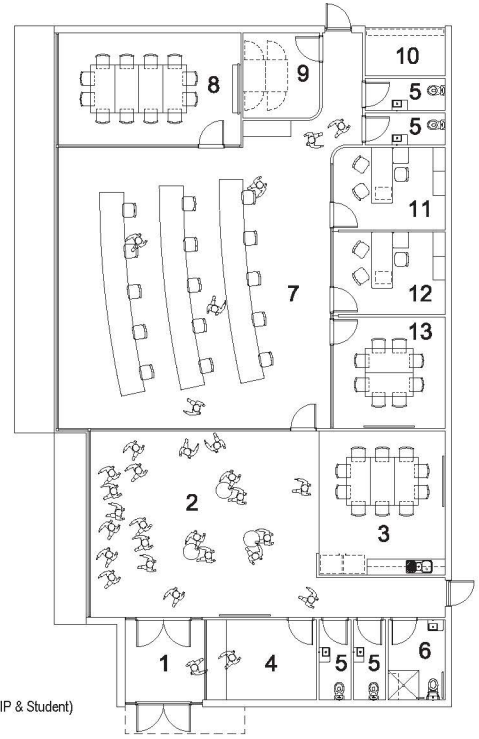
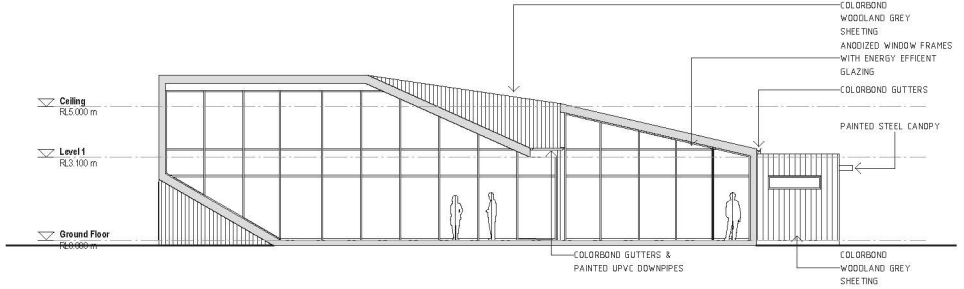


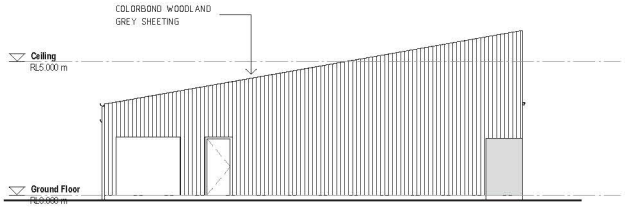
SCHEDULE:

1. Airlock
2. Viewing Gallery (VIP & Student)
3. Kitchen / Cafe
4. Security Office
5. Unisex WC Amenities
6. Disabled Access WC Amenities
7. Launch Control
8. Briefing / Meeting Room (12p)
9. Comms/Data
10. Plant (external)
11. Client Office
12. Southern Launch Office
13. Meeting Room (8p)

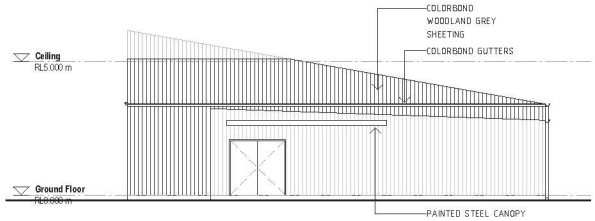
1 Ground Floor
1 : 100 at A1



2 WEST ELEVATION
1 : 100 at A1



3 NORTH ELEVATION
1 : 100 at A1



5 SOUTH ELEVATION
1 : 100 at A1

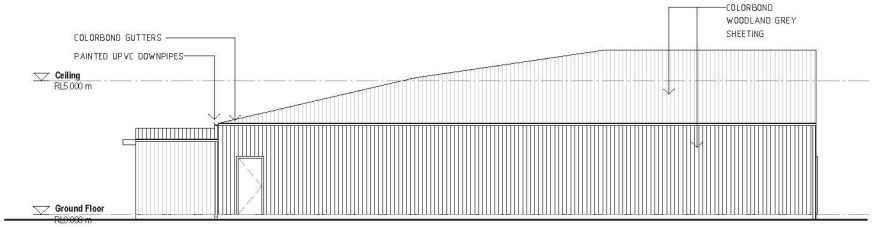


FIGURE 5.16

FLOORPLAN & ELEVATIONS

SOURCE: GREENWAY ARCHITECTS

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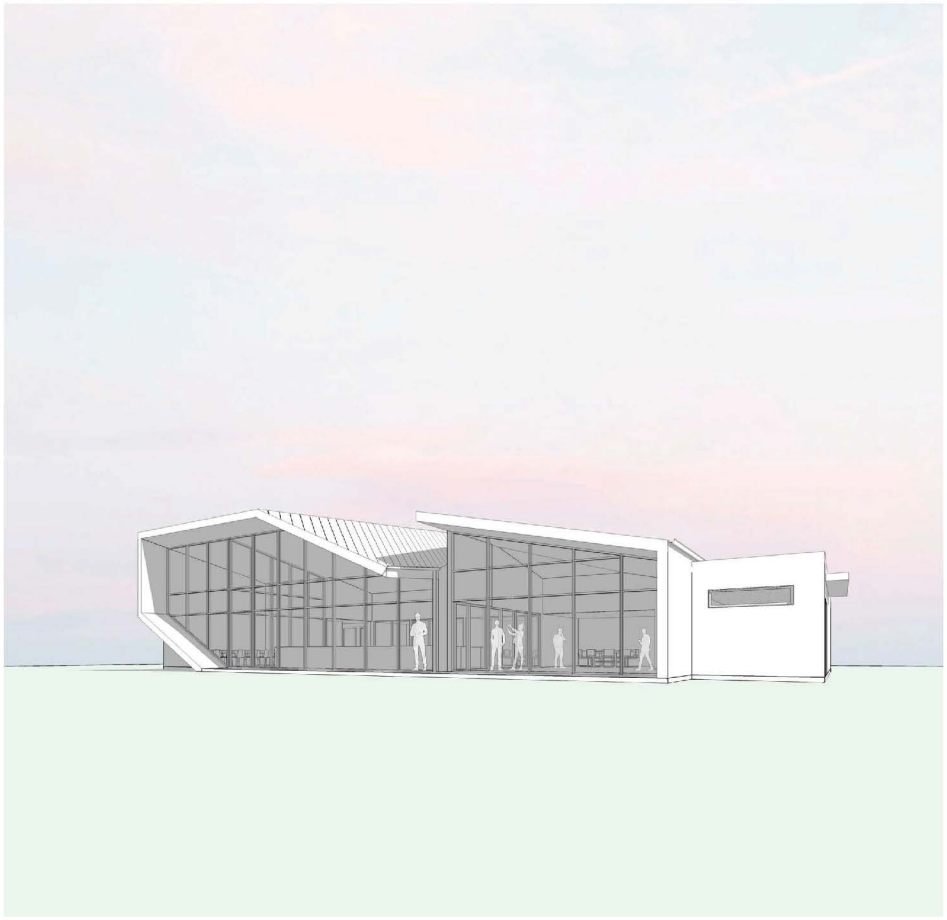

FIGURE 5.17

RANGE CONTROL - PERSPECTIVES

SOURCE: GREENWAY ARCHITECTS

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FIGURE 5.18

RANGE CONTROL - 3D

SOURCE: GREENWAY ARCHITECTS

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It is envisaged the facility will accommodate up to 40 staff, and an additional maximum of 20 invited guests could be accommodated to observe launch events.

To the north of the range control building infrastructure services will be located, including water storage, wastewater treatment, waste receptacles and generator.

Roof stormwater will be captured and directed to three (3) 25,000 litre tanks to be utilised as potable water and for firefighting requirements.

Swales will direct overland stormwater flows around the site into two (2) stormwater detention basins located as shown on the Range Control Facility Site Plan. Water quality treatment and detention will be provided for stormwater from carparking and other hard surface areas before water enters the detention basins.

The building will be serviced by a package wastewater treatment system and irrigated onto a dedicated area on the western and northern sides of the range control building.

Waste will typically be office and kitchen waste which will be stored in appropriate receptacles and removed from site by a licensed contractor. A waste bin storage area is proposed as shown on the Range Control Facility Site Plan and will be enclosed by suitable screen fence.

5.5 Site Access

Vehicle access and circulation throughout the overall site is proposed by combination of upgrades to existing access tracks and the construction of new access tracks to connect the two (2) launch sites, the infrastructure site, and the range control site to the upgraded existing access tracks.

The access roadway works are shown on the Existing Alignment Modifications Overall Site Plan (**Figure 5.19**).

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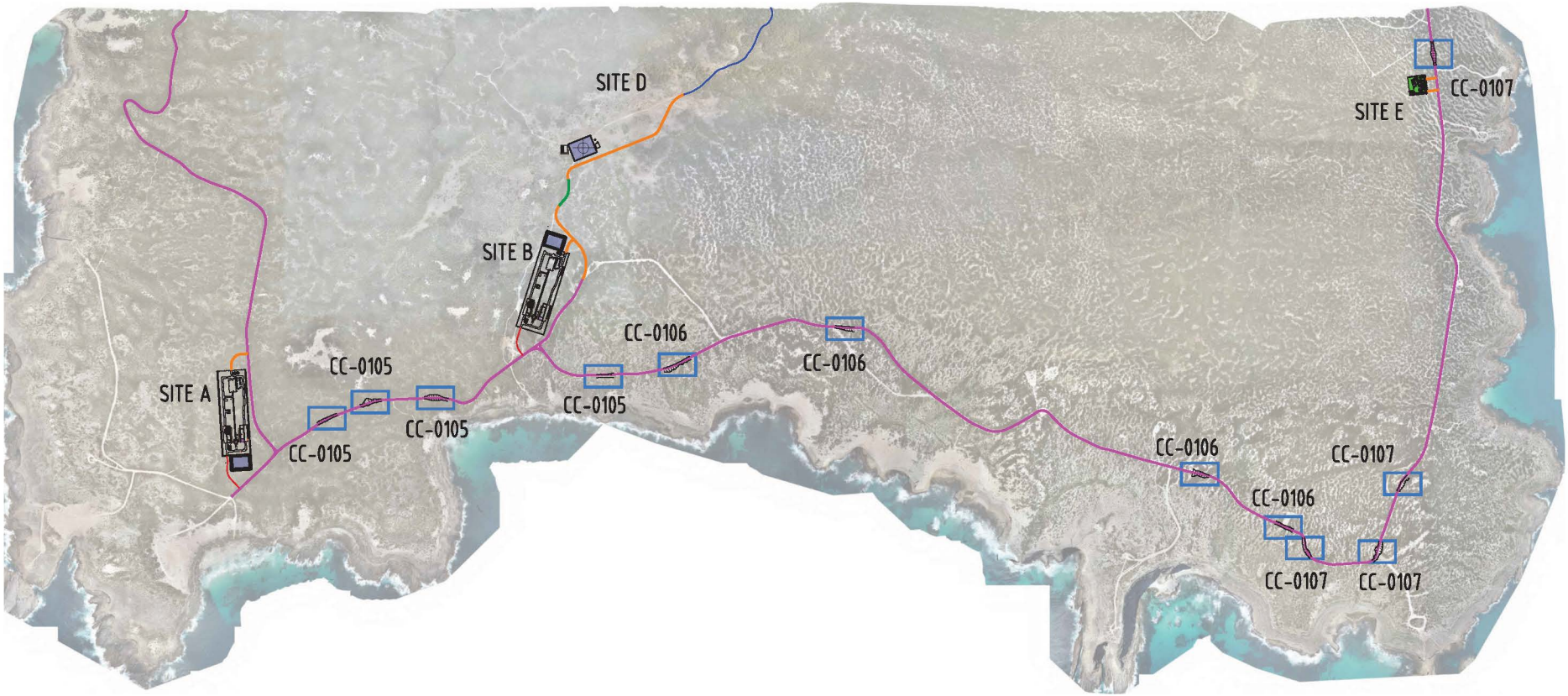

FIGURE 5.19

EXISTING ALIGNMENT MODIFICATIONS

SOURCE: WGA

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During operations a number of vehicles will be utilised to deliver, operate and maintain the various site infrastructure, which consists of many interrelated systems such as civil (building), mechanical (air conditioning, extraction and exhaust) and hydraulic (plumbing and drainage, wastewater treatment, compressed air etc).

The launch vehicles themselves will be largely constructed offsite, containerised, and then delivered to site for final assembly.

The following vehicles would be expected to be used during operations:

- Commercial vehicles of a size up to 19-metre semi-trailers for component deliveries.
- Small rigid vehicles (SRV) for smaller deliveries.
- Forklifts to unload and move containers. Forklift activities may occur at locations around the site.
- Commercial vehicles up to 19-metre semi-trailer (sealed tanker) for liquid fuel deliveries.
- Various maintenance vehicles for mechanical and road maintenance and repairs.
- Passenger vehicles and small bus vehicles for staff and visitors.

The majority of the existing access track, commonly known as Whalers Way Drive, will be retained in its current condition, with localised grading and re-sheeting, not affecting the existing alignment, and not requiring an expansion of the existing footprint, as required to maintain all weather access.

A new road alignment will be constructed to the east and north of Launch Site B, with existing access roadway sections being decommissioned and rehabilitated. The new sections of road will be constructed to a width of 8.8 metres at the northern end and 4.0 metres at the southern end.

A new access roadway alignment will similarly be constructed to a width of 8.8 metres to the south of Infrastructure Site D connecting with the existing road to the east of Site B with existing road sections being decommissioned and rehabilitated.

The 8.8 metre access road will continue approximately 200 metres to the east of Site D, where the upgraded access roadway will narrow to a 5.0-metre-wide track providing emergency egress to the northern boundary of the WWOLC site.

Launch Site A and Launch Site B will be provided connections to the above main circulation road for both general access (8.8-metre-wide carriageway) and emergency vehicle access (4.0-metre-wide carriageway).

Range Control Site E will be provided general vehicle access to the main circulation road via two (2) short road carriageways 8.8 metres wide.

Localised works will be required to both the horizontal and vertical alignments of the existing main access roadway throughout the site. The condition audit has identified twelve (12) locations where upgrade works are required. Where these works will extend beyond the existing footprint of the access roadway, the area required to accommodate the localised upgrades has been calculated and included in the overall calculation of the clearance footprint of the site.

The new roads will be constructed of an all-weather rubble surface. Car parking and circulation roads within each facility, as detailed on the plans for each site, will be bituminised.

5.6 Construction Methodology

This section describes the construction methodology proposed and the order of the establishment of each of the site elements.

5.6.1 Project Scope

5.6.1.1 Project Scope

Construction and project management activities comprise as follows:

Pre-Construction

- Project Management Plans development:
  - plans include overarching Project Management Plan (PMP), Work Health & Safety Plan (WHS), Construction Environmental Management Plan (CEMP) specific for the Project and in accordance with scope of works and technical criteria, design, and project conditions of approval;
  - securing approvals required prior to the commencement of construction, including Early Works EMP if required; and
  - providing construction programme and environmental management information for community consultation requirements.
- Preliminary activities include:
  - establishment site access roads and site compound;
  - identification and signage of site services;
  - fencing of CEEC's and Heritage sites;
  - fencing of the Project Boundary;
  - install erosion and sediment controls; and
  - construction of transverse (clean water) drainage.

Construction

- Two (2) traditional rocket launch sites and associated infrastructure.

- A range control facility.
- Assembly facilities.
- Supporting infrastructure including:
  - Diesel and/or Hydrogen Fuel Cell Powered Generators;
  - Helicopter Pad(s);
  - Water Tanks;
  - Water Capture and Treatment Systems;
  - Launch Pads;
  - Lightning Rods;
  - Anemometer Towers;
  - Engine Test Stands;
  - Propellant (liquid, hybrid and solid) Storage;
  - Secure Block Houses;
  - Blast Walls;
  - Bunding (for blast wave deflection); and
  - Installation of Fibre Optic and Satellite Communication Systems.
- Upgrade and construction of internal access roads.
- Visitor viewing area and interpretative facilities.
- Temporary infrastructure associated with construction of the development, including but not limited to:
  - temporary concrete batching plant;
  - temporary site and construction offices and facilities;
  - temporary laydown areas; and
  - temporary access tracks.
- Other Construction Work:
  - site stabilisation and rehabilitation; and
  - landscaping.
- Finishing works:
  - removal of temporary construction compounds;
  - remove and restore temporary construction compounds; and
  - general site clean-up.

5.6.2 Construction Method Statement

5.6.2.1 Site Establishment & Preparation

Release of Areas Subject to Environmental/Archaeological Inspection.

A regime shall be established with the Superintendent's Representative regarding the release of areas subject to environmental/archaeological inspection.

These areas shall be identified at project commencement and fenced/barricaded off and signposted. The workforce will be advised of the locations where access is restricted at the Project induction. Written evidence (Hold Point release or similar) shall be provided of the release of these areas prior to construction commencing in these areas.

Ancillary Facilities

Facilities specifically associated with construction are detailed on the Construction Facilities Plan (**Figure 5.20**).

FIGURE 5.20

CONSTRUCTION FACILITIES PLAN

SOURCE: WGA

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The primary site compound with amenities, lunchrooms, training and meeting facilities and associated bathroom amenities will be located at Infrastructure Site D. Construction personnel and visitor carparking is also identified on the Construction Facilities Plan (**Figure 5.20**).

Laydown areas, plant and machinery parking and maintenance areas, and stockpile locations will be cleared with a suitable surface established and signposted as part of the Site Establishment program.

Access tracks will be routed to minimise impact on existing native vegetation and ecological vegetation communities where practical and in accordance with project approvals.

The installation of clean water drainage and diversions as well as erosion and sediment controls as part of the site establishment will ensure early set up of controls that will ensure impacts are kept to a minimum.

5.6.2.2 General Earthworks

Establish Survey Control and Set-out

Survey control will be setup at the commencement of the Project by the Project surveyor. The set out will be carried out using electronic design information received from the design consultants.

Clearing & Grubbing

The footprint area will be cleared and grubbed as required using a bulldozer and mulching equipment. The mulch will be moved to stockpile sites for later reuse, including for use as erosion and sediment control material during the earthworks phase of the Project, as per CEMP. Where necessary, beneath the formation, grubbing will occur up to a depth of 500 millimetres below natural surface to remove all stumps and tree roots.

Strip Topsoil & Stockpile

Stripping of topsoil will be in accordance with requirements on the drawings; topsoil will be stripped and transported to nominated stockpile sites within the works.

Topsoil stockpile will be wheel rolled during the stockpiling process to ensure the sides are compacted and stable. All necessary erosion controls will be installed around the topsoil stockpiles in accordance with the Erosion and Sediment Control Plans. Stockpiles may be seeded with a mix of suitable grass species to stabilise the surface and water carts will be available for dust control as required.

Foundation Preparation

Foundations will be jointly inspected by the Earthworks Foreman, a Geotechnical Representative and the Client's Representative following the removal of topsoil, to determine the suitability of the foundation. Any unsuitable material will be removed at this time. After the foundation has been approved, it shall be ripped and compacted to a depth of 150 millimetres.

Removing Unsuitable Materials (Spoil)

All unsuitable areas will be removed by excavator and will be carted using dump trucks to a spoil stockpile. Unsuitable material will be removed as directed by the Geotechnical Representative and the Client's Representative.

Access Tracks, Haul Roads

Minimum numbers of haul roads and tracks will be provided to carry out the works in order to minimise the disturbance to the surrounding areas. They will be formed from existing roads and tracks as far as possible. The major haul route will be along the existing road between Site B and Site D. Haul roads, where applicable, will require bunds to be constructed on the edges to prevent any vehicle run off and to control stormwater. All haul roads will be adequately built to carry the type of plant utilised for the works. Graders and water carts will be utilised to maintain haul roads, to ensure both the efficiency of the haul, to minimise generation of dust and to maintain drainage to minimise erosion and sediment transport.

Protection of the Work

All works will be protected as necessary for the length of the contract to ensure full compliance with contract specifications. Any identified damage during the course of works to the existing or finished surfaces will be maintained to the satisfaction of the Client's Representative.

Materials

At this stage it is not fully known as to what pavement type materials will be won and processed on-site. A detailed material management plan, including the source material to be used and the method of processing, will be produced prior to commencing works. All the materials will be assessed and tested as described in the specifications and geotechnical report for the Project.

Mass Haul & Material Management

Following an analysis of in-situ materials for the construction a mass haul diagram should be produced to determine the following:

- location and quantity of material in each structural zone;
- location and quantity of material required for each usage type;

- requirements for import material;
- stockpiling areas; and
- potential uses for spoil material and disposal provisions.

Blasting

Blasting is not envisaged to be necessary for this project. A worst-case scenario is believed to be the use of large trenching machines. In the unlikely event that blasting is required, a blasting plan will be developed in conjunction with the operations personnel at the WWOLC, the relevant authorities, contractor, and a blasting subcontractor.

Batter Stabilisation

A Geotechnical Consultant will determine if any batter stabilisation will be required.

Timing

The timing for individual activities will be determined from the overall Construction Program.

Major Plant & Equipment

In general, topsoil will be removed by scrapers, with assistance from graders as required. Excavators and dump trucks will be used in areas of deeper spoil.

The bulk earthworks will be moved by scrapers, with dozers and excavators used to assist loading, as well as dump trucks and excavators. There is the potential for the use of excavators equipped with rock breakers or trenching machines if the rock is hard.

Compaction will be carried out predominantly using compactors and pad foot rollers. The rolling pattern will be trialled after commencing on site to determine the most effective compaction method.

Graders and water carts will be used for maintaining haul roads, spreading material in the embankments, applying water for conditioning, compaction purposes and dust control.

5.6.2.3 Structure Works

Assembly Buildings (Sites A & B)

On completion of the earthworks and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader is used to trim the base to required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Workshop Building (Site D)

On completion of the earthworks and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader is used to trim the base to required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Range Control Building (Site E)

On completion of the earthworks and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader is used to trim the base to the required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Launch Pad and Flame Trench (Sites A & B)

The works area of the flame trench and launch pad will be cut to required depths including benching using excavators. Shoring along the sides will be installed. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement for the flame trench. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

Once the concrete works has cured for the required time specified during detailed design, the void behind the flame trench will be backfilled. The backfill specification will be determined during detailed design.

Installation of trenches and sub-base pipework/conduit required for the launch pad follows until the site is prepped for installation of launch pad membrane, slab/footings formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

Other Concrete Works (All sites)

Other concrete works involve a series of concrete pads. On completion of the earthworks and as the works areas become available under a staged hand over, base installation shall commence. For large pads, a GPS controlled grader is used to trim the base to required level and line and the base is compacted with a roller. For smaller pads, the works may be completed utilising bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines. Curing compounds will then be applied.

Water Deluge System (Sites A & B)

The water deluge system consists of a 20-metre-tall tank stand, 150,000-litre tank, pipework, and control system. Trenching will be undertaken from the tank stand to the launch pad. Excavation using bobcats and excavators will be undertaken to reach the desired depth. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks, reinforcement and hold down bolts. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines. Curing compounds will then be applied.

The tank stand is erected utilising cranes, scissor lifts and scaffolding. The 150,000-litre tank is lifted into position using cranes. Pipework is installed from the tank to connect to the underground pipe network and a control system is installed.

Blast Walls (Sites A & B)

Blast walls are to be installed to protect the fuel and oxidiser infrastructure. The walls will also reduce noise levels emanating outside the facility boundary.

The works area of the blast walls will be cut to required depths using excavators. Shoring along the sides will be installed if required. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and subbase pipework/conduit follows until the site is prepped for installation of membrane, formworks and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

The walls with then be backfilled with gravel materials as per specification developed during detailed design.

Fuel and Oxidiser Facilities (Sites A & B)

Two (2) areas are to be constructed behind blast walls. One (1) area is for the storage of fuels. The other is for the storage of oxidisers.

The works area of the fuel/oxidiser's facilities will be cut to required depths using excavators. Shoring along the sides will be installed if required. Base installation shall commence utilising graders, rollers, bobcats, and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, formworks, hold down bolts and reinforcement. Concrete is poured using concrete trucks supplied from Port Lincoln. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

Tanks, pumps, pipework, and pipe trays are trucked in. Lighter materials are hand lifted into position, whilst large items such as pumps and tanks are craned into position. Pipe works and control systems are installed and then commissioned.

5.6.2.4 Drainage (All Sites)

Drainage works shall be carried out as soon as possible to enable the site to be well drained and reduce susceptibility to wet weather.

Installation of the stormwater detention basins and stormwater open swales shall be installed where possible along with the establishment of erosion and sediment controls at the start of the bulk earthworks.

Transverse drainage shall be installed as soon as possible subject to depth of cover over the drainage line, etc.

Stormwater drainage swales and outlet structures will be installed progressively along with the pipes, to ensure lines are completed with minimum distribution to the earthworks and follow pavements.

Drainage works within the sites of works will be done under appropriate safe working arrangements.

5.6.2.5 Communications, Lighting, Cameras, and IT Infrastructure (All Sites)

The actual communication, lighting and IT works required will be dependent upon the detailed design. This will detail the types of components required to be installed. All communications, lighting and IT civil installation will be carried out in conjunction with the civil works under a joint programme to ensure that all activates are completed in a timely manner to allow commissioning to be carried out at the correct time and to prevent unnecessary rework. This will include the installation of cable routes; pits, servers; poles, cameras, light fittings, and main cable installation etc.

Cable terminations, pre-testing, final testing, commissioning, and systems integration will be carried out by the nominated Contractor approved by Southern Launch.

5.6.3 Environmental Requirements

Control of Erosion & Sedimentation

Prior to commencement of any work, erosion and sediment control measures will be implemented as per the CEMP. The methodology will ensure that all the existing and finished surfaces are protected from damage due to work activities, contamination from site conditions and any climate conditions, and ensuring no damage would occur beyond the disturbance boundary downstream side of works area. The CEMP will always be in place during the course of individual operation and will be amended accordingly with site conditions to suit the works.

All necessary drain paths will be identified to separate clean and dirty water on site and works will be performed for the diversion, restriction or management of any flow or seepage of surface or ground water around the works for water runoff. The plan will be prepared to show dispersing of clean water either in stable areas or natural watercourses, while all measures (sediment traps, basins) will be taken to collect dirty water and re-use it for site works.

Temporary Drains

Catch drains will be formed along haul roads and access tracks for any potential hazards due to their steepness or soil erodibility. All drains will be formed to intercept and divert run off from roads to stable outlets. The configuration of these drains will include check dams, sandbags to decelerate runoff to non-erosive velocities. All drains will be formed with adequate plant type, capacity to perform the works.

Temporary Sedimentation Control Works

Temporary sediment trapping devices will be installed downstream of the embankment works area within the disturbance boundary. They will be provided during construction to filter sediment-laden runoff or water from dewatering operations. They will be positioned to filter sediment before crossing the disturbance boundary and entering any natural watercourses downstream of the works area.

De-Watering

All water will be sampled, analysed and results assessed to ensure that any dewatering will comply with any Environment Protection Licence and/or the requirements of any relevant environmental legislation. All dewatering activities will be in accordance with the dewatering procedures within the Soil & Water Management Plan. All dewatering activities are monitored with records maintained by the environmental personnel.

5.6.4 Testing & Inspection

A Quality Plan will be submitted prior to the commencement of works. This will include a detailed Testing and Inspection Plan. A NATA accredited testing authority will be employed to undertake all testing of earthworks and concrete on site. All select materials to be incorporated into the works will be tested and certificates attached to quality documents.

5.6.5 Dust Control

All works will be conducted as per the CEMP, for the suppression control of dust; any exposed areas which allow for revegetation to be used as dust control barrier, (Stockpiles, Mounds) will be applied as soon as practical, otherwise, a water cart will be allocated for works in areas, where dust control during earthwork operations is required.

5.6.6 Noise Mitigation

Sites A, B and D are located a significant distance from the nearest sensitive receptors. As the works include large sized plant and equipment, a noise control plan will also be implemented to ensure works are conducted within mandated time periods, affording no disturbance to the surrounded community.

If it is required for the works to be conducted outside of mandated time periods, then the affected community will be notified prior to the works being conducted and with the Principal's representative's approval.

5.6.7 Revegetation

Revegetation of disturbed areas and any areas beyond the embankment footprints will take place as soon as any of the area is available, to reduce potential for erosion and to have permanent vegetation as a barrier for water runoff. Seeding will be applied by an approved process and will include one (1) application over each area. It will commence as soon as topsoiling is completed.

Storage tanks, containers and equipment used in the hydro seeding and mulching will be clean and free of contamination from previous operations. Mulch placement methods will be approved by the Principal's Representative prior to the commencement of mulching.

5.6.8 Plant & Equipment

Earthworks and Drainage

For the cut to fill operation, the earthmoving equipment used would most probably include:

- 30 and 25 tonne excavators.
- Backhoes.
- Scrapers.
- Dump trucks.
- Loaders.
- Tippers.
- Bulldozers – potentially up to D11.
- Water Carts.
- Graders.
- Track Trenching Machines such as the Vermeer T555.
- Compactors.
- Smaller Machinery such as bobcat, hand operated compactors and hand tools.

Structural Works

Preparation of the sub-base and base will utilise equipment stated above. Other equipment required will include:

- Cranes.
- Welding equipment.
- Scaffolding.
- Mobile elevated platforms.
- Hand tools.

Concrete Works

Concrete works will require:

- Concrete trucks – transport concrete from Port Lincoln.

- Concrete pumps.
- Formwork.
- Vibration equipment.
- Ride-on and hand operated trowel machines.
- Scaffolding.
- Hand tools.

5.6.9 Safety

Safety is paramount and Southern Launch is committed to an incident free worksite. A detailed safety management plan will be developed in conjunction with the main contractor. Southern Launch is committed to meeting all its legislative obligations in respect of safety.

Any construction site is a high-risk environment, particularly when heavy equipment is involved. Major safety considerations include:

- Heavy equipment movements.
- Working around heavy equipment.
- Vehicle movements.
- Working at height.
- Working at depth.
- Vibration related injuries.
- Hot works.
- Noise.
- Dust.
- Electrical related injuries.
- Crush related injuries.
- Tool related injuries (e.g., eye injuries, degloving).
- Environment related injuries (e.g., heat exhaustion, hypothermia).
- Slip and fall related injuries.
- Potential for unauthorised vehicles/people entering the site.

6 PROJECT OPERATIONS & MANAGEMENT

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6.0 PROJECT OPERATIONS AND MANAGEMENT

This section sets out the typical operations of the facility through the lifecycle of the Project.

6.1 Concept of Operations

The proposed orbital launch operations are a highly structured operation that will be the subject of significant operational planning coordinated between Southern Launch and their customers.

The proposed facility will be operated by Southern Launch allowing for customer use for the launch of vehicles. Southern Launch will be responsible for the provision and maintenance of the infrastructure on the facility and for coordination with customers undertaking launch operations. Southern Launch will also be responsible for the security of the facility, for coordination with various tiers of government in respect of operational approvals and licences and also emergency planning, management and coordination.

Southern Launch will provide additional services to customers on an as-needed basis.

As the operator of the facility and holder of the various regulatory approvals and licences, Southern Launch will be responsible for compliance with those approvals and licences and will coordinate closely with launch customers to ensure that compliance is achieved at all stages of operations.

6.2 Delivery and Operation of a Rocket Launch

Following the completion of the site infrastructure assembly, the rocket components and payload will be delivered to the site and combined to form a launch vehicle.

This process will occur as follows:

(a) Vehicle stages are shipped to the site via proximate air or sea facilities where they will be loaded onto a suitable road transport for delivery to the site.

(b) Vehicle stages are transported to the Assembly Building and unloaded.

(c) Checking of the different vehicle stage electronics and systems are undertaken.

(d) Payloads (satellites) are delivered onsite and checked by technicians.

(e) Payloads are integrated into the final vehicle stage.

(f) The complete vehicle is assembled in the horizontal position within the Assembly Building.

(g) The assembled vehicle is driven to the launch pad and lifted into the vertical position.

(h) The vehicle is tested on the pad.

(i) The launch corridor (range) is cleared to ensure there are no aircraft, vessels, personnel, or ground traffic in the area.

(j) The vehicle is launched.

The above steps take approximately seven (7) days to complete, hence a launch window (the amount of time allocated by the Government to undertake a launch within) is usually 21 days to account for variable weather. Some of the steps outlined above could be done at an auxiliary site at another location to reduce the time spent at the launch site. During this period of time the immediate site surrounding the Assembly Building and Launch Site would need to be closed to visitors to ensure Work, Health and Safety Regulations are met.

As outlined above, the facility will cater for launches by a variety of customers. The number of launches based on the initial phase of the development is anticipated to commence with approximately six launches in the first year of operations, increasing to a maximum of 36 launches per year in year five of operations.

The facility has been uniquely designed to enable the launch sites to be used by multiple customers, who will transport their equipment and launch vehicle stages to the site before undertaking final assembly in preparation for the launch. Once the launch is complete, the customer will remove their equipment and vacate the launch site ready for occupation by the next customer.

Typically, a launch cycle will run in the order of three (3) to five (5) weeks from occupation to vacation of a launch site; however, the exact timeframe will vary based on the nature of the launch vehicle and the specific requirements of an individual launch mission.

Following vacation of a launch site, routine inspections, maintenance, and repair will be undertaken.

When a launch site is not occupied, the intensity of activity will typically be very low, particularly in times where no maintenance or repair work is occurring. Accordingly, the intensity of use of the site will vary throughout the course of the year, with times where there is no material activity on-site and only routine security present. At other times, when multiple launch sites are occupied, the level of activity will be more significant with larger numbers of staff on site.

6.3 Typical Launch Timeline

The nature and activity associated with each launch will be unique, based on the specific requirements of the mission. However, the process for launches will have a high degree of commonality in activities as the launch site is occupied and preparations for the launch proceed. Furthermore, launches are a highly structured operation requiring input and oversight of numerous government agencies.

A typical launch will see an increase in the intensity of site operations approximately 21 to 28 days prior to the launch. The following timeline indicates a typical sequence of activities leading up to and following a launch:

4 weeks prior to launch date:

- QA processes are completed at site and the launch site is verified as being suitable for occupation by the customer.
- Specific notification with and coordination with local stakeholders and regulatory authorities is undertaken.

3-4 weeks prior to launch date:

- Those launch vehicle components not manufactured in Australia will arrive to an off-site reception facility.
- Customs and import processes will be undertaken, followed by an initial acceptance inspection.
- It is anticipated that off-site installation of components will occur as required to minimise the amount of assembly (and assembly time) required at the WWOLC. It should be noted that the proposed concept of multi-use launch infrastructure is a relatively unique concept.
- To be cost effective and minimise the amount of time they spend at a launch site, it is anticipated that the initial installation processes for both launch vehicles and payloads will occur offsite. This could occur in Port Lincoln, Adelaide or elsewhere in Australia. The customer will undertake acceptance inspections of the launch site ready for formal occupation.

2-3 weeks prior to launch:

- The customer will occupy the launch site. Once this occurs, the customer will begin to bring equipment to the site. The number of personnel on-site (both customer and Southern Launch personnel) will begin to increase approximately three (3) weeks prior to launch and will continue to increase progressively as the launch approaches.

1-2 weeks prior to launch:

- By this time the customer has occupied the launch site. Depending on the nature of the launch, the launch vehicle will be transported to site between seven (7) to 14 days prior to the launch.
- The launch vehicle will be brought to site in the form of partially assembled stages for mating on-site.

- As the stages of the launch vehicle are brought to site by truck, they will be transported into the assembly building.
- During this period, the Southern Launch Range Operations Manager will continue coordination and liaison with local authorities in advance of the launch.
- The launch table/pedestal is moved into position at the launch pad in preparation for the installation of supporting infrastructure.
- At this point there will be a further increase in equipment being brought to site, with radiofrequency (RF) and IT equipment for the management and monitoring of the launch being delivered.
- In the assembly building, the vehicle assembly continues, with stages being mated and other external and internal components added to the launch vehicle.
- External systems including fuel, oxidiser, communications, and IT are connected to the launch table.
- There will be a continued increase in the number of staff at the site during this period.

7 days prior to launch:

- Fuels and oxidisers trucked to site and either decanted into the on-site storage at the launch pad or retained in transportable tanks.
- Vehicle assembly continues and the connection of systems to the launch table also continues.

2-7 days prior to launch:

- At this time, the major assembly of the launch vehicle will be close to complete. This enables one or more 'dress rehearsals' of the launch to be undertaken. These processes will test roll-out, erection and countdown procedures, however, do not involve engine firing although they can involve fuelling the launch vehicle. Typically, after a dress rehearsal is complete, the launch vehicle will be rolled back to the assembly building for storage.
- Coordination continues with local authorities and external regulatory authorities.
- There will be a continued increase in staff numbers, with peak staff numbers typically reached at some point during this period.

1 day prior to launch:

- The day prior to launch will be focussed on checking and testing of systems in preparation of the launch. This will include a run through of checks similar to launch day and verification all systems associated with the launch are working.

- On the day prior to launch the flight readiness review will be undertaken and a go/no-go decision will be made. If a no-go decision is made, a rescheduled launch date may be determined and any NOTAM or NOTMAR for the following day cancelled.
- Relevant liaison with government agencies to confirm regulatory arrangements are in place.

Day of launch:

- On the launch day there will be the final roll-out of the vehicle to the launch pad for launch. The vehicle will be attached to launch table and erected. Pre-launch system checks begin.
- One (1) hour before launch, following completion of roll-out procedures, the final preparation of the vehicle for launch will proceed. This will include evacuation of staff from the launch pad to safe areas of the site. Once the evacuation is completed, fuelling of the launch vehicle commences which involves decanting the fuel and oxidiser into the internal tanks for the vehicle. Once fuelling commences, critical countdown commences, and final critical system checks undertaken.

30 seconds before lift-off

- The deluge water system activates.

Lift-off

- Vehicle engine(s) ignite for lift off.
- Umbilicals and collections to launch table disconnect and the vehicle commences vertical ascent.
- The vehicle clears the tower and continues on launch trajectory.

Post-launch site activities:

- Following the launch of the vehicle, launch pad systems will be made safe. This will include initial checks, following which fuel, oxidiser and cryogenic lines will be checked and purged.
- Once the launch pad is made safe a comprehensive set of checks for foreign object damage at the launch pad and surrounding areas will be undertaken.
- Mission control and range control continue to monitor the launch vehicle until after payload separation, which will typically occur one (1) to two (2) hours after launch.
- Once the launch vehicle payload has separated, systems shutdown procedures begin, and disassembly of the launch pad and other equipment can proceed. This will include the launch table being disconnected and moved off the launch pad.

- The customer disassembles equipment and vacates assembly building and launch pad.
- Once the customer has vacated, acceptance checks are undertaken by Southern Launch. As required, maintenance and repair work undertaken on-site between customers and the launch sequence then starts again for subsequent customers.

Ongoing:

- Engagement and liaison with commercial air and maritime operators and, their peak bodies, that use the air and maritime areas south of Whalers Way.
- STEM and public outreach activities, providing the public with an insight into space launch activities.

6.4 Suborbital Rockets

Whalers Way will also be used to launch rockets that do not go into orbit around the Earth. These rockets are known as sounding rockets or suborbital rockets. They are used to access altitudes between 50 and 120 kilometres, which are too high for balloons to reach, and too low for satellites.

Typical purposes for sounding rocket missions include:

- atmospheric research;
- testing and qualification of space systems; and
- STEM education.

The payloads of these rockets are often quite small, weighing in the range of two (2) to 20 kilograms. Their composition would potentially include electronics, metallic structures, optical materials like glass or ceramics, and batteries. These small payloads can be launched to altitudes above 150 kilometres, from which they can descend through the atmosphere.

Given they have small payloads and address specific research questions, many sounding rockets are designed to be low-cost and rapidly deployable. They will generally be smaller than orbital rockets. They may consist of more than one rocket stage. Thrust is mostly provided by solid propulsion but can also be supplied through other propulsion technologies including hybrid and liquid.

Certain developers of orbital launch vehicles use suborbital flights to test stages. If these flights test the first stage of an orbital vehicle, the launch will more closely resemble an orbital launch. If these launches test upper stages, they will generally resemble scientific type sounding rocket flights, but have engineering payloads instead of experiments. These kinds of launches are not likely to happen more than frequently during the development of an orbital launch vehicle and as such, will be relatively rare occurrences, typically one (1) or two (2) per year and a maximum of six (6).

When launched at overland rocket ranges, sounding rocket payloads are normally recovered and reused, with the rocket body being single use and not reconditioned for a subsequent launch. Since launches at Whalers Way will be over the water, it will be impractical in most cases to recover the payloads and they would remain in the ocean.

6.5 Launch Frequency

Given the potential complexity of retrieving payloads from the open ocean, sounding rocket launches will be infrequent on the Whalers Way site and will generally be undertaken at Southern Launch's Koonibba Test Range site. It is envisaged that there would typically be few sounding rocket launches undertaken at Whalers Way per year with a maximum of potentially six per annum.

This number is additional to the estimated 36 conventional launches per annum at the Whalers Way site.

The T-Minus Engineering Dart is an early example a small sounding rocket that Southern Launch intends to operate. That vehicle consists of lightweight and powerful booster motor and a smaller dart shaped payload compartment that separates from the booster and continues substantially further downrange. The dart component is between 900 and 1,500 millimetres with a diameter of less than 50 millimetres.

The dart will have a total mass, including payload, of between 3.0 and 5.0 kilograms. This component of the rocket will reach speeds of between Mach 5 and 6.

The Booster is approximately 2.0 to 3.0 metres in length, up to approximately 400-millimetre diameter with a loaded mass of between 15 and 30 kilograms. The booster section of the sounding rocket will return to earth between 3.0 to 8.0 kilometres downrange. The dart section will return to earth between 40 to 150 kilometres downrange.

6.6 Safety Zones

To ensure people are safe during the launch process, an exclusion zone is required to be established around the launch site (Launch Exclusion Area), and on the ground along the path the rocket will fly to get into space (Launch Exclusion Corridor). For safety reasons, no unauthorised persons or vehicles are allowed in these areas during a launch.

Exclusion Zones will only be in effect when they are needed, and the public will be given notice before they are put in place through the standard Notices to Airmen (NOTAM) and Notices to Mariners (NOTMAR). Additional notification of launches via media channels will be undertaken to inform the public through the processes defined by the Australian Space Agency.

The exact size and location of an exclusion zones will be based on the size of the rocket being launched at the time and the flight path the rocket will follow. Exclusion zones will be designed to not encroach on any neighbouring properties or other areas without prior consent.

The final dimensions of the exclusion zones will be approved by the relevant Australian regulator for the airspace or maritime areas prior to being put in place. For the purpose of the EIS, nominal safety zones have been calculated based on the largest rockets expected to launch from the site. The calculated exclusion zones for individual launches are expected to be smaller, and often significantly smaller than the safety zones.

Figure 6.1 shows the launch safety zones overlaid on the site.

Subject Allotment
Zone Boundary
Key Road
Lease Boundary

CTP Caravan and Tourist Park
Con Conservation
CWOI Coastal Waters annd Offshore Islands
Ru Rural

SITE A Launch Facilities
SITE B Launch Facilities
SITE D Infrastructure
SITE E Range Control

Key Site Access
Radius 3120m to Site A Launchpad
Radius 2100m to Site B Launchpad

FIGURE 6.1

LAUNCH SAFETY ZONES - SITE PLAN

SOURCE: MASTERPLAN

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6.7 Overflight and Marine Danger Area

Commercial and private aviation may currently overfly the launch site, the rocket flight path, and the exclusion zone.

As part of any launch process, Notices to Airmen (NOTAM) for air traffic and Notices to Mariners (NOTMAR) for sea traffic are issued in accordance with Australian regulatory requirements.

Temporal separation between air and maritime users, and any rocket launch operations will be implemented with close coordination with Australian regulators.

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7 EFFECT ON NATIVE VEGETATION

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7.0 EFFECT ON NATIVE VEGETATION

7.1 Summary

A key consideration for this project is the clearance of native vegetation from the subject land and the potential impacts this presents to the local environment. It is acknowledged in the Assessment Guidelines that much of subject land is comprised of significant stands of native vegetation and is located within the Coastal Conservation Zone of the Development Plan and the Conservation Zone of the Planning and Design Code.

The various project sites will all require some level of clearance of native vegetation in order to accommodate the construction of the Project Footprint including each site and supporting infrastructure. This is of particular importance given that much the selected site location is presently covered by a Heritage Agreement.

The key technical investigations that assess the impacts of the proposal on native vegetation include the Marine Ecological Assessment (**Appendix S**), which outlines the anticipated impacts on marine flora, and the Terrestrial Ecological Assessment (**Appendix P**), which addresses impacts on terrestrial vegetation.

The discussion hereunder considers the methodology adopted in these investigations and their respective findings in respect to the EIS Guidelines relevant to the Effect on Native Vegetation, namely Guidelines 2.1 to 2.8 and Assessment Requirement 2.

7.2 Methodology

7.2.1 Terrestrial Ecological Assessment Methodology

In respect to native vegetation, the approach adopted by AECOM in the Terrestrial Ecological Assessment (**Appendix P**) comprised of two (2) key steps, a terrestrial biodiversity assessment (to determine the vegetation characteristics, communities and flora species likely to be present in the area), and an impact assessment (assessment of the significance of potential project impacts on native vegetation and flora populations).

7.2.1.1 Terrestrial Biodiversity Assessment

This included a desktop assessment of the site using various public resources and additional site-specific background documents and previous investigation reports in order to develop a baseline understanding of the vegetation communities and flora species that may inhabit the area.

A likelihood of occurrence assessment was then undertaken for all threatened flora species that were identified in the desktop assessment. This considered the presence of suitable habitat, sighting records, the date of records, and location proximity to the Project Site. The likelihood of occurrence findings was updated following site surveys.

A series of field surveys, covering both baseline and targeted surveys were undertaken between the following dates: 16 March, and 19 March 2020; 22 June and 24 June 2020; and 13 October and 15 October 2020. These were led by a Native Vegetation Council (NVC) accredited ecologist, who was assisted in each survey by different assistants, consisting of an Environmental Scientist (March Survey), Ornithologist (June Survey), and a second NVC accredited ecologist (October Survey).

The surveys relevant to the topic of Native Vegetation, included:

- Flora and vegetation survey:
  - undertaken in accordance with the NVC Bushland Assessment Method (BAM) 2019;
  - measures and scores the biodiversity value against benchmark communities;
  - considers three (3) components - vegetation condition, conservation value, and landscape context; and
  - the three (3) components are combined to determine a Unit Biodiversity Score (UBS) for a hectare (ha). This can then be multiplied by the total site area (ha) to provide a Total Biodiversity Score for the site.
- Targeted searches:
  - targeted searches were conducted for threatened flora and fauna species that were considered likely to occur in the Project Footprint;
  - a ramble survey method was used (i.e., walking through areas of vegetation to cover different topography and habitats); and
  - when threatened species were identified, a GPS location and observations were recorded.
- Targeted Flora Survey:
  - this was undertaken to determine the presence and extent of *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *National Parks and Wildlife Act 1972* (NPW Act) listed flora species utilising the Project Site;
  - the area of the Project Footprint was assessed as a grid search with an approximately 10 metre intervals giving 5.0 metres each side of the transect search;
  - access tracks were assessed with one (1) surveyor covering each side as an up and back method with approximately 10 metres covered off on each side;
  - four (4) threatened flora species were considered as likely occurring; and
  - seven (7) threatened flora species were considered as possibly occurring.

7.2.1.2 Impact Assessment

The impact assessment considered proposed activities (including vegetation clearance) and unplanned events (e.g., chemicals spills, launch failures, fire) that may occur during construction and operation of the facility.

The Impact Assessment considered the impacts of the Project against the EPBC Act. Under the EPBC Act specific guidelines are provided to assist in undertaking a 'self-assessment' to determine the likelihood of significant impact. These guidelines are referred to as the *Significant Impact Guidelines 1.1 Matters of national Environmental Significance* (SIG 1.1). This SIG 1.1 process was used in AECOM's assessment to determine the likelihood of the Project resulting in a significant impact, qualifying the likelihood as either:

- Unlikely;
- Potential; or
- Likely.

Additionally, the likely impacts were assessed with consideration of the terrestrial biodiversity components of the relevant EIS assessment guidelines, focusing on those guidelines that related to native vegetation, terrestrial flora, and fauna species, and introduces species. A matrix of the relevant assessment guidelines and the Project response/justification is provided within **Appendix E**.

It is noted that Southern Launch are addressing the EPBC Act via a separate referral under that legislation, rather than via the EIS process.

7.2.2 Marine Ecological Assessment Methodology

The methodology adopted by J Diversity Pty Ltd in the Marine Ecological Assessment (**Appendix S**) comprised of two components, an analysis of the ecological values of the local marine environment, and an impact assessment considering the impacts of the proposal on the marine environment.

7.2.2.1 Assessment of Ecological Values

The Marine Ecological Assessment (**Appendix S**) defines the key ecological values of the local marine environment, describing the habitats that are present and the marine flora populations known to exist in the area. The ecological values of the Thorny Passage Marine Park and the Southern Ocean are specified.

This assessment was undertaken via a desktop analysis which considered a variety of resources including:

- State and Commonwealth Government environment mapping;
- review of previous studies of the area including diver surveys; and
- review of relevant literature and Government reports and resources related to the region.

7.2.2.2 Impact Assessment

The Impact Assessment considerers the following impacts on the marine environment:

- Operational impacts:
  - collision of rocket debris with wildlife;
  - noise and vibration impacts; and
  - pollution associated with debris.
- Construction noise:

It was determined that neither construction nor operational impacts would be likely to impact on marine flora. Neither sound nor debris (functioning as a high-speed projectile) would have any significant impact on marine flora below the surface because of rapid attenuation of both forms of energy on entering the water. Impacts of debris settling into the benthic environment was also considered.

7.3 Relevant EIS Guidelines

Assessment Requirement 2: *The proposed development is located on land which currently holds significant stands of native vegetation within the Coastal Conservation zone.*

2.1. Describe the location, condition and significance of native vegetation on the subject site, including individual species and communities. Include reference to areas that have Heritage Agreements under the Native Vegetation Act 1991 and any proposed alterations to or implications for the Heritage Agreement.

2.2. Describe the location, condition and significance of native vegetation species and communities that may need to be cleared or disturbed during both the construction and maintenance phases. This should include clearing for all buildings, structures, exclusion zones and access arrangements.

2.3. Describe the potential impacts on native vegetation fragmentation and the ability of communities or individual species to recover, regenerate or be rehabilitated during all phases of development.

2.4. Identify the habitat value of native vegetation and the potential for habitat fragmentation during both construction and maintenance (and decommissioning). Include a description of the effects of any fragmentation that may occur over the life of the project.

2.5. Detail any likely changes in remaining vegetation surrounding the launch pads, which may be impacted by the proposed operations. Mitigation measures should be documented to minimise the impact on remaining species and communities in the immediate vicinity of the launch pads.

2.6. Outline any compensatory activities proposed, making reference to guidelines produced by the Native Vegetation Council.

2.7. Identify the potential impact of fire on native vegetation, and the effects of fire risk management processes during both construction and operation.

2.8. Describe the location, extent, condition and significance of native vegetation species and communities in the marine environment within the impact area of spent (discarded) launch vehicles.

7.4 Analysis

7.4.1 Guideline 2.1

2.1. Describe the location, condition and significance of native vegetation on the subject site, including individual species and communities. Include reference to areas that have Heritage Agreements under the Native Vegetation Act 1991 and any proposed alterations to or implications for the Heritage Agreement.

7.4.1.1 Condition of Vegetation

The location, condition and significance of native vegetation located within the WWOLC has been detailed in Section 6.2 and Section 6.3 of AECOM's (2021) Terrestrial Biodiversity Assessment (refer to **Appendix P**).

No Threatened Ecological Communities (TEC's) of vegetation are known or considered likely to occur at Whalers Way. No threatened flora species listed under the EPBC Act or NPW Act were observed within the Project Site or within the general Whalers Way region during the baseline and targeted flora surveys over two (2) seasons, including walking of the entire Whalers Way coastal band.

Vegetation community composition within the Project Footprint and immediate surrounds at Whalers Way was transitional dependent on two (2) major factors; exposure to salt laden winds, and soil type and depth. Six (6) vegetation associations were observed within the WWOLC area, identified in **Table 7.1** below:

Table 7.1: Vegetation Associations Observed within the Project Area (AECOM, 2021).

NUMBER	DESCRIPTION
1	*Beyeria lechenaultii* (Pale Turpentine Bush) *Melaleuca lanceolata* (Dryland Tea-tree) Low Shrubland over sclerophyllous shrubs.
2	*Acrotriche patula* (Prickly Ground Berry) Very Low Open Shrubland.
3	*Eucalyptus diversifolia* (Coastal White Mallee) Low Mixed Mallee over sclerophyllous shrubs.
4	*Eucalyptus angulosa* (Ridge Fruited Mallee)+/-*Eucalyptus rugosa* (Coastal White Mallee) Low Mixed Mallee.
5	*Leucopogon parviflorus* (Coastal Bearded Heath) Low Very Open Shrubland over exotic annual grasses.
6	*Callitris* sp. 'Limestone' (Native Pine) Low Shrubland.

Vegetation Association 1 (Low Shrubland over sclerophyllous shrubs) was observed to be primarily dominant on the near cliff zone where stable dune habitats were present intertwined with exposed sheet limestone which was generally devoid of vegetation or contained only sparse sclerophyllous shrubs. Cover within Association 1 was generally high with the most diverse floristic community observed across the area with a mix of primarily coastal front species co-habiting with other taller shrubs which were persisting in the hollows resulting in a mixed community.

Vegetation Association 2 (Very Low Open Shrubland) was observed to occupy exposed and/or elevated sections of clifftop where a lack of soil, high alkalinity and salt laden winds result in specific niche communities dominated by ground hugging shrubs and mat plants. The average overstorey height in these areas is less than 300 millimetres in most instances.

Vegetation Association 3 was recorded on stable dunes where grey sandy loams overlay sheet limestone. These were often transitional between the low coastal shrublands of the clifftop edges and the higher elevation calcareous clay loam soils. Association 3 occurs in patches, varying from circular 'hummocks' to linear lunettes further from the coast. The interpatch spaces were generally sheet limestone occupied by Association 1. With distance from the coastline, the community structure changed by way of a more continuous and taller stratum with average heights of 3.5 metres and a denser canopy cover.

Vegetation Association 4 (Low Mixed Mallee) was present where soils were largely a calcareous silty loam. The soil surface was highly stable and formed a thick crust with high levels of biocrust and Moss species. *Melaleuca* species were a common species in this Association compared to those on lighter soils with Coastal White Mallee. Inter-patches were dominated largely by Association 6 (limestone *Callitris* sp.). In areas where the community was protected from high coastal winds the strata were taller, with an average of 3.0 metres compared to 2.0 metres near the coast.

Vegetation Association 5 (Low Very Open Shrubland over exotic annual grasses) is a disturbed regenerating association with pioneer species such as Coast Bitter Bush (*Adriana quadripartita*) present that were otherwise absent from the intact sections of the Project Site. Numerous environmental weed species were present throughout the area and grass species were overwhelmingly annual exotic species such as Brome (*Bromus*), Fescue (*Vulpia*) and Wild Oat (*Avena*). Overall, the condition was very poor, and regeneration of local species was patchy.

Vegetation Association 6 is dominated by *Callitris* sp. 'Limestone' mixed with other sclerophyllous shrubs. It occurred exclusively with Association 4 on calcareous silty loam soils. Condition of these communities was generally good with the only perennial exotic species present Sea Lavender (*Limonium companyonis*) which increased with proximity to the coast.

Vegetation gradually transitions from one (1) association to another, effectively causing a mosaic landscape lacking distinct changes in vegetation. The six (6) associations are all considered typical of coastal communities that occur along the southern Eyre Peninsula. Detailed descriptions of the vegetation associations, along with mapping of the associations that were identified within the Project Footprint is detailed further in AECOM's report (2021, pp. 33 – 44), (refer to **Appendix P**).

Photograph 7.1: Representative photograph of Vegetation Association 1 (AECOM, 2021, p.34).

Photograph 7.2: Representative photograph of Vegetation Association 2 (AECOM, 2021, p.34).

Photograph 7.3: Representative photograph of Vegetation Association 3 (AECOM, 2021, p.35).

Photograph 7.4: Representative photograph of Vegetation Association 4 (AECOM, 2021, p.35).

Photograph 7.5: Representative photograph of Vegetation Association 5 (AECOM, 2021, p.36).

Photograph 7.6: Representative photograph of Vegetation Association 6 (AECOM, 2021, p.36).

7.4.1.2 Heritage Agreement

The Heritage Agreement covering the Project Allotment was put in place in 1988 and established under the former *SA Heritage Act 1978* (now replaced by the *Heritage Places Act 1993*). The Agreement is registered as dealing number 6456268 listed on the Certificate of Title for the purposes of a Native Vegetation Heritage Agreement HA 148. The Agreement is now operating under the *Native Vegetation Act 1991*.

The proponent is seeking to amend the Heritage Agreement to relocate and consolidate exclusion areas to cover the development footprint. The NVC have provided in-principal support to this approach, subject to certain considerations, including:

- The overall size of the Heritage Agreement remains largely the same.
- The layout and design of the proposed development and the likely impacts on native vegetation as presented to the NVC at that time, remains largely unchanged.
- The varied Heritage Agreement is to include a clause requiring the development and implementation of a plan to actively manage the Heritage Agreement area for improved ecological outcomes.
- Pending the amendment of the Heritage Agreement, the proposed development will not conflict with the agreement and will be located outside of areas to which the Heritage Agreement applies.

7.4.2 Guideline 2.2

2.2. Describe the location, condition and significance of native vegetation species and communities that may need to be cleared or disturbed during both the construction and maintenance phases. This should include clearing for all buildings, structures, exclusion zones and access arrangements.

The Project will require clearing 23.76 hectares of native vegetation for construction including launch pads, access tracks and associated laydown areas. The WWOLC Project Footprint boundaries have been extensively refined during the design phase to reduce the amount of native vegetation to be cleared in areas of lower condition rating as far as practicable.

The extent of each vegetation association to be cleared at each Project Site within the WWOLC is presented in **Table 7.2** below.

Table 7.2: Proposed Vegetation Clearance Footprint (AECOM, 2021, p.43).

VEGETATION ASSOCIATION	PROJECT AREA							TOTAL (HA)
	Site A	Site B	Site D	Site E	Access B-D	Access Roads	Whalers Way Access Roads	
1	3.34	0.58	0.29	-	0.1	-	0.63	4.94
2	0.23	-	-	-	-	0.11	0.4	0.74
3	1.54	4.06	1.41	-	0.62	0.22	0.51	8.36
4	-	-	-	0.75	-	-	0.45	1.2
5	-	-	4.92	-	-	-	-	4.92
6	-	0.4	-	-	-	-	3.2	3.6
Total	**5.11**	**5.04**	**6.62**	**0.75**	**0.72**	**0.33**	**5.19**	**23.76**

A Bushland Assessment Method (BAM) assessment has determined scores for the condition of vegetation be cleared. Launch Site A had the highest condition score of 74.53 and the highest average score of 67.09. The lowest condition score was at Infrastructure Site D which had a score of 30.66. The scores are largely influenced by partial clearing, weed invasion and species richness. Further detail on the location, condition and significance of native vegetation required to be cleared within the WWOLC is detailed in **Section 6.2** and the potential impacts discussed in Section 7.1 within **Appendix P**.

The clearance of 23.76 hectares will be offset through a biodiversity offset program developed in accordance with NVC guidelines. Construction and operation of the Project will be managed in accordance with a Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) to ensure that all impacts are reduced as far as practicable utilising management measures outlined in Table 20 of Section 8 within **Appendix P**.

7.4.2.1 Threatened Flora Species

A desktop assessment undertaken by AECOM identified 11 threatened flora species that may occur within 10 kilometres of the Project Footprint. Following the baseline survey, a further desktop assessment of a 20-kilometre buffer was applied, and 33 species of Commonwealth and State conservation status were identified, including:

- Five (5) species listed under the EPBC Act; and
- 28 species listed under the NPW Act.

Of these, four (4) threatened flora species were considered likely to occur within the Project Area, and comprised of:

- Alcock's Wattle (*Acacia alcockii*), Rare under the NPW Act;
- Port Lincoln Guinea-flower (*Hibbertia cinerea*), Rare under the NPW Act;
- Western Daddy-long-legs (*Caladenia bicalliata ssp. bicalliata*), Rare under the NPW Act; and
- West Coast Mintbush (*Prostanthera calycina*), Vulnerable under both the EPBC Act and NPW Act.

An additional seven (7) threatened flora species were considered possible to occur within the Project Area:

- Annual Candles (*Stackhousia annua*), Vulnerable under both the EPBC Act and NPW Act;
- Eyre Peninsula Fringe-lily (*Thysanotus wangariensis*), Rare under the NPW Act;
- Hidden Leek-orchid (*Prasophyllum occultans*), Rare under the NPW Act;
- Leafless Globe-pea (*Sphaerolobium minus*), Rare under the NPW Act;
- Limestone Leek-orchid (*Prasophyllum calcicole*), Vulnerable under the NPW Act;
- Scaly Poa (*Poa fax*), Rare under the NPW Act; and
- Snowdrop Spurge (*Phyllanthus calycinus*), Rare under the NPW Act.

Lists of all flora species recorded or predicted to occur are provided within **Appendix P** including their conservation status, habitat descriptions and likelihood assessment. Those species assessed as having an unlikely occurrence in the Project Footprint are not considered further in the EIS.

Following the desktop assessment, targeted surveys of the Project Footprint were undertaken over two seasons. No threatened flora species listed under the EPBC Act or NPW Act were observed within the Project Footprint or within the Project Site. It is deemed unlikely that any such flora species are present.

In respect to Commonwealth Listed Species, one (1) species, West Coast Mintbush, was considered likely to occur in the desktop assessment, however an intense targeted search of the Project Footprint returned no individuals, and as such the likelihood of their presence is considered low.

Another Commonwealth Listed Species, the Annual Candles was considered possible to occur as a result of the desktop assessment, however no presence of the species was observed during the targeted surveys. Their occurrence as such is considered unlikely.

7.4.3 Guideline 2.3

2.3. Describe the potential impacts on native vegetation fragmentation and the ability of communities or individual species to recover, regenerate or be rehabilitated during all phases of development.

Once native vegetation is cleared, there is minimal opportunity for individual species and communities to naturally regenerate and recover. Therefore, the clearance of native vegetation will require an offset through a biodiversity offset program developed in agreement with NVC.

Habitat fragmentation relates to the physical dividing up of a continuous habitat into separate smaller fragments (Fahrig 2002). The habitat situated between fragments is often artificial and less suitable to the species remaining within these fragments (Bennett 1990).

The landscape in which the WWOLC is situated is relatively undisturbed with significant vegetation cover, with fragmentation of vegetation occurring through access tracks that have been constructed for recreational and tourist access to Whalers Way. The Project Activities will contribute to fragmentation of vegetation by increasing the number and width of access tracks and the clearing of four (4) discreet areas. Clearance and subsequent fragmentation may impact threatened flora species and regionally significant vegetation.

Fragmentation as a result of vegetation clearing for the Project is considered to be localised. The vegetation in the local area is contiguous and provides ample connectivity across Whalers Way. It is unlikely that vegetation clearing will result in the inability of any species to become genetically isolated and lead to sub-populations in the local area.

The widening of tracks and the construction of the launch pads may lead to local fragmentation; however, the majority of species at Whalers Way are mobile and are able to traverse the distance a track represents. Fragmentation is therefore considered limited and unlikely to be considered significant.

Further detail on the impacts of native vegetation fragmentation and the biodiversity offset program is contained within the AECOM report in **Appendix P**.

7.4.4 Guideline 2.4

2.4. Identify the habitat value of native vegetation and the potential for habitat fragmentation during both construction and maintenance (and decommissioning). Include a description of the effects of any fragmentation that may occur over the life of the project.

The six (6) vegetation associations identified to occur within the Project Footprint are identified in **Section 7.4.1**. Also provided is a detailed description of each association, the species present, and the physical qualities of the vegetation. **Section 7.4.2** describes the condition of the vegetation to be cleared, outlining the scores from the Bushland Assessment Method (BAM) assessment conducted by AECOM. These sections adequately describe the condition and value of the vegetation.

The habitat value of the native vegetation for fauna was also considered by AECOM in their field assessment and described in their report (**Appendix P**). Three (3) fauna habitats have been defined and mapped for the WWOLC Project Footprint based on the results of the field assessment. These habitats are described as follows:

- Coastal Heath: high quality habitat with multiple shrub layers and sedges, grass tussocks and mat plants with low exposed bare ground area;
- Shrubland on Scree: high quality habitat particularly for small reptiles as it includes plants, rock/stones with cracks, and sand hummocks; and
- Low Mallee: high quality fauna habitat with numerous structural layers of vegetation with moderate to high litter cover.

The removal of vegetation resulting in habitat loss and degradation is likely to pose the largest risk of adverse impacts for terrestrial biodiversity arising from the Project. The impact may be direct in the form of vegetation and habitat clearance, or indirect, such as a reduction in flora and fauna diversity due to shortages in available habitat resources or habitat degradation in areas adjacent to direct impacts.

Habitat loss and fragmentation as a result of vegetation clearing is likely to occur during the construction phase activities. Maintenance activities during the operational phase of the Project or decommissioning activities at the closure of the WWOLC will not materially further increase habitat loss or fragmentation.

The Project will clear 23.76 hectares of native vegetation in four (4) discreet locations (Launch Site A, Launch Site B, Infrastructure Site D and Range Control Site E) and several new and upgraded access roads. No threatened flora species listed under the EPBC Act and NPW Act are considered likely to occur within these areas or within close proximity.

The vegetation habitats to be cleared have been mapped and are identified in the following **Figures 7.1 – 7.5**.

FIGURE 7.1

VEGETATION ASSOCIATIONS TO BE CLEARED WITHIN THE PROJECT AREA

SOURCE: AECOM

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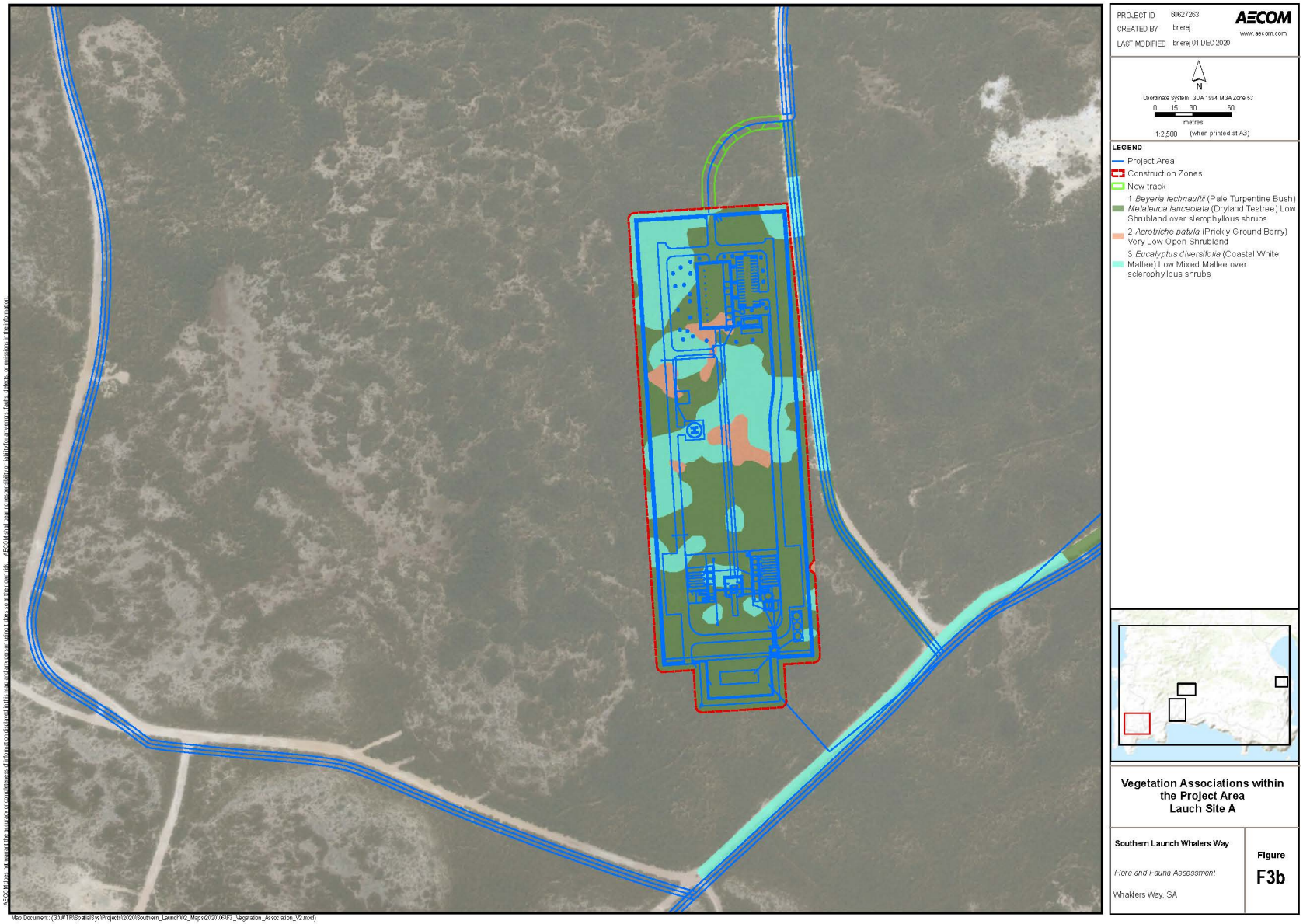

FIGURE 7.2

VEGETATION ASSOCIATIONS TO BE CLEARED WITHIN THE PROJECT AREA — LAUNCH SITE A

SOURCE: AECOM

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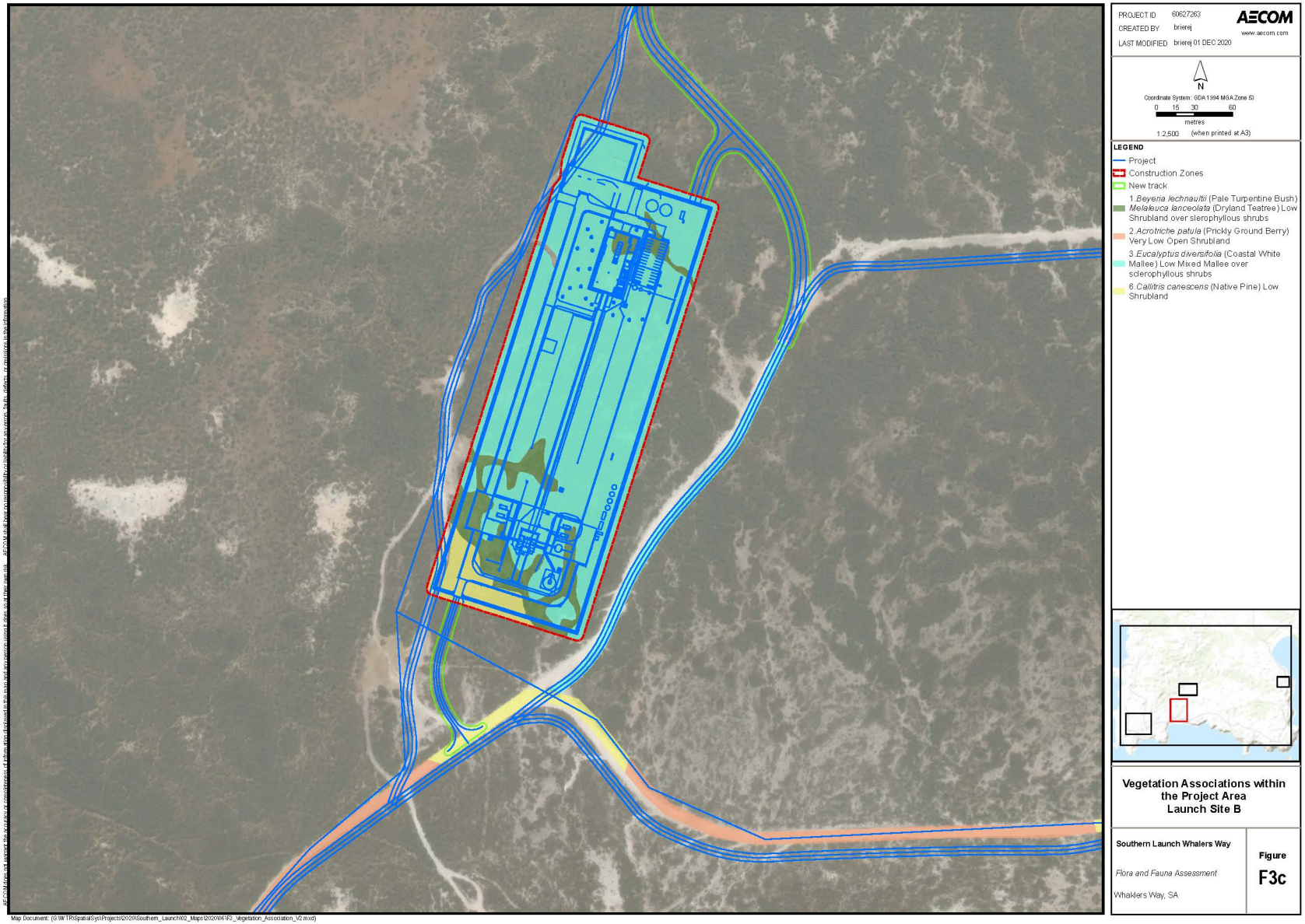

FIGURE 7.3

VEGETATION ASSOCIATIONS TO BE CLEARED WITHIN THE PROJECT AREA — LAUNCH SITE B

SOURCE: AECOM

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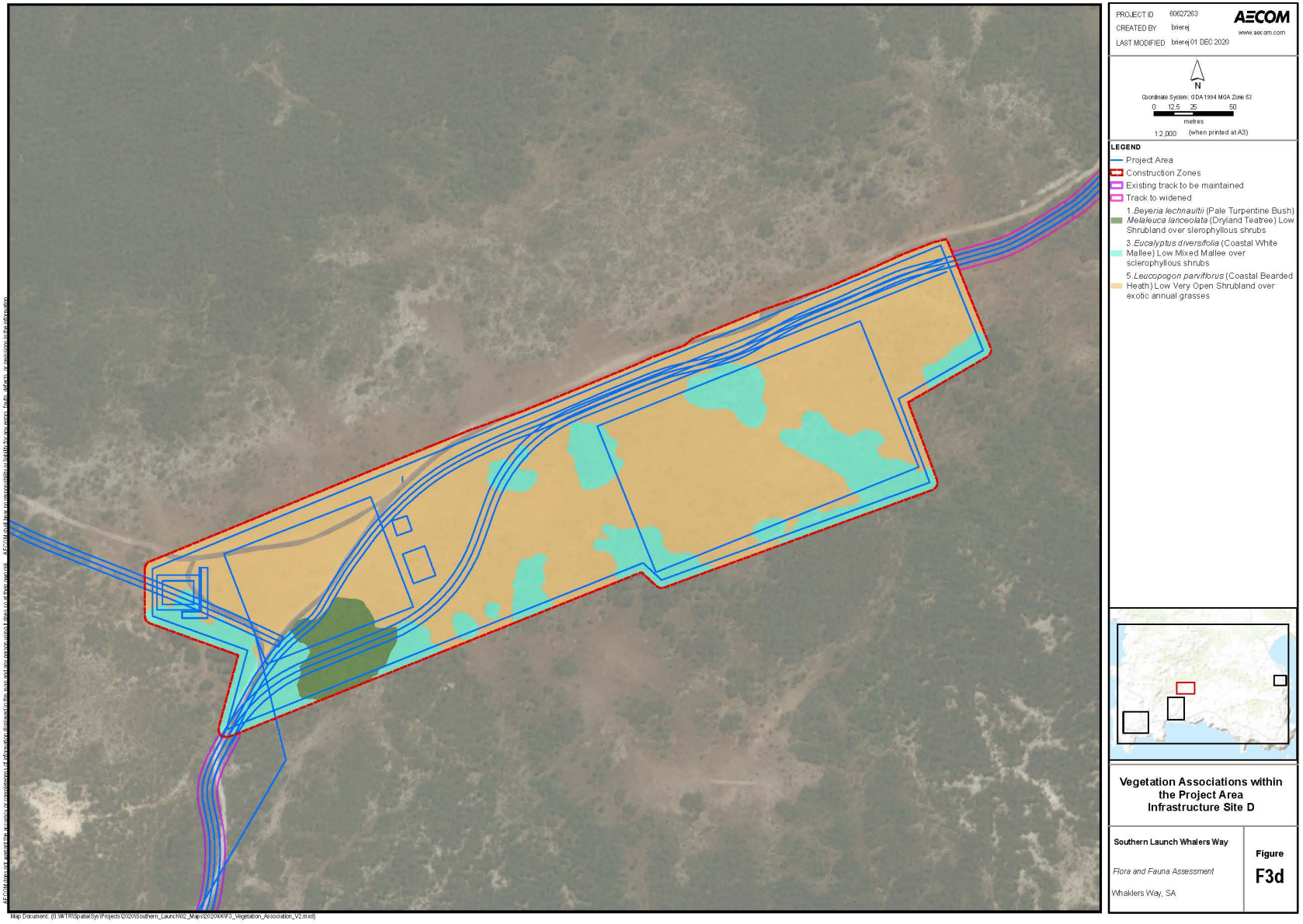

Map Document: (I:\WTR\Spatial\Syn\Projects\2020\Southern_Launch\02_Maps\620290491\F3_Vegetation_Association_V2.mxd)

FIGURE 7.4

VEGETATION ASSOCIATIONS TO BE CLEARED WITHIN THE PROJECT AREA — INFRASTRUCTURE SITE D

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FIGURE 7.5

VEGETATION ASSOCIATIONS TO BE CLEARED WITHIN THE PROJECT AREA — RANGE CONTROL SITE E

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It is likely that some threatened fauna species (birds) are likely to occur or are present in these areas. These species are highly mobile, it is therefore difficult to predict to what extent they utilise an area without completing a comprehensive bird census. The impact of vegetation clearance and habitat fragmentation on fauna is considered in more detail in **Section 9** of the EIS.

As discussed in **Section 7.4.3**, the Project activities that may contribute to fragmentation of fauna habitat is increasing of the number and width of access tracks and the clearing of four (4) discreet areas. Habitat fragmentation as a result of vegetation clearing for the Project is considered localised. The habitat in the local area is contiguous and provides ample connectivity across Whalers Way.

The widening of tracks and the construction of the launch pads may lead to local fragmentation, however, the majority of species at Whalers Way are mobile and are able to traverse the distance a track represents. Fragmentation is therefore considered limited and unlikely to be considered significant.

7.4.5 Guideline 2.5

2.5. Detail any likely changes in remaining vegetation surrounding the launch pads, which may be impacted by the proposed operations. Mitigation measures should be documented to minimise the impact on remaining species and communities in the immediate vicinity of the launch pads.

Section 7.0 within **Appendix P** provides a detailed analysis of the potential impacts the Project may present on both flora and fauna surrounding the Project Footprint, including the launch pads, other sites, and access roads.

The key potential impacts relevant to surrounding vegetation include:

- Habitat loss and fragmentation through vegetation clearing;
- Invasion of weed and pest species;
- Edge effects;
- Effects of dams and detention basins;
- Irrigation effects
- Increased fire risk; and
- Indirect impacts.

Habitat loss and fragmentation through vegetation clearing has been previously addressed within the preceding sections. The other impacts and the mitigation methods that will be adopted to manage and control them is discussed within the following sections.

7.4.5.1 Displacement of Flora Species from Invasion of Weed and Pest Species

Weed and pest species have the potential to impact on terrestrial biodiversity as native species can become displaced through predation and competition with exotic biota. Pest species can also damage native vegetation by grazing and trampling.

Five (5) non-native weed species have been recorded within the Project Footprint. Of these, one (1) weed species (Bridal Creeper) is a listed WONS and a Declared Weed under the LSA Act. Without appropriate management strategies, the Project activities have the potential to disperse weeds into areas of remnant vegetation where weed species are currently limited or occur in low densities.

Project activities also have the potential to introduce new weed species into the Project Site and surrounding area. The most likely causes of weed dispersal and introduction associated with the Project include earthworks, movement and disturbance of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases. Weed dispersal by vehicles along access tracks and roads is a key source of weed invasion (Birdsall et al 2012). Weed invasion is an indirect impact that may degrade the quality of habitats, potentially resulting in habitat loss.

Soil disturbance during construction may increase the risk of invasion from weed species, which can further reduce habitat quality and compromise the integrity of adjacent areas of native vegetation.

Exotic flora species were observed as sparsely present during the baseline field survey. As the vegetation condition of the Project Footprint is of a relatively high quality with low weed invasion it will be important to ensure exotic weed species are not spread and brought onto site during all phases of the Project. The potential for habitat modification from weed invasion resulting from the Project is highest where Project activities take place in areas of high-quality vegetation condition, such as those identified as containing intact remnant vegetation that currently has low weed diversity and abundance.

Mitigation methods will be applied to all project activities to minimise the potential for the displacement of flora species through the invasion of pest and weed species. These will cover all project phases. The mitigation strategies and methods within each respective project phase are detailed as follows:

<u>Detailed Design Phase:</u>

- A Weeds and Pests Sub-plan will be developed as a component of the CEMP and OEMP in accordance with the Development Act, the NV Act and relevant LSA board recommendations.
- The Weeds and Pests Sub-plan will ensure weed control methods for threatened species will be done in accordance with the relevant Recovery Plan for the species (i.e., the Western Whipbird (eastern) National Recovery Plan).

Pre-construction/Construction Phase:

- Undertake a weed survey within and immediately adjacent to the construction impact zone prior to construction commencing, to understand existing weed conditions and potential impacts (e.g., spread) during construction.
- Remove or destroy all WONS and Declared and/or environmental weeds located within the construction impact zone, prior to construction commencing.
- Undertake weed control such as (but not limited to) slashing, spraying, or physical removal, prior to the weeds setting seed. Ensure weed control methods within threatened species habitat areas are in accordance with the relevant National Recovery Plan for the species.
- Display a fact sheet on Declared and environmental weeds known to occur within the construction impact zone, on site notice boards and in lunchrooms.
- Ensure all vehicles and construction equipment are clean and free of soil material containing weed seed or propagules, prior to arriving on site. If vegetative material or earth is present, ensure that the equipment is taken away and washed down at an appropriate facility to prevent vegetative material or earth potentially containing weed seeds being brought into the site.
- Install a designated wash-down bay to clean vehicles and construction equipment during construction works and prior to leaving site.
- Ensure all earthmoving equipment is clean and free of soil material prior to commencing earthworks within known threatened species habitat.
- Ensure all fill materials (e.g., sand, aggregate) imported to site are sourced from weed and pathogen free sites.
- Locate stockpiles of clean, weed free soil or fill material away from areas of weed infestation.
- If stockpiling of weed infested material is required, ensure it is stored on a constructed hardstand and separated from clean, weed free materials.
- If soil or fill material stockpiles become infested with weeds, undertake weed control (spray with herbicide) as soon as practicable and at least 10 – 14 days prior to moving material.
- Store construction vehicles and equipment on constructed hardstands, away from areas of weed infestation.

Operation Phase:

- Prevent establishment of new weed species and/or infestations during the operational phase by implementing standard hygiene practices when bringing equipment, vehicles and other materials which have the potential to harbour weed seed or propagules, onto the site (e.g., for maintenance purposes) and by practicing minimal disturbance methods.
- Conduct an annual survey to identify and monitor the location, extent, and abundance of weed species, particularly WONS and Declared weed species.

7.4.5.2 Edge Effects

Edge effects refer to the changes in environmental conditions (e.g., altered light levels, wind speed, temperature) that occur along the edges of habitats. These new environmental conditions along habitat edges can promote the growth of different vegetation types (including weed species) (Moenting and Morris 2006). No threatened flora species protected under the EPBC Act and NPW Act have been identified within the Terrestrial Biodiversity Assessment (**Appendix P**) as likely to be potentially impacted by edge effects.

The Project may create edge effects resulting in habitat degradation and a reduction of the habitat available for a range of flora species through the expansion of access tracks and clearance for the launch pads. Within the Project Site, the vegetation patches are large and have generally not been disturbed from previous clearance or edge effects. There are some areas that have had minor disturbance through the construction of access tracks, cleared areas and infrastructure for tourist activity the Whalers Way.

Native vegetation that is not cleared for the Project will be protected and managed as part of the CEMP and OEMP that will include a series of management measures. Additionally, the protection afforded to the existing vegetation by way of the Heritage Agreement will continue unaffected by the proposal, with the proposal only seeking to relocate existing areas currently exempt from the agreement.

Mitigation methods will be applied to all project activities to minimise the potential for impact on flora through edge effects. These will cover all project phases. The mitigation strategies and methods within each respective project phase are detailed as follows:

Detailed Design Phase:

- The Project Footprint is sited to use existing access tracks and low vegetated areas wherever possible. The footprint has been aligned to be co-located to limit the amount of native vegetation and fauna habitat to be cleared. This will minimise the creation of new edges and the related potential impacts to surrounding vegetation and habitat.

Pre-construction/Construction Phase:

- Use vegetation clearing methods that encourage natural regeneration of rootstock, minimise land disturbance and maintain soil stability.
- Apart from initial earthworks to construct access tracks and hardstand areas, ensure all vehicles and construction equipment always utilise dedicated access tracks and hardstands within the Project Area and do not travel outside of these areas.
- Construct windrows (small soil berms) on the edge of access tracks and hardstands to delineate the boundary and prevent vehicles and construction equipment damaging vegetation beyond the construction impact zone.
- Ensure all physical flora control measures, such as windrows, signage and exclusion barriers/bunting are checked and maintained on a regular basis (weekly as a minimum).
- Where construction work (e.g., excavation) is required beneath the canopy of a tree, ensure that it is carried out carefully and by hand to avoid damage by equipment.
- This is to be guided by best practice and, where relevant, as per Tree Protection Zones detailed in *AS4970 2009 Protection of Trees on Development Sites*.
- Do not disturb the ground beneath the canopy of any tree that is not in the approved clearance footprint and ensure that vehicles, construction equipment, materials or waste are not located beneath the canopy of any tree.
- Undertake a weed survey within and immediately adjacent to the construction impact zone prior to construction commencing, to understand existing weed conditions and potential impacts (e.g., spread) during construction.
- Remove or destroy all WONS and Declared and/or environmental weeds located within the construction impact zone, prior to construction commencing.
- Undertake weed control such as (but not limited to) slashing, spraying, or physical removal, prior to the weeds setting seed. Ensure weed control methods within threatened species habitat areas are in accordance with the relevant National Recovery Plan for the species.

Post Construction Phase:

- All disturbed land will be rehabilitated to achieve stable and sustainable conditions of soil cover and vegetation.
- Revegetation is to occur through natural regeneration as well as through assisted planting to create a vegetated buffer between the disturbance footprint and adjacent values. Plantings (tube stock and seed) to consist of native species analogous to adjacent vegetation community.

Operation Phase:

- Maintenance activities and refuelling must be carried out a minimum of 50 metres from vegetation, with appropriate interception measures in place to avoid impacts.
- Ensure all physical control measures, such as windrows, sediment fencing, signage and exclusion barriers/bunting are checked and maintained on a regular basis (weekly as a minimum).

7.4.5.3 Effects of Dam and Detention Basins

Detention basins will be located at Launch Site A and Launch Site B and a 30 megalitre capacity dam is to be located at Infrastructure Site D. There is the potential impact that these water bodies will increase the presence of weeds. The detention basins will be lined with a polymer lining and a chain mesh fence will be installed around all the three (3) water bodies. Additionally, the basins will have top liners to limit their attractiveness to animals. Weed control will be a regular mitigation measure during the construction and operational phase of the Project as detailed in **Section7.4.5.1**. These mitigation measures will ensure pest and weed species are prevented from establishing around the water bodies.

7.4.5.4 Irrigation Effects

The major threat irrigation poses to the environment is increased salt content in the soil which leads to decline in nutrients in soils and loss of habitat for native flora and fauna species. Irrigation also modifies vegetation structure and composition and may facilitate weed invasion and may increase local herbivory. Irrigation for the Project is subject to the detailed design phase and an irrigation management plan and water quality monitoring program will be developed to manage irrigation for the Project.

All irrigation will occur within the Project Footprint. Irrigated areas will be surrounded by gravel areas with a minimum buffer zone of 23 metres from native vegetation at one (1) point with most irrigation having a gravel/asphalt buffer zone of greater than 30 metres from native vegetation.

The Project will limit the landscaping from a flora perspective using species growing in situ only where possible. Any disturbed topsoil from top 200 millimetres during construction will be stockpiled in low windrows until construction complete and then used to recover areas post hard landscaping to promote natural regeneration including sticks, litter, and detritus. This material carries necessary seedbank, fungal and mycorrhizal material to allow for natural germination of indigenous species.

Through the implementation of these design considerations and mitigation measures, the risks irrigation pose can be managed adequately.

7.4.5.5 Increased Fire Risk

An increase in fire frequency is likely to disrupt the life cycle of flora and fauna and often results in a change in vegetation structure which includes loss of fallen timber and stags and is often followed by an increase in shrub density. While many Australian flora species have developed mechanisms to cope with fire in the landscape, frequent fires will decrease the resilience of the plant communities. Some flora species may be burnt before they are mature enough to seed thus reducing the diversity of the vegetation community which in turn can further reduce its habitat quality. Excessively hot fires also have the potential to sterilise the ground by killing the seedbank and further altering the vegetation structure.

The loss of fallen timber and stags decreases habitat availability for many native species and is likely to increase stress and resource pressure on fauna species. The loss of these habitat features may also increase the risk of predation of species by both native and introduced fauna.

The Project may increase the risk of fire due to hot works during construction activities and the chance of sparks occurring off the rocket launches during times of hot and dry conditions.

Mitigation methods will be applied to all project activities to minimise the potential for impact on flora through increased fire events. These will cover all project phases. The mitigation strategies and methods within each respective project phase are detailed as follows:

- Firebreaks incorporated along fences to protect and mitigate one (1) of the primary threats to species present.
- All buildings and facilities are sited within the Project Footprint to achieve suitable clearance from vegetation for fire mitigation purposes. The siting of all buildings and facilities within the Project Footprint achieves the minimum fire clearance requirements under the National Construction Code.
- Assembly Building, Fuel Pad and Oxidiser pad will have firefighting services as per legislative requirements.
- Adequate water supply for firefighting will be available at each site including water stored in 25,000 litre tanks at initial stages and then significant water supply through the dam and detention basins once established.
- Bush fire risks will be mitigated through the installation of firefighting equipment at every launch event. Initial firefighting capabilities during rocket launch attempts will be augmented by local Country Fire Service (CFS) crews. Sufficient water will be located onsite to successfully control and contain any unexpected fire. There will also be a fire truck on site during launches.

7.4.5.6 Indirect Impacts

Potential indirect impacts the Project may have on terrestrial ecology values have been detailed above. Through progressed design buffers have been applied in the Project Area footprints of each facility and tracks to limit indirect impacts to vegetation in the vicinity.

All vegetation within the Project Area has had an additional 5.0 metre clearance buffer applied to the Project Footprint. The buildings and infrastructure are all located within minimum 5.0 metre setback from the Project Footprint boundary, in some instances up to 20 metres from the boundary dependant on the form of batters.

All roads have a 3.0 metre buffer applied to each side of the road however this may be utilised as 6.0 metres on one (1) side of the road as part of upgrades or alternatively as the buffer is stated, dependent on the bends in roads and terrain encountered. This is also provided to allow for the addition of power and water easements, the construction method and infrastructure type are not finalised at this stage.

7.4.6 Guideline 2.6

2.6. Outline any compensatory activities proposed, making reference to guidelines produced by the Native Vegetation Council.

A Significant Environmental Benefit (SEB) is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that a SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

The SEB obligation is quantified by multiplying the geographical area in hectares by the Unit Biodiversity Score (UBS). In this case, the total maximum area of clearance is 23.76 hectares. The individual hectares represented by each vegetation association is multiplied by the UBS, resulting in subsequent points of loss and overall hectare requirement.

The resulting calculation indicated 1312.94 SEB points in total. The overall SEB requirement calculated by Southern Launch for this project currently stands at $915,078.45 plus an administration fee of $50,329.31. The total SEB payment as calculated is $965,407.76. Southern Launch will either provide a SEB in the form of an inground offset provided by SEB credit providers within the region, or through payment of the required fee.

It is noted that a Heritage Agreement (HA) which protects vegetation for conservation currently applies to the areas of vegetation to be cleared. In most circumstances, when applying for clearance of protected areas SEB calculation would be subject to loading and the size of the SEB would be increased. Loading has not been applied to the SEB calculation in this instance.

The HA will be varied prior to clearance occurring so that these areas are exempt from protection under the agreement.

It is acknowledged that the cleared areas have been protected for some time (30 years); however, those areas presently exempt from the HA have typically been managed to the same standard as those that are not exempt throughout that period. Under the proposed arrangement the presently exempt areas will be included in the HA, and the exemption will apply to the Project Footprint. This arrangement will ensure that the size of HA and the condition and quality of vegetation within the HA will remain equivalent to that at the present time.

Further details of the SEB offset program developed in accordance with NVC is outlined in Section 8.2 of **Appendix P**.

7.4.7 Guideline 2.7

2.7. Identify the potential impact of fire on native vegetation, and the effects of fire risk management processes during both construction and operation.

As discussed in **Section 7.4.5.5**, an increase in fire frequency is likely to disrupt the life cycle of flora and often results in a change in vegetation structure which includes loss of fallen timber and stags and is often followed by an increase in shrub density. While many Australian flora species have developed mechanisms to cope with fire in the landscape, frequent fires will decrease the resilience of the plant communities.

Fire protection mitigation measures include:

- Firebreaks incorporated along fences to protect and mitigate one (1) of the primary threats to EPBC listed species present.
- All buildings and facilities are sited within the Project Footprint to achieve suitable clearance from vegetation for fire mitigation purposes. The siting of all buildings and facilities within the Project Footprint achieves the minimum fire clearance requirements under the National Construction Code Assembly building, Fuel Pad and Oxidiser Pad will have firefighting services as per legislative requirements.
- Bush fire risks will be mitigated through the installation of firefighting equipment at every launch event. Initial firefighting capabilities during rocket launch attempts will be augmented by local Country Fire Service (CFS) crews. Sufficient water will be located onsite to successfully control and contain any unexpected fire. There will also be a fire truck on site during launches.
- Adequate water supply for firefighting will be available at each site including water stored in 25,000 litre tanks at initial stages and then significant water supply through the dam and detention basins once established.
- Fire risk management processes are to be incorporated into a CEMP and OEMP.

7.4.8 Guideline 2.8

2.8. Describe the location, extent, condition and significance of native vegetation species and communities in the marine environment within the impact area of spent (discarded) launch vehicles.

7.4.8.1 Location, Extent and Condition of Marine Vegetation

The benthic marine ecology is described in Section 2.3 of the Marine Ecological Assessment prepared by J Diversity (**Appendix S)**.

J Diversity (2021) indicated that the majority (80 per cent) of the subtidal habitats in the Thorny Passage Marine Park have not been mapped (Bryars et al. 2016). Using broad scale (1:100,000) mapping with satellite imagery, J Diversity (2021) has identified that the western and southern coasts of Whalers Way is surrounded by granite reef for 200 to 700 metres offshore, with sand beyond the reef on the western coast, and unmapped area on the southern coast (DEWNR 2015e, Edyvane 1999).

J Diversity (2021) outlined the findings of dive surveys by Shepherd et al. (2005) at Redbanks, which encountered both granite and calcareous reef, dominated by large brown canopy-forming macroalgae including common kelp and a variety of species from the order of Fucales. It was also noted that Granite reef has been mapped adjacent to the western and south-eastern shore of Liguanea Island, and around the mainly submerged rock south of the island.

Importantly, J Diversity (2021) noted that the red macroalga *Erythrotrichia ligulata*, recorded 1.0-kilometre south-west of Cape Carnot, has been classified as Vulnerable by Cheshire et al. (2000) due to the few records (three (3)) in southern Australia.

The benthic habitat below the intertidal bedrock platforms on the eastern coastline of the Whalers Way site has been mapped as sand (DEW 2020a, Edyvane 1999). No seagrass has been mapped but has been observed immediately adjacent to the intertidal habitats around Whalers Way (DEW 2020d).

7.4.8.2 Impact of Spent (Discarded) Launch Vehicles on Marine Vegetation

Rockets are constructed predominantly from inert materials including carbon fibre with some metal, including aluminium, stainless steel, and titanium, and would not result in negative impacts on ocean water quality. There may be batteries of similar volume to several car batteries, which would be expected to have minor, localised impact.

Casings that have not already broken up during re-entry would generally shatter into thousands of pieces on impact with sea surface, with the possible exception of some thick carbon fibre components. All fragments would sink, with the possible exception of some small pressure vessels, which would be expected to have negligible impact.

Early termination of a flight may result in the immersion of some amount of unspent solid propellant. Due to the low toxicity of the fuel and its rapid dissociation on contact with water, toxic concentrations would be short term (*Brown & Root 1996, FAA 2016*).

No significant impact on marine vegetation is expected from spent (discarded) launch vehicles.

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8 NOISE & VIBRATION IMPACTS

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8.0 NOISE AND VIBRATION IMPACTS

8.1 Summary

The EIS assessment requirements and guidelines acknowledge that the WWOLC project has the potential to disturb fauna, nearby residents, and visitors through the creation of noise and vibration impacts. The guidelines require analysis to be undertaken to demonstrate what noise and vibration impacts will result from the WWOLC and how these impacts will be mitigated and managed.

Noise and vibration have the potential to adversely affect wildlife, humans, heritage structures, sensitive habitat and infrastructure located near noise generating activities. To determine and test the likely noise impacts resulting from the proposal AECOM have prepared a Noise and Vibration Assessment (2020).

These predicted noise levels and likely impacts are documented in the Noise and Vibration Assessment (**Appendix O**), which models the noise and vibration levels likely to be produced by the Project and addresses the impacts on the human population, and the Terrestrial Ecological Assessment (**Appendix P**), which addresses the noise and vibration impacts to wildlife.

These assessments analyse the potential noise and vibration impacts on sensitive receptors and the existing environment. Sensitive receivers including conservation-significant fauna and residential dwellings (approximately 2.8 kilometres separated from the nearest project related site which will generate material noise and vibration impacts) have been identified to occur within the survey area.

The following map excerpt from AECOM's report (**Appendix O**) shows the Project Footprint and the proximity of identified sensitive receivers:

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FIGURE 8.1

UNATTENDED NOISE MONITORING LOCATIONS & RESIDENTIAL RECEPTORS

SOURCE: AECOM

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These two (2) respective investigations by AECOM have been considered in this is assessment section in response to the EIS Noise and Vibration Impact Guidelines (6.1 to 6.8) and Assessment Requirement 6.

These investigations utilise a number of acronyms in respect to different noise level quantifications that are used within the discussion herein. For ease of reference these acronyms are outlined in **Table 8.1** as follows:

Table 8.1: Glossary of abbreviations and acronyms used in respect to noise levels.

TERM	DEFINITION
dB	Decibel – the measurement unit of sound.
dB(A)	Decibel (A-weighted) - an expression of the relative loudness of sounds in air as perceived by the human ear.
dB(L)	Decibel (Linear weighted) – a sound level frequency weighting, linear over a frequency range.
L_{Aeq}	Ambient noise – all noise at a certain point from all noise sources far and near.
L_{90}	Background level – the underlying noise level present in the ambient noise when extraneous noise is removed.
L_{A90}	Arithmetic average background level – average background levels for each hour during a period of the day during which an activity typically operates.
L_{eq}	Equivalent (energy average) noise level measured over a time period – A noise descriptor commonly used in environmental noise policies and assessments. The relevant time period is often included in the subscript (i.e., $L_{eq,\ 30min.}$).
L_{max}	The maximum sound level recorded over the measurement period.
L_{Amax}	The maximum A-weighted (dB(A)) sound level recorded over the measurement period.
SEL	Sound Exposure Level – a measure of the total acoustic energy transmitted to the listener during an event.

8.2 Methodology

8.2.1 Noise and Vibration Assessment (Appendix O) Methodology

The Noise and Vibration Assessment conducted by AECOM detailed the likely noise and vibration that will be generated by the WWOLC and considered the potential impact this presents on human populations. The impact on fauna was not considered and has been considered separately by AECOM and J-Diversity in the ecological studies for the proposal.

The methodology adopted by AECOM in this assessment was undertaken in the following stages:

- Baseline conditions: Overview of the Project study area, sensitive receptor locations and baseline noise levels.
- Assessment criteria: A summary of the acceptable noise and vibration limits (criteria) set out in relevant policies and guidelines.
- Impact assessment: Desktop assessment to determine likely construction and operational impacts.
- Mitigation measures: Description of mitigation measures to be used where impacts are predicted to exceed the noise and vibration criteria.

These various stages of assessment and the methodology that was adopted within each stage is summarised **below**. This summary does not extend to the findings of these investigation and instead outlines the approach only.

8.2.1.1 Baseline Conditions

Baseline conditions assessment was used to identify where sensitive receptors are located relative to the proposed Project Footprint and to characterise the existing acoustic environment within the study area. A study area up to 5.0 kilometres from the Project Allotment was considered appropriate. Sensitive receivers were identified using site investigations and desktop analysis. Unattended noise monitoring was undertaken at five (5) sites within the survey area for a period of up to two (2) weeks to quantify the existing noise environment at these locations.

8.2.1.2 Assessment Criteria

Relevant policy, guidelines and legislation was reviewed to establish the parameters for acceptable and unacceptable noise and vibration criteria. These criteria were used to assess the impacts for construction activity, day-to-day operations, and launch and testing activities. Noise and vibration criteria guidance was derived from various policy and legislative instruments and local, national and international standards, including the following:

- South Australia, *Environment Protection Act 1993*.
- South Australia, *Environment Protection (Noise) Policy 2007*.
- Australian Standard 2436-2010 Guide to noise and vibration control on construction, demolition, and maintenance sites.
- Australian Standard AS 2187.2-2006 Explosives – Storage and use Part 2: Use of explosives.

- United States Federal Aviation Administration (FAA), 14 CFR Part 150 - Airport Noise Compatibility Planning.
- British Standard 5228-1:2009 Code of practice for noise and vibration control on construction and open sites –Part 1: Noise.
- DIN 4150-3, 2016 Edition, December 2016 - Vibrations in buildings - Part 3: Effects on structures.

8.2.1.3 Impact Assessment

The AECOM study assessed the noise and vibration impacts of activities in the construction and operational phases of the Project. The approach to the impact assessment for both the construction and operational phases followed these steps:

- Identification of sensitive receptors likely to be impacts within the study area.
- Determination of the source, location, duration, and timing for activities that may cause an impact.
- Calculation of the level of noise or vibration produced by each activity at the identified sensitive receptors.
- Comparison of the predicted noise levels to the assessment criteria relevant to each activity.
- Recommendation of conceptual mitigation methods for managing noise and vibration impacts that may exceed the assessment criteria.

The methodology and assumptions used for the impact assessment have been documented below:

- Construction.
  - noise from construction activities was calculated assuming geometric spreading of sound from each noise source. This method was used to highlight if there are sensitive receptors within proximity that could be affected; and
  - vibration levels during construction were predicted using empirical formulae that accounts for the distance between vibration source and receptors.
- Operation (supporting infrastructure):
  - for the purpose of the assessment the noise and vibration impacts associated with supporting infrastructure (day-to-day operations) and the launch and testing infrastructure were modelled and assessed separately from launch and testing activities;

- noise emissions from key supporting infrastructure, plant, equipment, and activities were based on international standards and the AECOM noise source data base;
- noise propagation calculations were performed assuming simple geometric spreading of sound from each noise source; and
- assumptions were made where necessary in terms of estimations of the noise level, location, duration, and expected operation of noise sources.

• Operation (launch and testing):

- environmental noise levels produced by the engine and exhaust during launches and rocket testing events were predicted using the RUMBLE computer modelling package developed by Blue Ridge Research and Consulting;
- RUMBLE is an acoustic simulation model designed to evaluate the effects of noise from commercial space rocket launch activities. The primary objective of RUMBLE is to assist the user in responding to questions of the environmental consequences associated with noise from commercial rocket launches; and
- A literature review was undertaken to determine the risk of adverse behavioural or physiological effects on sensitive receptors from sonic booms based on the location and intended direction of the launches. A sonic boom is caused by launch vehicles reaching velocity faster than the speed of sound (supersonic).

The WWOLC proposal is a novel form of development which has not occurred previously in Australia and has only occurred in a very limited number of locations across the world. No literature exists on the effect rocket launch noises have on the specific fauna found at the tip of the Eyre Peninsula.

The investigation relies on computational models to predict the noise and vibrations generated during a rocket launch event and ecological studies have subsequently considered the effect these modelled impacts would likely have on the local fauna species. The computational models for noise and vibration assessment are not specifically orientated to rocket launches and therefore have limitations in their applicability, which has been compensated for by adding additional layers of conservatism to the models.

8.2.1.4 Mitigation Methods

The Project design, construction methodology and operation strategies were progressed at the commencement of this impact assessment. Accordingly, mitigation measures that were already incorporated in the Project planning were considered within the assessment. These include:

• Construction noise management.

• Water deluge system.

• Blast wave bunding.

8.2.2 Terrestrial Ecological Assessment (Appendix P) Methodology

The Terrestrial Ecological Assessment prepared by AECOM considered the potential impacts on native fauna from noise and vibration generated by WWOLC. The predicted noise and vibration levels identified in the Noise and Vibration Assessment (**Appendix O**) were utilised and the effect these impacts may have on local wildlife populations was considered.

The approach adopted by AECOM in this investigation comprised of two (2) key steps, a terrestrial biodiversity assessment (to determine the wildlife populations likely to be present in the area), and an impact assessment (assessment of the significance of likely noise and vibration impacts on these wildlife populations). The processes undertaken within these two (2) key steps is identified below:

8.2.2.1 Terrestrial Biodiversity Assessment

This comprised of a desktop assessment of the site using various public resources and additional site-specific background documents and previous investigation reports in order to develop a baseline understanding of species that may inhabit the area.

A likelihood of occurrence assessment was then undertaken for all threatened species and communities that were identified in the desktop assessment. This considered the presence of suitable habitat, sighting records, the date of records, and location proximity to the Project Site. The likelihood of occurrence findings was updated following site surveys.

A series of field surveys, comprising of both general and targeted surveys were undertaken between the following dates: 16, and 19 of March 2020; 22 and 24 June 2020; and the 13 and 15 October 2020. These were led by a Native Vegetation Council (NVC) accredited ecologist, who was assisted in each survey by different assistants with various expertise, including an Environmental Scientist (March Survey), Ornithologist (June Survey), and another NVC accredited ecologist (October Survey). The primary purpose of the surveys was to search of the Project Footprint for threatened species and consisted of the following:

- Targeted searches:
  - targeted searches were conducted for threatened fauna species that were considered likely to occur in the Project Footprint;
  - a ramble survey method was used (i.e., walking through areas of vegetation to cover different topography and habitats); and
  - when threatened species were identified a GPS location and observations were recorded.
- Targeted Fauna Bird Survey:
  - this targeted survey focused on two (2) species of conservation significance, the Southern Emu-wren (Eyre Peninsula) and the Western Whipbird (eastern);

- the methodology involved walking through the preferred habitat and listening for calls or physical signs of the species. If a call was heard or brief sightings, judicious use of call playback applications were used to confirm the sighting;
- the Southern Emu-wren (Eyre Peninsula) assessment was undertaken as a broadscale assessment, covering an area of approximately 350 hectares over three (3) days; and
- the Western Whipbird (eastern) are incredibly difficult to observe by sight but have a highly unique and unmistakeable call. As such, these species were recorded by call, detecting their presence through recording occurrences of their distinctive song, and logging the location.

8.2.2.2 Assessment of Potential Impacts

The impact assessment considered a full range of potential impacts on terrestrial wildlife that may be generated by the WWOLC across all project phases. Noise and vibration impacts were one (1) of the impacts considered. The analysis conducted considered:

- wildlife response to noise;
- wildlife impacts during construction;
- wildlife impacts during operation;
- exposure to shockwaves;
- underwater impacts; and
- ground vibration.

Impacts on specific threatened species known or likely to occur within the Project Footprint were also considered, including:

- Australian Fairy Tern (Vulnerable);
- Western Whipbird (eastern) (Vulnerable); and
- Southern Emu-wren (Eyre Peninsula) (Vulnerable).

Various noise and vibration impact management and mitigation measures that could be applied are outlined within Section 8 of **Appendix P**. Additionally, specific consideration was given to the EIS assessment guidelines relevant to noise and vibration impacts on terrestrial wildlife. Each guideline was addressed individually within a matrix which outlined the relevant assessment guidelines and the Project response/justification.

8.3 Relevant EIS Guidelines

Assessment Requirement 6: *The proposed development has the potential to disturb fauna, nearby residents, and visitors through the creation of noise and vibration impacts.*

6.1. Detail the predicted levels of environmental noise and vibration associated with construction and operation of the proposed development, identifying all potential noise and vibration sources, and assessing the impact upon sensitive receivers in the immediate and wider locality (including residents, visitors, marine fauna, terrestrial native animals and livestock, and avifauna including migratory species).

6.2. Provide information on the anticipated frequency of launch events, initially and into the future. Include information regarding individual launch events and predicted noise and vibration impacts to be generated.

6.3. The location of noise and vibration sensitive receivers should be identified on an appropriately scaled plan.

6.4. Information, including noise contours from a suitable acoustic model, should be provided for all significant noise generating activities when operating under worst case meteorological conditions.

6.5. Describe current background noise and vibration levels at sensitive receivers and changes to these levels as a result of the project (during both the construction, maintenance, and operational phases). Sufficient data should be gathered to provide baseline information for comparison with any future monitoring undertaken during the construction and operational phases. Details of any noise or vibration monitoring undertaken should be incorporated.

6.6. Detail the predicted noise levels against the Environment Protection (Noise) Policy 2007 and section 25 of the Environment Protection Act 1993 at the nearest noise sensitive receivers when operating under worst case meteorological conditions.

6.7. Identify what reasonable and practicable measures will be used to minimise impacts from noise and vibration and assess their effectiveness. Details of how any such measures will be monitored, audited, and managed should be included.

6.8. Identify the potential impact of noise and vibrations on native fauna (terrestrial and marine), and the mitigation and monitoring strategies during both construction and maintenance.

8.4 Analysis

8.4.1 Guidelines 6.1 and 6.6

6.1.	*Detail the predicted levels of environmental noise and vibration associated with construction and operation of the proposed development, identifying all potential noise and vibration sources, and assessing the impact upon sensitive receivers in the immediate and wider locality (including residents, visitors, marine fauna, terrestrial native animals and livestock, and avifauna including migratory species).*

6.6.	*Detail the predicted noise levels against the Environment Protection (Noise) Policy 2007 and section 25 of the Environment Protection Act 1993 at the nearest noise sensitive receivers when operating under worst case meteorological conditions.*

The discussion below details the potential noise and vibration sources for this project across all stages, the likely noise and vibration levels to be produced from these sources and the likely impact this will present on animal and human populations within the area (specifically birds and nearby residential dwellings). The potential for noise impacts on marine fauna is addressed in **Section 9.0** and **Appendix S**.

8.4.1.1 Sources of Noise and Vibration

The potential noise and vibration sources have been detailed under various project scenarios comprising of:

- construction noise;
- operation of supporting infrastructure;
- operation of launch vehicles; and
- sonic booms.

Construction Noise and Vibration

Noise levels at various distance intervals from a number of construction-associated activities is detailed within the Noise and Vibration Assessment (**Appendix O**). The noise producing construction activities include:

- site preparation;
- utility construction (including ground compaction);
- foundations;
- structural works;

- testing and commissioning; and
- roads, landscaping, and reinstatement.

Vibration levels for various construction activities is also considered within the AECOM assessment. The types of vibration-intensive construction activities considered, include:

- drop hammer;
- excavation;
- hydraulic jacking rig;
- pile boring; and
- vibratory rig.

For a full list of vibration-intensive construction activities refer to page 34 – 35 within **Appendix O**. Vibration impacts are expected to be contained to construction activities.

Operation of Supporting Infrastructure

Noise levels at various distance intervals from the activities associated with the operation of supporting infrastructure is detailed within the Noise and Vibration Assessment (**Appendix O**). The key noise generating activities associated with this project scenario included:

- Building generators;
- Workshop activity;
- Truck movements; and
- Lifting crane.

Operation of Launch Vehicles

Noise during testing and rocket launch events can be attributed to the engine and exhaust noise produced during launch functions.

Ground vibration during launches is expected to be limited to the launch sites and the buildings supporting the launch. No evidence of damage or significant disturbance through ground vibration was identified during a literature review on typical launch and testing impacts.

Sonic Booms

A sonic boom occurs when a rocket reaches a velocity faster than the speed of sound (supersonic). Air overpressure and noise are products of a sonic boom. Air overpressure is often perceived by humans and animals as ground vibration as it can cause windows to rattle and other building elements to shake. The audible component of a sonic boom may sound similar to a distant thunderclap.

8.4.1.2 Noise and Vibration Levels and the Impacts on Sensitive Receivers

Construction Noise Levels and Impacts

It was determined that the construction activity with the greatest potential to impact on sensitive fauna and human settlements was utility construction, with ground compaction being the noisiest feature within these works.

In respect to human impacts, the noise levels likely to be experienced at the nearest residence to the site during utility construction are calculated to be less than 51 dB(A). These levels are compliant with the noise criteria under the *Environment Protection (Noise) Policy 2007* (Noise EPP). All works will be conducted between Monday and Saturday between the hours of 7:00 am to 7:00 pm, during which times no noise limits apply under the Noise EPP.

In respect to impacts on wildlife, typically noise levels above 93 dB(A) could potentially result in temporary hearing loss, auditory fatigue, masking of environmental noise, and behavioural and/or physiological effects in birds. This results in a temporary shift in the auditory threshold known as a temporary threshold shift, where the birds ear sensitivity will decrease as a measure of protection. Ground compaction during utility construction is expected to exceed 93 dB(A) at distances approximately 10 – 20 metres from the works.

At a greater distance from the works (approximately 1.0 kilometre), it is expected that construction noise levels may be up to 20 dB above the ambient noise level. Continuous noise at 20 dB above background levels may temporarily mask the detection and discrimination of vocal communication signals between birds.

Potential behavioural and/or physiological effects are noted as possible in any case where construction noise is audible. This includes both construction activities that produce short bursts of impulsive noise and the continuous noise.

It would be impossible to reduce construction noise to an inaudible level. However, construction noise impacts can be minimised by limiting the intensity and duration of high impact activities near sensitive wildlife in the area where possible. Construction activity will be managed in accordance with the Construction Environment Management Plan (CEMP) to ensure impacts are managed as far as practical using the management measures outlined (refer to **Section 23** and/or **Appendix AD**).

Operational (Supporting Infrastructure) Noise Levels and Impacts

Building generators are the loudest component of the supporting infrastructure and would produce a noise level of 62 dB(A) at a distance of 25 metres from the site of the generator, reducing at various intervals to a level of 20 dB(A) at 1.0 kilometre from the site of the generator.

In respect to human impacts, the closest residential dwelling is more than 2.3 kilometres away from the infrastructure site (Site D). As such, operational noise from supporting infrastructure will likely be inaudible at the nearest residential dwelling to the site.

In respect to impacts on animals, a noise level of 62 dB(A) within 25 metres of the building generator is below the continuous noise level threshold of 93 dB(A) for causing temporary threshold shifts in birds. It is considered therefore that the risk of operational noise impacts from supporting infrastructure is minimal and would be limited to the temporary masking of communication signals and/or a brief behavioural response.

In addition to fixed supporting infrastructure, truck movements within the site will also produce noise. It is assumed at this stage that 16 truck movements per week can be expected. The maximum (L_{Amax}) noise produced by a single truck is approximately 85 dB(A) at ten (10) metres from the vehicle. Noise levels produced by truck movements is also unlikely to cause temporary threshold shifts in birds and is unlikely to be audible or cause significant noise impacts at the closest residential dwelling.

Operational (Launch Vehicles) Noise Levels and Impacts

Noise from launches and testing will temporarily alter the quiet setting of the natural environment for one (1) to two (2) minutes during launches and for up to 15 seconds during testing. These events have the potential to disturb nearby residents and wildlife.

The likely noise levels experienced at the closest residential properties, is detailed in **Table 8.2** below. This assessment should be considered conservative as the noise levels produced by the smaller rockets (i.e., quieter) planned for use at the Southern Launch have not been considered for these worst-case scenarios.

Table 8.2: Noise levels from launches at nearby residences

LOCATION	LAUNCH FROM SITE A		LAUNCH FROM SITE B		DAY-NIGHT AVERAGE SOUND LEVEL (DNL)
	L_{Amax}	SEL	L_{Amax}	SEL	
Residence A	95	112	99	116	63
Residence B					
Residence C					

The United States Federal Aviation Administration (FAA) uses the Day-Night Level (DNL) to describe the daily noise energy exposure based on annual aviation activities. FAA defines a "significant impact" due to aviation noise as a noise level greater than a DNL of 65 dB(A) at a sensitive location.

At the ultimate operating scenario, the proposed WWOLC facility will host in the vicinity of 36 yearly launches. The cumulative noise exposure is 63 DNL, satisfying the DNL 65 dB(A) assessment criteria applied by the FAA. The achievement of this indicates that the overall level and frequency of the planned Southern Launch activities is unlikely to cause a significant impact on human settlements in the area.

Maximum external noise levels (L_{Amax}) of up to 95 dB(A) and 99 dB(A) were calculated outside the residential property nearest to Launch Site A and Launch Site B respectively. At this level it is likely that a rocket launch would cause some annoyance and disturbance. It is also noted that at this stage of the Project it is proposed that a rocket could be launched at any time over a 24-hour period.

During the evening and night, the internal levels within a typical residential building during a launch would likely be high enough to disturb sleep. Noise during a day launch or test may also be at an annoying outdoor level for a brief period (less than one (1) minute). For context, a comparable level of sound could be experienced by standing close to a train pass by or below an aircraft flyover at low altitude.

Rocket launch and testing events also have the potential to disturb and cause an adverse physiological or behavioural impact on the wildlife located in the local habitat. Noise from launches and stationary rocket testing are predicted to temporarily alter the quiet setting of the natural environment with noise briefly above the measured ambient level at distances further than 5.0 kilometres from the launch.

The Southern Emu Wren (Eyre Peninsula), Western Whipbird (eastern) and other protected species that inhabit the areas close to the launch site are at greatest risk of increased stress, adverse behaviour reactions and physiological impacts. Coastal species are predicted to generally be exposed to low levels of noise however a brief adverse behavioural response is likely.

A threshold of 140 dB(A) has been identified by AECOM as the permanent hearing damage threshold for wildlife. No wildlife is predicted to be exposed to levels above the permanent hearing damage threshold of 140 dB(A). Sound pressure levels of this magnitude are likely to be limited to the launch site only.

There is no clear consensus within available literature whether long term behavioural changes on wildlife would be caused by launch vehicles or if the birds in this area would habituate to the sound of launches and testing. In respect to mammals, studies have shown that noise levels of 120 dBA can damage mammals' ears, and levels at 95 dBA can cause temporary loss of hearing acuity. It is likely that the possible impacts to mammals would be similar to birds, however mammals would be unable to move away from the noise being produced as quickly and may be exposed to higher levels for longer.

Sonic Boom Noise Levels and Impacts

The literature review undertaken for this component found that maintaining a level below 133 dB(L) peak would minimise the chance of damage to buildings and structures, and limit disturbance to sensitive receptors (human and animal) caused by air overpressure produced during launch events caused by air overpressure produced during launch events.

Noise and air overpressure resulting from sonic booms are not expected to exceed the assessment criteria of 133 dB(L) on land. This is due to the fact that supersonic speeds are not expected to be achieved until the launch vehicle is some 3.0 kilometres from the coastline. Furthermore, due to the relatively small size of the rockets the sonic boom will be limited in size and will be unlikely to be large enough to reach the surface.

Impacts on Marine Wildlife

Acoustic energy from in-air noise does not effectively transfer across the sea surface meaning that most of the noise is reflected off the water surface especially if a sound wave hits the interface at shallow angles of incidence (Vella, et al., 2001). Accordingly, underwater noise impacts were not considered significant and environmental risk to marine species and were not assessed further.

In respect to impacts on the Australian Sea Lion and Long Nosed Fur Seal populations on Liguanea Island, criteria presented by Southall et al. (2007) for noise impacts on pinnipeds above water suggest that there would be no temporary hearing loss for pinnipeds at sound pressure levels below 140 dB.

Therefore, no temporary hearing loss or permanent hearing damage is expected on the Australian Sea Lion and Long Nosed Fur Seal populations on Liguanea Island, or Long Nosed Fur Seal populations hauled-out at Cape Wiles. There may be some behavioural response to the noise, however there is little available data or literature on the subject.

8.4.2 Guideline 6.2

6.2. Provide information on the anticipated frequency of launch events, initially and into the future. Include information regarding individual launch events and predicted noise and vibration impacts to be generated.

The WWOLC will cater for launches by a variety of customers. The number of launches based on the initial phase of the development – two (2) launch facilities - is anticipated to commence with approximately six (6) launches in the first year of operations, increasing to a maximum of 36 launches per year in year five (5) of operations.

WWOLC will also be used to launch rockets that do not go into orbit around the Earth. These rockets are known as sounding rockets or suborbital rockets. They are used to access altitudes between 50 and 120 kilometres, which are too high for balloons to reach, and too low for satellites. It is envisaged that there would typically be one (1) or two (2) sounding rocket launches undertaken at Whalers Way per year with a maximum of potentially six per annum. This number is additional to the estimated 36 conventional launches per annum at the Whalers Way site.

The facility has been uniquely designed to enable the launch sites to be used by multiple customers, who will transport their equipment and launch vehicle stages to the site before undertaking final assembly in preparation for the launch. Once the launch is complete, the customer will remove their equipment and vacate the launch site ready for occupation by the next customer. Typically, a launch cycle will run in the order of three (3) to five (5) weeks from occupation to vacation of a launch site. The typical launch cycle from four (4) weeks prior to the launch date is detailed within **Section 6.0**.

For predicted noise and vibration impacts to be generated by launch events please refer to discussion in **Section 8.4.1** above and to **Appendix O** and **Appendix P**. The analysis of noise impacts have applied worst-case scenario conditions in respect to meteorological conditions, timing, and rocket sizes.

8.4.3 Guidelines 6.3 and 6.4

6.3.	*The location of noise and vibration sensitive receivers should be identified on an appropriately scaled plan.*
6.4.	*Information, including noise contours from a suitable acoustic model, should be provided for all significant noise generating activities when operating under worst case meteorological conditions.*

Figures 8.2 – 8.5 below (overleaf) depict the noise levels at various distance intervals from both Launch Site A and Launch Site B. These were prepared by AECOM (2020) within their Noise and Vibration Assessment (refer to **Appendix O**).

L_{Amax} Noise Levels

85 dBA	105 dBA	125 dBA
90 dBA	110 dBA	130 dBA
95 dBA	115 dBA	135 dBA
100 dBA	120 dBA	

Features

- Construction Zones
- Residential Locations

FIGURE 8.2

CALCULATED LAmax NOISE LEVELS FOR A ROCKET LAUNCH AT SITE A

SOURCE: AECOM

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FIGURE 8.3

CALCULATED LAmax NOISE LEVELS FOR A ROCKET LAUNCH AT SITE B

SOURCE: AECOM

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FIGURE 8.4

CALCULATED SINGLE LAUNCH SOUND EXPOSURE LEVEL AT SITE A

SOURCE: AECOM

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Sound Exposure Level

105 dBA
110 dBA
115 dBA
120 dBA
125 dBA
130 dBA

Features

Residential Locations
Construction Zones

FIGURE 8.5

CALCULATED SINGLE LAUNCH SOUND EXPOSURE LEVEL AT SITE B

SOURCE: AECOM

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8.4.4 Guideline 6.5

6.5. Describe current background noise and vibration levels at sensitive receivers and changes to these levels as a result of the project (during both the construction, maintenance, and operational phases). Sufficient data should be gathered to provide baseline information for comparison with any future monitoring undertaken during the construction and operational phases. Details of any noise or vibration monitoring undertaken should be incorporated.

The existing noise and vibration environment in the study area has been identified to be low, as is typical of rural and remote areas. The local acoustic environment is predominantly influenced by weather-induced noise, such as wind interaction with vegetation. Other noise sources are a result of insect and fauna activity.

The baseline noise environment was measured at five (5) different locations over several days between Tuesday 17 March and Friday 19 March 2020. The monitoring locations are identified in **Figure 8.1** above. The background levels in the study area were considered typical of rural and remote areas with low residential density and little exposure to transportation or industrial noise.

8.4.4.1 Average Background Noise Levels (L_{A90})

A summary of the measured background noise levels is provided in **Table 8.3** below.

Table 8.3: Background noise monitoring results (average measured LA90 noise level) (AECOM 2020, p.32)

SITE	DESCRIPTION	MEASURED L_{A90} NOISE LEVEL, dB(A)	
		DAY	NIGHT
1	Low mixed Mallee	24	32
2	Low mixed Mallee	23	30
3	Low mixed Mallee	23	26
4	Open shrubland	27	35
5	Very low shrubland	24	30

8.4.4.2 Ambient Noise Levels (L_{Aeq})

The average measured ambient noise level for the daytime, evening and night-time periods at each unattended monitoring location is shown in **Table 8.4** below.

Table 8.4: Ambient noise monitoring results (average measured LAeq noise level) (AECOM 2020, p.32)

SITE	DESCRIPTION	MEASURED LAEQ NOISE LEVEL, DB(A)	
		DAY	NIGHT
1	Low mixed Mallee	42	37
2	Low mixed Mallee	38	33
3	Low mixed Mallee	39	30
4	Open shrubland	46	41
5	Very low shrubland	51	48

A key observation from the existing conditions noise monitoring was that the night-time background noise levels are greater than the day-time background noise levels at all locations. Reasons for this have not been established, however, it is possible for this to be caused by insects or birds.

8.4.5 Guideline 6.7

6.7. Identify what reasonable and practicable measures will be used to minimise impacts from noise and vibration and assess their effectiveness. Details of how any such measures will be monitored, audited, and managed should be included.

The primary noise mitigation technique will be through source noise mitigation methods, this being a water deluge system (example shown in **Photograph 8.1** below) to reduce both near and far field noise impacts and blast walls/bunds to reflect acoustic energy away from sensitive areas. These are noted as two (2) of the most effective noise suppressants when a rocket is in a launch position. It is not feasible or practical for further source noise mitigation techniques to be employed.

Photograph 8.1: Kennedy Space Centres Launch Pad 39A water sound suppression system. (Source - NASA - https://www.nasa.gov/missions/shuttle/f_watertest.html)

The example photograph above is from a launch at the Kennedy Space Centre (KSC) and depicts a water deluge system in operation. It is important to note that the scale of the water deluge system to be implemented at WWOLC will be significantly reduced from what is utilised at KSC which pumps millions of litres per minute.

Administrative measures proposed by Southern Launch would also include a plan to notify residents of upcoming launch activities and to restrict human presence within the required safety distances prior to a launch. This may not necessarily reduce the noise level exposure but would prepare residents for a loud acoustic event and inform them about the activities being undertaken on site.

It is unlikely that there are feasible source controls available in addition to those already incorporated in the design and operational proposals. As the long-term impacts are unknown, a plan to monitor the behaviour of protected wildlife in response to noise will be included within the CEMP and OEMP.

In summary, the proponent will implement the following practical measures to minimise impacts from noise and vibration:

- Source noise mitigation measures will be implemented to minimise noise impacts during launch events, this will include a water deluge system and blast walls.
- Construction noise will be minimised by limiting intensity and duration of high impact activities near sensitive wildlife area where possible.

- Construction and operation of the Project will be managed in accordance with the CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures outlined. Good practice construction noise management measures will be incorporated into the applicable CEMP and OEMP.

- Administrative measures proposed by Southern Launch would also include a plan to notify residents of upcoming launch activities and to restrict human presence within required set back distances prior to a launch.

- A noise monitoring and reporting program would also be developed to verify noise impacts of launch activity on nearby residents. As part of the Complaints Management/Community Engagement Plan, a program of assessment, monitoring and reporting will be utilised:

    - all complaints will be recorded and assessed;
    - a compliance check will be undertaken;
    - if required correction action will be undertaken; and
    - on-going monitoring will ensure continuing compliance.

- Implement plans from CEMP and OEMP to monitor the behaviour of protected wildlife in response to noise.

8.4.6 Guideline 6.8

6.8. Identify the potential impact of noise and vibrations on native fauna (terrestrial and marine), and the mitigation and monitoring strategies during both construction and maintenance.

Discussion in respect to the potential impact of noise and vibrations on wildlife is in **Section 8.4.1**. The discussion below outlines the noise mitigation practices that will be employed to manage noise and vibration impacts on sensitive receivers (human and animal).

Noise and vibration have the potential to adversely affect wildlife and sensitive habitat located near construction activities. Noise impacts may include changes in behaviour and physical harm, which have the potential to adversely impact sensitive wildlife populations.

Birds have been identified as the primary noise-sensitive receptors for the Project; however, mammal and reptile species were also noted within the Project Footprint. The potential of anthropogenic noise on birds are commonly identified as follows (Dooling & Popper 2007):

- Physiological effects, such as stress, avoidance and fright-flight responses;

- Damage to hearing from acoustic over-exposure; and

- Masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects (Shannon, et al. 2016).

The range of hearing for mammals and reptiles and the consequent sensitivity to anthropogenic noise are not as well researched. However, behavioural and physical responses similar to those listed above have been noted in the available literature.

A summary of the impacts to animal species has been provided in the following sections. The basis for these findings has been determined through an extensive review of available literature undertaken by AECOM to inform the preparation of the Noise and Vibration Assessment (**Appendix O**) and Terrestrial Ecological Report (**Appendix P**).

8.4.6.1 Wildlife Response to Noise

In birds, hearing is the second most important sense after vision (Beason 2004). The noise from a rocket launch could elicit a startle response in birds located in the immediate area of the launch. Noise generated during launch activities have the potential to disturb birds, resulting in the potential loss of bird eggs, and abandonment of nesting, breeding or feeding areas (FAA 2009) and (SpaceX 2019).

High levels of disturbance, such as from aircraft operations, can cause sudden nest abandonment, which can lead to a potential loss of eggs or chicks through breakage, trampling, chilling, and predation (Wilson, Culik, Danfeld, & Adelung 1991).

The response of seabirds to disturbance varies on the stage of breeding or growth:

- non-breeding seabirds are more likely to flee, compared to breeding birds which are reluctant to abandon their eggs or chicks;
- breeding birds tend to flee more readily when their chicks are larger, particularly after chicks begin crèching;
- chicks in the crèche stage are more sensitive to helicopter noise and are more likely to stampede; and
- birds in the moult phase are also more sensitive to helicopter operations.

Dooling & Popper (2016) recommend interim guidelines for potential effects to birds from different noise sources, presented in **Table 8.5**.

Table 8.5: Recommended interim guidelines for potential effect from different noise sources (AECOM 2021, p.76)

NOISE SOURCE TYPE	HEARING DAMAGE	TEMPORARY THRESHOLD SHIFT (TTS)	MASKING
Single impulse (e.g., starter's pistol 6" from the ear)	140 dBA	NA	NA
Multiple impulse (e.g., jackhammer, pile driver)	125 dBA	NA	Ambient dBA
Mammals	110 dBA	NA	Ambient dBA
Non-strike continuous (e.g., construction noise)	None	93 dBA	Ambient dBA

8.4.6.2 Wildlife Impacts During Construction

As previously discussed in **Section 8.4.1.2**, utility construction activities are expected to be the nosiest stage of the Project construction, with ground compaction expected to produce the highest level of noise from the site. Noise levels in excess of the those that have been established to protect birds from temporary hearing damage (LAeq 93 dB) are predicted to be achieved at distances approximately 10 – 20 metres from the works.

Masking of communication signals may be impacted temporarily during construction. Ambient sound measured throughout the study area was as low as 38 dBA during the day and 30 dBA at night, meaning that construction noise could be up to 20 dB above the ambient level at approximately 1.0 kilometre from the proposed construction areas.

Continuous noise levels that are 20 dB above background (50 – 60 dB(A)) in the frequency region of bird hearing and communication can have a detrimental effect on the detection and discrimination of vocal signals by birds (Dooling & Popper, 2007).

Potential behavioural and/or physiological effects are noted as possible in any case where construction noise is audible. This includes both construction activities that produce short bursts of impulsive noise and the continuous noise produced by mobile and fixed machinery.

8.4.6.3 Wildlife Impacts During Operation

<u>Supporting Infrastructure</u>

As discussed in **Section 8.4.1.2**, the predicted noise level of 62 dB(A) at 25 metres from the Project Footprint is below the continuous noise level threshold of 93 dB(A) for causing temporary threshold shift in birds. It is considered that the risk of operational noise impacts from general site facilities would be limited to the masking of communication signals and brief behavioural response.

Rocket Launches

The maximum instantaneous sound pressure level (LAmax) for the subsonic launch activities assuming the loudest rocket in each location has been modelled (refer to **Figure 8.2 – 8.5**). The computational models have relied on noise data that is not specifically oriented to rocket launches and has therefore applied other forms of aircraft and noise sources, which has limited applicability. This has been compensated for by adding additional and substantial layers of conservatism to the models. The results therefore should be considered conservative as the noise levels produced by the smaller rockets (i.e., quieter) planned for use at the Southern Launch have not been considered for these worst-case scenarios.

As discussed in **Section 8.4.1.2**, the following sound pressure thresholds have been identified by AECOM through the literature review in respect to the likely impact of noise on wildlife, however there is little consensus within the literature on the long-term behavioural responses these may produce:

- 140 dB(A) - permanent hearing damage threshold for wildlife;
- 120 dB(A) - potential damage hearing damage threshold for wildlife; and
- 95 dB(A) - potential temporary loss of hearing for wildlife.

No wildlife is predicted to be exposed levels above the permanent hearing damage threshold of 140 dB(A). Sound pressure levels of this magnitude are likely to be limited to the launch site only. Noise from launches and stationary rocket testing are predicted to temporarily result in noise above the measured ambient level at distances further than 5.0 kilometres from the launch. This may cause a brief behavioural response from wildlife. In rare extreme cases temporary hearing loss at up to 1,500 metres from either launch site could be experienced.

Potential impacts include increased stress, adverse behaviour reactions and physiological impacts. Coastal species are predicted to generally be exposed to low levels of noise however a brief adverse behavioural response is likely.

In an effort to limit the presence of fauna in immediate proximity to the launch pads, a noise gas gun will be used to 'scare' any fauna that are near the immediate area prior to launch in accordance with SA EPA *Environmental Noise Guidelines – Audible Bird Scaring Devices* (EPA 2007).

EPA 2007 allows for maximum accumulated peak level for impulsive noise devices of 118 dB. These devices generate approximately 120 dB and can be used multiple times throughout hours of 7.00 am to 8.00 pm. Primary producers set these devices to generate loud noise bursts for six (6) to ten (10) (or more) bursts per day which results in potentially over 130 (or more) loud and sudden bursts of every three (3) weeks. The proposal involves one (1) loud burst of noise every three (3) weeks to encourage fauna in the immediate vicinity of the launch to move away from the area.

8.4.6.4 Exposure to Shockwaves

The potential impact from sonic booms has been determined by comparing the impact of other launch facilities with a similar planned azimuth, trajectory, and rocket size.

Supersonic speeds are assumed to occur approximately 3.0 kilometres from the coast during vehicle ascent over the ocean. Sonic booms produced during vehicle ascent are typically directed in front of the vehicle and the entire boom footprint is usually some distance downrange of the launch site (SpaceX, 2020). The small rockets to be used at the WWOLC will limit the size of sonic boom being created.

Furthermore, impact assessments for suborbital rocket launch facilities in the United States (FAA, 2009) have concluded that sonic booms are less likely to contribute to other noise impacts associated with the launch if they occur over the ocean at a high altitude.

Hence, the overpressure produced by the sonic boom is not expected to exceed the assessment criteria of 133 dBL on land. The audible component of a sonic boom may result in a short-duration startle response.

8.4.6.5 Marine Wildlife Impacts

Underwater noise impacts are not considered significant environmental risk to sub-surface marine species. Acoustic energy from in-air noise does not effectively transfer across the sea surface. Most noise will be reflected off the water surface.

As discussed in **Section 8.4.1.2**, noise impacts on Long Nosed Fur Seal populations on Liguanea Island, or Long Nosed Fur Seal populations hauled-out at Cape Wiles will likely be limited to some short duration behavioural response. No temporary hearing loss or permanent hearing damage is expected.

8.4.6.6 Ground Vibration

The extent of ground and structural vibration produced by the acoustic environment near the launch vehicle is expected to be limited to the buildings supporting the launch.

8.4.6.7 Noise and Vibration Impacts on Threatened Species

AECOM's desktop analysis identified 28 listed terrestrial fauna species likely to occur within the vicinity of the Project. An assessment of likelihood of occurrence was undertaken for these species. Of the 28 threatened fauna species, two (2) have been recorded within and in close proximity to the Project Footprint and one (1) is likely to occur:

- Australian Fairy Tern (Vulnerable) – likely to occur;
- Western Whipbird (eastern) (Vulnerable) – known to occur; and
- Southern Emu-wren (Eyre Peninsula) (Vulnerable) – known to occur.

The potential noise and vibration impact on these specific species identified by AECOM in their assessment is outlined below.

Australia Fairy Tern

There is no breeding habitat within the Project Footprint. It is possible that the species breeds along the cliffs of Whalers Way, which is 2.0 kilometres from the Project Footprint; however, direct impacts from clearing of suitable habitat or construction activities are not anticipated to occur in this area.

Impacts from noise and lighting may displace individual birds in the area. Noise generated during launch activities have the potential to disturb birds, resulting in the potential loss of bird eggs, and abandonment of nesting, breeding, or feeding areas (FAA 2009) and (SpaceX 2019). These impacts are anticipated to be localised and of short duration therefore should not reduce the area of occupancy for an extended period in the local vicinity.

Important populations for this species have not been defined therefore for the purpose of this assessment all breeding locations are considered important populations.

This species is highly mobile and has a range that extends around majority of Australia's mainland. It is unlikely that the Project will result in a decrease in size of an important population.

Western Whipbird (eastern)

The Western Whipbird (eastern) has known populations in the nearby Coffin Bay National Park and Lincoln National Park that will not be affected by the Project. Following the clearing for the Project, it is anticipated that the remaining vegetation will continue to be able to support the population that currently resides in the area.

Operational noise through the launching of rockets at a frequency of once every three (3) weeks for a duration of 75 seconds will generate noise at a level that will likely impact the species up to a distance of four (4) to five (5) kilometres from the launch site. The species is sensitive to discrete, unpredictable disturbances such as sudden loud noises that can cause physiological effects, such as stress, avoidance and fright-flight responses, damage to hearing from acoustic over-exposure, and masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects.

Impacts from noise may displace individual birds in the area. These impacts are anticipated to be localised and of short duration therefore should not reduce the area of occupancy for an extended period in the local vicinity.

Although there is suitable habitat and known populations in nearby national parks the potential operational noise impacts has the potential to lead to a long-term decrease in the size of the population of a species.

Southern Emu Wren (Eyre Peninsula)

The sub-population of Southern Emu-wren (Eyre Peninsula) at Whalers Way is considered one (1) of five (5) important populations to ensure the long-term survival of the species (DAWE 2020e). A total of 18 individuals were recorded within the Project Footprint during the targeted survey and it is estimated the overall population is under 100 individuals in the Whalers Way area from Cape Wiles to Cape Carnot making the Whalers Way Peninsula population tenuous to the impacts detailed in preceding sections.

It is uncertain what impacts the noise and lights would have on the ongoing occupancy of this species at Whalers Way.

Operational noise through the launching of rockets at a frequency of once every three (3) weeks for a duration of 75 seconds will generate noise at a level that will likely impact the species up toa distance of four (4) to five (5) kilometres from the launch site. The species is sensitive to discrete, unpredictable disturbances such as sudden loud noises that can cause physiological effects, such as stress, avoidance and fright-flight responses, nest abandonment, damage to hearing from acoustic over-exposure, and masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects.

The Project is therefore likely to reduce the area of occupancy of this species.

9 EFFECT ON NATIVE FAUNA

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9.0 EFFECT ON NATIVE FAUNA

9.1 Summary

A key consideration for this project is the potential impact on native fauna populations known to inhabit the terrestrial and marine environments in proximity to the Project. The EIS Guidelines recognise the importance of this environment for native fauna and the seek to understand what potential impacts this project may present on important populations within the area.

The discussion hereunder considers the finding of key specialist investigations related to both marine and terrestrial ecology and the impacts of the proposal in respect to the EIS Guidelines relevant to the Effect on native fauna, namely Guidelines 3.1 to 3.7 and Assessment Requirement 3.

9.2 Methodology

The key studies considered in the assessment of effects on native fauna include the Terrestrial Ecological Assessment (**Appendix P**) and the Marine Ecological Assessment (**Appendix S**). The methodology adopted in these studies, as is relevant to the topic of native fauna, is outlined below.

Further to this, as an outcome of the findings of the preliminary terrestrial fauna assessment, additional investigation in respect to coastal raptor species (Eastern Osprey and White-bellied Sea Eagle) has been prepared and considered in this assessment (**Appendix R**).

Whilst the topic is relevant to the discussion on the proposals effect on native fauna, noise and vibration impacts on native fauna, and the related Noise and Vibration Assessment (**Appendix O**), are considered in detail in **Section 8.0** of this report and as such have not been detailed within this section.

9.2.1 Terrestrial Ecological Assessment

The approach adopted by AECOM in this investigation comprised of two (2) key steps, a Terrestrial Biodiversity Assessment (to determine the wildlife populations likely to be present in the Project Site), and an Impact Assessment (assessment of the significance of likely project impacts on these wildlife populations). The processes undertaken within these two (2) key steps is identified below:

9.2.1.1 Terrestrial Biodiversity Assessment

This is comprised of a desktop assessment of the site using various public resources and additional site-specific background documents and previous investigation reports in order to develop a baseline understanding of fauna species that may inhabit the area.

A likelihood of occurrence assessment was then undertaken for all threatened fauna species that were identified in the desktop assessment. This considered the presence of suitable habitat, sighting records, the date of records, and location proximity to the Project Footprint. The likelihood of occurrence findings was updated following site surveys.

A series of field surveys, comprising of both general and targeted surveys were undertaken on between the following dates, 16, and 19 March 2020; 22 and 24 June 2020; and 13 and 15 October 2020. These were led by a Native Vegetation Council (NVC) accredited ecologist, who was assisted in each survey by different assistants, consisting of an Environmental Scientist (March Survey), Ornithologist (June Survey), and second NVC accredited ecologist (October Survey).

The surveys consisted of the following:

- Flora and fauna habitat survey:
  - fauna habitats were assessed for specific habitat components including consideration of structural diversity and refuge opportunities for fauna, in order to determine the potential for these habitats to support threatened species. The survey focussed on searching for habitat that would be utilised by threatened species identified in the desktop assessment as having the potential to occur in the area.
  - fauna habitat assessments were undertaken at sample point locations throughout the Project Footprint that were considered the best representative of the area where qualitative aspects such as canopy coverage, surface strew, litter, understorey density etc. were recorded. The fauna habitat assessments included:
    - location;
    - general habitat description;
    - habitat condition and disturbance types;
    - dominant/characteristics flora species and vegetation layers;
    - presence and abundance of key habitat features such as large mature trees, small and large hollows, fallen logs, course and fine litter, decorticating bark, bare ground, grass, stones and boulders, rock crevices, soil cracks, vines, dense shrubs, water bodies etc.;
    - presence of fauna and secondary signs (e.g., scats, digging, tracks, burrows, eggshell bones, feathers etc.); and
    - connectivity of habitat.

- Targeted searches:
  - targeted searches were conducted for threatened fauna species that were considered likely to occur in the Project Footprint;

- a ramble survey method was used (i.e., walking through areas of vegetation to cover different topography and fauna habitats); and
- when threatened species were identified a GPS location and observations were recorded.

• Targeted Fauna Bird Survey:

- this targeted survey focused on two (2) species of conservation significance, the Southern Emu-wren (Eyre Peninsula) and the Western Whipbird (eastern) that are protected under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*;
- the methodology involved walking through the preferred habitat and listening for calls or physical signs of the species. If a call was heard or brief sightings, judicious use of call playback applications were used to confirm the sighting;
- the Southern Emu-wren (Eyre Peninsula) assessment was undertaken as a broadscale assessment, covering an area of approximately 350 hectares over three (3) days; and
- the Western Whipbird (eastern) are incredibly difficult to observe by sight but have a highly unique and unmistakeable call. As such, these species were recorded by call, detecting their presence through recording occurrences of their distinctive song, and logging the location.

9.2.1.2 Impact Assessment

The Impact Assessment considered planned activities (e.g., construction of launch pads and associated infrastructure, vehicle movement, rocket launches) and unplanned events (e.g., chemicals spills, launch failures) that may occur during construction and operation.

The Impact Assessment considered the impacts of the Project against the EPBC Act. Under the EPBC Act specific guidelines are provided to assist in undertaking a 'self-assessment' to determine the likelihood of significant impact. These guidelines are referred to as the *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (SIG 1.1). This SIG 1.1 process was used in the AECOM assessment to determine the likelihood of the Project resulting in a significant impact, qualifying the likelihood as either:

• Unlikely;

• Potential; or

• Likely.

Additionally, the likely impacts were assessed with consideration of the terrestrial biodiversity components of the relevant EIS assessment guidelines, focusing on those guidelines that related to fauna species and introduced species. A matrix of the relevant assessment guidelines and the Project response/justification is provided within The Terrestrial Ecology Report in **Appendix P**.

9.2.2 Marine Ecological Assessment

The methodology adopted in the Marine Ecological Assessment is comprised of two (2) components, an analysis of the ecological values of the local marine environment, and an Impact Assessment considering the impacts of the proposal on the marine environment.

9.2.2.1 Assessment of Ecological Values

The Marine Ecological Assessment (**Appendix S**) defines the key ecological values of the local marine environment, describing the habitats that are present and the marine fauna, avifauna, and mammal populations known to inhabit the area. The ecological values of the Thorny Passage Marine Park and the Southern Ocean are specified.

This assessment was undertaken via a desktop analysis which considered a variety of resources including:

- State and Commonwealth Government environment mapping;
- review of previous studies of the area including diver surveys; and
- review of relevant literature and Government reports and resources related to the region.

9.2.2.2 Impact Assessment

The Impact Assessment considerers the following impacts on the marine environment:

- Operational impacts:
  - collision of debris with fauna;
  - other impacts associated with debris;
  - noise, vibration (acoustic trauma, behavioural impacts); and
  - pollution associated with debris.
- Construction noise.

It was determined that neither sound nor debris (functioning as a high-speed projectile) would have any significant impact on marine life below the surface because of rapid attenuation of both forms of energy on entering seawater. As such, the Impact Assessment is largely related to above-water marine fauna populations.

9.2.3 Coastal Raptor Assessment

Through preliminary investigation and engagement with the Department of Environment and Water (DEW) it was determined that the coastal raptor species of the Eastern Osprey and White-bellied Sea Eagle required specialist assessment to determine their status, the likely impacts of the proposal, and potential mitigation measures that may be required.

The coastal raptor assessment adopted a separate but similar methodology to assess the impacts on the respective Osprey and White-bellied Sea Eagle populations. The assessment approach that was adopted is outlined as follows.

9.2.3.1 Osprey

SA distribution and Status

This section sought to identify the nature of the population of Osprey that could potentially reside in the area by drawing on a wide variety of resources and literature. The key steps undertaken in this component of this investigation consisted of:

- review surveys in the locality to determine likely population distribution;
- review of literature in respect to breeding habits and habitat;
- review of literature in respect to known sources of disturbance and observed behavioural/physiological responses;
- review of known records of sightings and nests near in the area dating back to the 1970's;
- analysis of the Whalers Way environment, location, and the condition of known nests; and
- analysis of known nests in the wider region and the species nesting practices globally.

Significant Impact Assessment

An Impact Assessment considered the findings of the Terrestrial Ecological Assessment (**Appendix P**) in respect to the impact on the Eastern Osprey. A review of the findings was undertaken, and additional information and commentary provided to supplement and corroborate the findings.

9.2.3.2 White-bellied Sea Eagle

SA distribution and Status

This section sought to identify the nature of the population of White-bellied Sea Eagle that could potentially reside in the area by drawing on a wide variety of resources and literature. The key steps undertaken in this component of this investigation consisted of:

- review surveys in the locality to determine likely population distribution;
- review of literature in respect to breeding habits and habitat;
- review of literature in respect to known sources of disturbance and observed behavioural/physiological responses;

- review of known sighting records and nests near the site dating back to the 1960's; and
- review of common disturbance mitigation strategies utilised in other circumstances.

9.2.3.3 Rocket Launch and Bird Interaction Review

This section undertook a review of a number of similar rocket launch facilities and any associated records of bird interaction to further bolster understanding of risk and likely behavioural and physiological impacts.

9.2.3.4 Project Constraints Summary

This section considered preliminary commentary provided by the Department of Environment and Water and provided a matrix of response to their key stated concerns.

9.2.3.5 Opportunities

This section considered and summarised a number of potential opportunities that are presented by the proposal which could have a positive impact local raptor population.

9.3 Relevant EIS Guidelines

Assessment Requirement 3: *The proposed development will be constructed on land, but will also operate in the airspace and over adjoining waters with potential impacts on terrestrial and marine habitats which support significant populations of native fauna.*

3.1. Describe the location, extent, condition, and significance of native terrestrial and marine fauna populations, including individual species and communities in the surrounding area, including on land, cliffs and in adjoining waters, including Liguanea Island.

3.2. Describe the nature and extent of the impacts likely to affect native terrestrial and marine fauna species and populations during both construction and operation. Describe the ability of communities and individual species to recover, especially threatened or significant species (including those listed under the National Parks and Wildlife Act 1972). Specifically consider the impact of marine debris.

3.3. Identify the effect of the proposal on terrestrial habitat fragmentation including the ability of populations or individuals to recover during both construction and operation.

3.4. Identify the potential impact of fire and explosion on native fauna, and the effects of fire risk management processes during both construction, operation and maintenance.

3.5. Identify the potential impact of noise and vibrations on terrestrial, coastal and marine native fauna, and the mitigation and monitoring strategies during both construction and operational phases.

3.6. Detail appropriate buffer distances that would be required between proposed development (including coastal access points) and threatened terrestrial and marine species, including feeding areas, nesting sites and roosting sites.

3.7. Outline measures to avoid, minimise, mitigate, and monitor the effects on native fauna, including any compensatory activities.

9.4 Analysis

9.4.1 Guideline 3.1

3.1. Describe the location, extent, condition, and significance of native terrestrial and marine fauna populations, including individual species and communities in the surrounding area, including on land, cliffs and in adjoining waters, including Liguanea Island.

9.4.1.1 Terrestrial Fauna

Species Sited During Survey

A total of 34 fauna species were recorded during the field survey. This included 28 bird species, four (4) mammal species, and two (2) reptile species.

One (1) native mammal species was recorded throughout the Project Footprint being the Western Grey Kangaroo (*Macropus fuliginosus*). Three (3) exotic mammal species listed as Declared Pests under the LSA Act were recorded:

- Domestic Cat (*Felis catus*) tracks were observed frequently;
- European Rabbit (*Oryctolagus cuniculus*), which is an introduced pest species common in all states, was widespread and common; and
- Red Fox (*Vulpes vulpes*) was observed from numerous scats.

Two (2) reptile species were confirmed. The Shingleback Lizard (*Tiliqua rugosa*) is common to the Project Footprint habitat types and was commonly observed. The Mallee Heath Dragon (*Ctenophorus chapmani*) was common and widespread. Numerous skinks (not able to be identified) were noted.

Of the 30 bird species recorded one (1) was a declared pest under the LSA Act, namely, the Common Starling (*Sturnus vulgaris*). Four (4) of the bird species were associated with the cliffs in the south, and four (4) were associated with inland vegetation. The remaining species were common and widespread.

A comprehensive species list is presented the Terrestrial Ecological Assessment, contained in **Appendix P** of this report.

Threatened Species

The assessment undertaken by AECOM in their Terrestrial Ecological Assessment (**Appendix P**) quantified endangered and threatened fauna species identified within the Whalers Way region. The following threatened fauna were recorded during field surveys:

- Diamond Firetail (*Stagonopleura guttata*), *Vulnerable South Australian National Parks and Wildlife Act 1972* (NPW Act) – three (3) records;
- Eastern Osprey, Migratory and Marine EPBC Act, Endangered NPW Act – one (1) bird observed near Cape Carnot and one (1) nest was recorded on a cliffs edge 2.0 kilometres from launch Site B and 3.0 kilometres from Launch Site A;
- Western Whipbird (eastern), Vulnerable EPBC Act, Endangered NPW Act – numerous individuals recorded by call;
- Rock Parrot (*Neophema petrophila*), Rare NPW Act – 14 records;
- Southern Emu-wren (Eyre Peninsula); Vulnerable EPBC Act, Endangered NPW Act – 18 individuals were sighted consisting of four (4) pairs, one (1) group of three (3) and seven (7) singles; and
- White-bellied Sea Eagle (*Haliaeetus leucogaster*), Marine EPBC Act, Endangered NPW Act – one (1) pair.

Ten (10) other threatened fauna (bird) species are known to occur at Whalers Way (NatureMaps 2020). These species are all bird species listed under the NPW Act and include three (3) species listed as threatened, one (1) species listed as migratory and marine, and one (1) species listed as marine under the EPBC Act.

Commonwealth Listed Species

Species listed under the EPBC Act as Threatened or Migratory and/or Marine that are known, likely or possible to occur in Whalers Way are:

- Australian Fairy Tern.
- Bar-tailed Godwit.
- Black-faced Cormorant.
- Common Greenshank.
- Eastern Osprey.
- Fork-tailed Swift.
- Hooded Plover.
- Northern Siberian Bar-tailed Godwit.

- Pacific Gull.
- Sanderling.
- Short-tailed Shearwater.
- Southern Emu-wren (Eyre Peninsula).
- Western Whipbird (eastern).
- White-bellied Sea Eagle.

State Listed Species

State listed threatened species that are known, likely or possible to occur in Whalers Way are:

- Australian Bustard.
- Black Falcon.
- Cape Barren Goose.
- Diamond Firetail.
- Elegant Parrot.
- Painted Buttonquail.
- Peregrine Falcon.
- Purple-gaped Honeyeater.
- Rock Parrot.
- Sooty Oystercatcher.
- Yellow-tailed Black Cockatoo.

9.4.1.2 Osprey

The Project Site occurs in an area with known Osprey territories that were still active during the most recent surveys between 2015-2017 (Detmar and Dennis 2018). Osprey are known to nest in coastal cliff environments, often utilising sea stacks as their nest location.

Key sources of disturbance to Osprey nesting locations are attributed to activities occurring above their nest level, often associated with coastal recreational use by humans (walking trails, hiking, lookouts, car parks) and access by predators (e.g., feral cats, foxes).

Two (2) known abandoned nests are located at Cape Wiles and another between Cape Wiles and Cape Carnot. It has been suggested that installation of an Osprey viewing area and car park in the area may have led the birds to abandon the nests, given the regular disturbance from above. There are no recent records (BDBSA or Birdlife data) for these nest locations, nor has any nest activity been observed in relevant recent surveys.

The current Whalers Way coastline habitat (2.0 kilometres from the Project Site) provides sub-optimal habitat for potential Osprey nesting and activity given the cliff top tracks and viewing platform that are frequently used by the public at the unmanaged Heritage site.

During a recent survey (December 2020) a pair of Osprey were observed whirling and tumbling 500 metres offshore. The flight path appeared to be from Liguanea Island eastwards beyond Fishery Bay. Osprey were also observed lofting from the Redbanks area due to vehicular presence.

The Osprey flew westwards and commenced to hunt the waters adjacent to the Cathedral Rocks wind farm in a circular pattern. It is possible (but unconfirmed) that the pair of Osprey that have abandoned the stack nest at Cape Wiles may have re-established an old nest on a stack off Cathedral Rock which is greater than 5.0 kilometres from the launch sites.

9.4.1.3 White-Bellied Sea Eagle

The White-bellied Sea Eagle are known to reside in a range of habitats within South Australia including territories across; coastal, offshore island and inland river habitats (Dennis and Detmar, 2018). Nest sites include cliff-face ledges, shallow cave overhangs or on rock outcrops on steeply sloping terrain.

A total of 33 territories are known within the Western Eyre Peninsula region where the proposed project site is located. In this region, however, there are only seven (7) mainland territories (sparsely distributed, including an active cliff top nest greater than 5.0 kilometres from Launch Pad B) and the remaining 26 are located on offshore islands.

White-bellied Sea Eagles occupy a territory and nest on the offshore Liguanea Island and a recent territory and nest site has been established greater than 5.0 kilometres to the east of the launch sites. The exact location of the mainland clifftop nest site remains undisclosed due to potential disturbances.

During site surveys in November and December 2020 a pair of Sea Eagles were recorded circling inland coastal heath at Fishery Bay for a duration of 20 minutes prior to flying eastwards. Another pair of Sea Eagles were observed through a spotting scope overflying Liguanea Island and was last observed flying to the southern end of the island.

9.4.1.4 Marine Fauna

Marine fauna is discussed in Marine Biodiversity Technical Report, prepared by J Diversity (refer to **Appendix S**). The assessment identifies that a number of invertebrates, fish, and shark species have been identified in studies in areas proximate to the site or suitable habitats likely to contain these species have been noted.

Marine mammals, including the Australian Sea Lion, Long-nosed Fur Seal, and a number of cetaceans have been recorded on and around Liguanea Island.

Australian Sea Lion

The Australian sea lion (ASL) *Neophoca cinerea* is currently listed as Vulnerable under the NPW Act and Endangered under the EPBC Act.

Breeding sites are generally on offshore islands. A total of 58 regular breeding colonies and 151 haul-out sites have been identified in South Australia and Western Australia. Liguanea Island is the fifth largest of 11 breeding colonies within the 'Spencer Gulf' metapopulation, representing about 3.3 per cent of that metapopulation and about 0.9 per cent of total pup production (Goldsworthy 2020).

The ASL population breed mainly on the southern peninsula of the island, although pups have been seen on the east coast, and haul-out around the entire coastline, as well as on top of the island (Professor S. Goldsworthy, SARDI, 31 August 2020). A total population for the island is estimated at 100 in 2015.

Long-nosed Fur Seal

The Long-nosed Fur Seal (LNFS) is not listed as threatened under the NPW Act or the EPBC Act.

LNFS breeds in New Zealand and its subantarctic islands, and southern Australia from New South Wales to Western Australia, mostly (83 per cent) from 29 breeding sites in South Australia, of which 97 per cent are from colonies between Kangaroo Island and the southern tip of Eyre Peninsula (Shaughnessy et al. 2014).

The population of LNFS on Liguanea Island can be estimated at 1832 (Shaughnessy et al. 2015). The total for Liguanea Island represents 9 per cent of the LNFS pup production in South Australia. Additionally, Cape Wiles is known as a haul-out site for LNFS (McFarlane 2016).

Cretaceans

There are a number of records of whale species in the region:

- Blue Whale *Balaenoptera musculus*, a pair 9.0 kilometres south-east of the WWOLC in February 2007;
- Humpback Whale *Megaptera novaeangliae*, from autumn 2001 (individual) and 2003 (pair), in both cases 20 kilometres south-east of the WWOLC;
- Killer Whale *Orcinus orca*, undated record 8.0 kilometres south-west of the WWOLC;
- Southern Bottle-nosed Whale *Hyperoodon planifrons,* from February 1994, 1.5 kilometres south of the WWOLC;

- Southern Right Whale *Eubalaena australis*, records of up to eight (8) individuals from winter on four (4) occasions during 1991–2002, within 1.5 kilometres of the WWOLC, noting that Sleaford Bay, just east of the WWOLC, has been identified as a site where small, but increasing, numbers of mostly non-calving southern right whales regularly aggregate briefly (DSEWPaC 2012); and
- Dolphin populations from this area are estimated at 2,800 – 10,600 in summer and 13,000 – 20,000 in winter (Moller et al. 2012).

Seabirds

The Short-tailed Shearwater (STS) or Mutton Bird (*Ardenna tenuirostris*) is currently listed as Migratory under the *EPBC Act 1999*. The STS breeds in summer on Tasmania and off the coast of southern Australia, migrating to north of Japan for winter in May before returning in October. There are more than 10 million breeding pairs in southern Australia (Skira 1991), including one (1) million in South Australia (Copley 1996) across at least 33 colonies (Robinson et al. 1996), including 14 in the Thorney Passage Marine Park (Bryars et al. 2016). The breeding colony on Liguanea Island spans approximately a quarter of the island's area. The total number of burrows has been estimated at 10,665, corresponding to a population of 20,330 (Robinson et al. 1996).

The Crested Tern (*Thalasseus bergii)* is listed as Migratory under the *EPBC Act 1999*. There is a breeding population of 'several thousand' birds (Goldsworthy & Page 2010), of an estimated South Australian population of 13,000–25,000 (Copley 1996). Breeding in South Australia typically occurs in October (McLeay et al. 2017).

For most seabird species in the Great Australian Bight, there is little data on species distributions, and little or no quantitative data on their abundances (Goldsworthy et al. 2017).

9.4.2 Guideline 3.2

3.2. Describe the nature and extent of the impacts likely to affect native terrestrial and marine fauna species and populations during both construction and operation. Describe the ability of communities and individual species to recover, especially threatened or significant species (including those listed under the National Parks and Wildlife Act 1972). Specifically consider the impact of marine debris.

9.4.2.1 Impacts on Terrestrial Fauna

Impact of Vegetation Clearance

It is expected there will be direct impacts to State and EPBC Act listed fauna species through the clearance of 23.76 hectares suitable habitat and indirect impacts from noise during operations of rocket launches.

The removal of vegetation resulting in habitat loss and degradation is likely to pose the largest risk of adverse impacts for terrestrial biodiversity arising from the Project. The impact may be direct in the form of vegetation and habitat clearance, or indirect, such as a reduction in flora and fauna diversity due to shortages in available habitat resources or habitat degradation in areas adjacent to direct impacts. Small-scale clearing within largely intact patches of vegetation can cause localised depletion of some species (Kutt et al. 2012). Habitat loss as a result of vegetation clearing is likely to occur during the construction phase activities. Habitats for threatened species are included in the likely receptors potentially impacted.

Vegetation clearing and habitat loss that cannot be avoided, particularly in high constraint areas, is likely to result in permanent impacts to threatened biodiversity receptors. This includes a reduction of feed availability for habitat-specialist fauna species which are dependent on native vegetation for food sources, such as Western Whipbird (eastern) and Southern Emu-wren (Eyre Peninsula) that forage actively, hopping through dense vegetation and taking food from reeds, foliage, twigs, and other surfaces of shrubs. The potential effects associated with this impact include direct loss of breeding habitat and loss of foraging habitat which will in turn lead to greater pressure on remining available habitat outside of the Project Footprint. The resulting increase in pressure on resource availability is likely to increase individual animal stress levels which may result in reduced breeding success, genetic isolation and population decline over time.

The vegetation to be cleared provides suitable habitat for the following threatened fauna species protected under the EPBC Act and NPW Act:

- Australian Fairy Tern;
- Black Falcon;
- Cape Barron Goose;
- Diamond Firetail;
- Eastern Osprey;
- Elegant Parrot;
- Painted Buttonquail;
- Peregrine Falcon;
- Purple-gaped Honeyeater;
- Rock Parrot (known to occur);
- Southern Emu-wren (Eyre Peninsula);
- Western Whipbird (eastern);
- White-bellied Sea Eagle; and
- Yellow-tailed Black Cockatoo.

There is a risk that some of the proposed clearing may pose a direct threat to the individual threatened species. Direct impacts to State and EPBC Act listed species are to be offset through a biodiversity offset program developed in accordance with NVC. Indirect impacts will be managed through the implementation of a CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures.

Habitat Fragmentation

Habitat fragmentation relates to the physical dividing up of a continuous habitat into separate smaller fragments (Fahrig 2002). The landscape in which the Project Footprint is situated is relatively undisturbed with significant vegetation cover, with the only fragmentation in fauna habitat occurring through access tracks that have been constructed for tourist access to Whalers Way. The Project Activities will contribute to fragmentation of fauna habitat by increasing the number and width of access tracks and clearing six (6) discreet areas. Habitat fragmentation may impact threatened species and wildlife refugia. This is due to the importance of connectivity, dispersal opportunities and habitat quality for species at a local scale.

Habitat fragmentation as a result of vegetation clearing for the Project is considered localised. The habitat in the local area is contiguous and provides ample connectivity across Whalers Way. It is unlikely that vegetation clearing will result in any species becoming genetically isolated and lead to sub-populations in the local area.

The widening of tracks and the construction of the launch pads may lead to local fragmentation, however, the majority of species at Whalers Way are mobile and are able to traverse the distance a track represents. Fragmentation is therefore considered limited and unlikely to be considered significant.

Fauna Species Injury or Mortality

Fauna injury and/or death is a direct impact that may lead to a decline in population size and extent of fauna species. This potential impact is most likely to occur during vegetation clearing, earthworks, trenching and increased labour force in the fields (through the movement of vehicles) during construction, and from vehicle collision during operation.

Earthworks and clearing of native vegetation may lead to interaction of machinery with fauna species, including any of the threatened bird species. This includes clearing vegetation that includes a nesting site, crushing or otherwise harming a fauna species with machinery.

The Project will result in increased vehicle movements that may cause injury or death to fauna by vehicle strike. Mammals, reptiles, and birds are all at risk of vehicle strike, particularly species that utilise roads for movement pathways. Threatened species such as Western Whipbird (eastern), Southern Emu-wren (Eyre Peninsula) and Rock Parrot that were recorded throughout the Project Footprint may be impacted as a result of increased vehicle activity.

Entrapment of wildlife in utility diversions (e.g., trenches) or other excavations associated with the Project (e.g., excavations for flame trench and/or water deluge system) may cause physical trauma to individual fauna. Open trenches for underground utilities, or other pits are known to be effective at trapping a wide variety of wildlife and often result in mortality. The threatened bird species known to occur in the Project Footprint are mobile species that are likely to be able to fly out of any trench or excavation. As such, it is unlikely that wildlife entrapment would have a significant impact on these species.

Disturbance to Breeding and Foraging Habitat

Many fauna species have specific requirements for breeding and foraging. The two (2) key threatened bird species recorded during field surveys (Southern Emu-wren (Eyre Peninsula) and Western Whipbird (eastern)) build nests out of twigs, barks and grass that is placed closed to the ground in dense vegetation. Both species breed during September and October (spring) (Picket 2006 and DAWE 2020d).

Works associated with the Project will have both direct and indirect effect on specialist habitat. Direct impacts will include the clearance of 23.76 hectares of suitable breeding and foraging habitat for fauna species while indirect impacts such as noise during construction works and rocket launch operations may affect where these species choose to nest and feed. Species which may be impacted due to the disturbance of these habitat features include the following EPBC Act and NPW Act listed species with known breeding or foraging habitat within the Project Footprint:

- Australian Fairy Tern;
- Black Falcon;
- Cape Barron Goose;
- Diamond Firetail;
- Eastern Osprey;
- Elegant Parrot;
- Painted Buttonquail;
- Peregrine Falcon;
- Purple-gaped Honeyeater;
- Rock Parrot (known to occur);
- Southern Emu-wren (Eyre Peninsula);
- Western Whipbird (eastern);
- White-bellied Sea Eagle; and
- Yellow-tailed Black Cockatoo.

These impacts are likely to be long term in relation to the removal of suitable habitat and may be short or long term in relation to operational noise depending upon individual species resilience.

Increased predation or competition from pest species

Pest species have the potential to impact on terrestrial biodiversity as native species can become displaced through predation and competition with exotic biota. Pest species can also damage native vegetation by grazing and trampling.

Unmitigated Project activities have the potential to disperse pest (animal) species from the Project Footprint into the surrounding landscape, due to habitat removal, noise disturbance, and human presence during the construction and operation phases of the Project. Construction of access tracks and the rocket launch pad facilities infrastructure through large patches of intact native vegetation may result in the introduction of pest species (particularly predators such as foxes and cats) into these areas. Unmitigated potential impacts of the displacement of native species through the invasion of non-natives may be temporary or permanent.

Edge effects refer to the changes in environmental conditions (e.g., altered light levels, wind speed, temperature) that occur along the edges of habitats. These new environmental conditions along habitat edges can promote invasion by pest animals specialising in edge habitats or change the behaviour of resident native animals (Moenting and Morris 2006). Edge zones can be subject to higher levels of predation by introduced mammalian and native avian predators.

A Weeds and Pests sub-plan will be developed as a component of the CEMP and OEMP in accordance with the Development Act, the *Native Vegetation Act 1991* (NV Act) and relevant Landscape South Australia (LSA) board recommendations. In accordance with the CEMP and OEMP, practical steps will be undertaken during all project phases to minimise the potential dispersal of pest species, including:

- Ensure construction compounds are kept neat and tidy at all times, to prevent pest animals from inhabiting the area.
- Ensure food waste is placed in enclosed / covered bins, to prevent pest animals from accessing it.
- Report and record rabbit/hare/fox/feral cat sightings.
- Annual surveys of the site will seek to identify if any pest fauna have become established, allowing management programs to be implemented or modified in suitable timeframe to reduce or avoid impacts on the existing terrestrial and/or marine environments.
- Control pest animal species (especially rabbits, foxes, and feral cats) that may proliferate as a result of site activities. Ensure rabbit control is in accordance with the threat abatement plan for competition and land degradation by rabbits.

At the present time the site presents opportunities for members of the public to visit the site with minimal formal management strategies in place to control or manage impacts. Through improved management, particularly around the management of waste, the proposed development offers the opportunity to reduce the presence of food sources which are attractive to pest fauna.

Barrier Effects

Barrier effects occur where particular species are either unable or are unwilling to move between suitable areas of habitat due to the imposition of a barrier. This can include a habitat type that has become unsuitable or a physical barrier such as a fence. Species most vulnerable to barrier effects include those with limited dispersal abilities.

Various project activities may create barrier effects, particularly those that may create a hard barrier that restricts fauna movement (e.g., cutting or embankments and fences). The Project includes exclusion fencing to prevent unauthorised entry to the launch pad facilities. The fences will also prevent the movement of fauna species, in particular large mammals (kangaroos, emus). It is unlikely that fencing required for the Project will prevent movement of the threatened birds that are known to occur in the Project Footprint.

Human activity and infrastructure are likely to create a barrier as many species are known to avoid areas of human activity resulting in indirect habitat loss. Human presence may affect species in different ways with some species displaying avoidance behaviour while others may habituate and become attracted to areas of human activity. Predators and prey may respond differentially to human activity, causing a disruption of community interaction and potentially disrupting ecological processes (Caro 2005).

Similarly, barrier effects may be experienced by native animals in the form of increased patrolling and predation by pest animals along barriers, such as a cleared corridor. Foxes and wild cats target these barrier areas as prey becomes more exposed and easier to detect and catch.

Dust and Light Impacts

Dust, and light are direct impacts that have the potential to occur as a result of the Project Activities during all phases and may also have cumulative effects. The likelihood of potential impacts is anticipated to be greatest where the Project Activities take place near vegetated areas and known habitat, during the construction and rehabilitation phases.

The Project will result in impacts from light spill into adjacent receiving environments (e.g., fauna habitat) due to the operation of plant and equipment throughout the construction phase of the proposal and installation of lighting on infrastructure required for the operation of the Project.

Impacts associated with light spill may include direct impacts (e.g., increased susceptibility to predation from increased light) or indirect impacts related to altered foraging and habituation in areas exposed to increased lighting. Light impacts associated with construction will be temporary in nature, however operational lighting impacts will be long term and localised (e.g., infrastructure) or transient in nature (i.e., vehicle movement).

Ecological receptors affected by these potential impacts include all threatened fauna species listed under the provisions of the EPBC Act and/or NPW Act. These types of impacts are likely to be short in duration and localised.

Lighting of an appropriate type that accords with the colour and intensity requirements of *National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds January 2020 Version 1.0* will be implemented where possible.

Impact of Launch Failures

The risk of launch failure impacting on mainland terrestrial biodiversity is extremely low. For a launch failure to impact on mainland terrestrial biodiversity it would require the rocket to explode at the point of ignition at launch. Due to the proximity of the launch sites to the ocean, within a few seconds after launch the trajectory of the launch will carry the vehicle over the ocean.

The main consequential risk in an ignition point failure scenario is the resulting potential for fire. Fire risk and mitigation methods are discussed further under **Section 9.4.4** below. Fire risks will be mitigated through the installation of Southern Launch firefighting equipment at every launch event, along with the water deluge system. Initial firefighting capabilities during rocket launch attempts will be augmented by local Country Fire Service (CFS) crews. Sufficient water will be located onsite to successfully control and contain any unexpected fire.

Impact of Noise and Vibration

Noise and vibration have the potential to adversely affect wildlife and sensitive habitat located near construction activities. Noise impacts may include changes in behaviour and physical harm, which have the potential to adversely impact sensitive wildlife populations.

Birds have been identified as the primary noise-sensitive receptors for this project, however, mammal and reptile species were also noted within the Project Footprint.

The potential of anthropogenic noise on birds are commonly identified as follows (Dooling & Popper 2007):

- physiological effects, such as stress, avoidance and fright-flight responses;
- damage to hearing from acoustic over-exposure; and

- masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects (Shannon, et al. 2016).

The range of hearing for mammals and reptiles and the consequent sensitivity to anthropogenic noise are not as well researched. However, behavioural, and physical responses similar to those listed above have been noted in available literature.

Impacts of noise and vibration on terrestrial and marine fauna is detailed in **Section 8.0** of this report. The basis for this discussion can be found in Noise and Vibration Assessment (**Appendix O**) and Terrestrial Ecological Assessment (**Appendix P**).

9.4.2.2 Impacts on Osprey

Whalers Way – the Project Site, occurs in an area with known Osprey territories that were still occupied during the most recent surveys between 2015-2017 (Detmar and Dennis 2018). Known disturbance threats to Osprey include:

- recreational activities;
- landscape scale habitat degradation (e.g., large scale vegetation clearance, fire, land use change, overgrazing);
- proximity to residential dwellings;
- drone use areas; and
- marine industry.

Key sources of disturbance to Osprey nesting locations are attributed to activities occurring above their nest level, often associated with coastal recreational use by humans (walking trails, hiking, lookouts, car parks) and access by predators (e.g., feral cats, foxes).

Due to human disturbance from recreational activities, including hiking, car parking and lookouts, two (2) Osprey nests located within 2.0 kilometres of the site are highly likely to be abandoned. Further to this, illegal dumping and waste left on the site by recreational users over an extensive period of time has likely resulted in increased predation within the Whalers Way area by invasive pest species (foxes and cats) which may have contributed to the abandonment of the nests.

The Project aims to better manage public access, particularly to the clifftop tracks and osprey viewing area (above an abandoned nest site). Based on this it is considered the Project is unlikely to substantially modify, destroy or isolate an area of important habitat. Rather the Project will benefit the local population, by reducing the current level of human disturbance and it is anticipated that Osprey may have the opportunity to use the coastline more actively.

Given standard CEMP and OEMP controls proposed to be implemented, it is not expected that the Project would increase the baseline status of invasive pest species. It is likely that a change of land use that is well managed, with better managed public access and reduction of illegal dumping will benefit all fauna present at the site that could be impacted by an increase in invasive pest levels.

It is acknowledged that there is potential for at least one (1) Osprey territory to overlap the Project Footprint area; however, given the lack of known active nests it is unlikely a core nest territory occurs within 2.0 kilometres of the Project Footprint or that the area forms a breeding habitat for the pair. The Project is not considered to directly impact the habitat of local individuals of the species, save for some noise related impacts.

Operations (launch) noise will peak during launch for approximately 75 seconds, every three (3) weeks (0.005 per cent of the time). This noise is generated whilst the launch vehicle ignites, lifts off and then moves a significant distance from the launch pad. The noise maximum will be between 130-140 dB (worst case scenario), up to 80 metres from the launch pad. A gas operated bird scare gun will be used to 'scare' any fauna that are near the immediate area prior to launch. This mitigation measure seek to will reduce the number of animals present in the immediate noise zone close to the launch pad at the time of the launch.

Noise impacts would be most significant to an individual nesting pair (if located within 2.0 kilometres of the launch pads) during the critical breeding period. In addition, the launch pad and other infrastructure location are not within the line of site of a known nesting pair. Based on this, it is considered that project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the Eastern Osprey.

9.4.2.3 Impacts on White-bellied Sea Eagle

Long-term studies of White-bellied Sea Eagles in a range of habitats identified a negative relationship between human activities and nest productivity outcomes (i.e., disturbed territories produced eggs less often, fewer young, and higher rates of nest failure than nests located in remote locations with less disturbance).

Any disturbance during their nesting period, particularly overhead, may cause the Eagles to abandon their nest. For nests that are more exposed or are on coastal terrain with low heath vegetation lack of visual screening increases vulnerability to disturbance from human activity.

White-bellied Sea Eagles occupy a territory and nest on the offshore Liguanea Island and a recent territory and nest site has been established greater than 5.0 kilometres to the east of the launch sites.

Current disturbances at Whalers Way consist of infrequent interactions with amateur photographers who discovered the onshore nest site during active searches possibly in 2018.

Searches online have also discovered drone footage of the cliff tops surrounding the nest at low altitude. It is well documented that both pedestrians on foot and drone flights above nests or sentry points will be perceived as threats by Sea Eagles which will result in flushing of birds and potential breeding failure.

Due to the better managed public accessibility to the area as a result of the proposal, it is highly likely that potential disturbance to the nest by human activity will decrease. As such, the proposal may enhance the protection to both onshore and offshore nests in the area, rather than increase their risks. Certain mitigation strategies will need to be employed to ensure that construction activities in proximity avoid important breeding times and minimise the potential for disturbance.

It is considered highly unlikely that proposed launch activities over 5.0 kilometres away from the onshore cliff top nest would cause disturbance or a startle response as the nest is below any visual sight line and background noise from surf and or wind would be likely to cancel out any possible minimal noise generated at launch.

9.4.2.4 Australian Fairy Tern

There have been two (2) sightings of the Australian Fairy Tern within 5.0 kilometres of the Project Footprint, one (1) of which was on Red Banks Beach and was considered to be potentially nesting (DEW 2020). Red Banks Beach is approximately 1.3 kilometres from the Project Footprint.

The main threats to the Australian Fairy Tern (DAWE 2020c) include:

- predation by introduced mammals such as the Red Fox, domestic cats, Black Rats (*Rattus rattus*), and native birds such as Silver Gulls (*Larus novaehollandiae*), Pacific Gulls *(Larus pacificus*), Swamp Harrier (*Circus approximans*) and Ravens (*Corvus spp.*);
- disturbance by humans, dogs and vehicles, which can cause the direct destruction of nests or the desertion of nests;
- increasing salinity in waters adjacent to Australian Fairy Tern colonies, which can lead to a collapse in the numbers of prey fish causing a decline in Australian Fairy Tern numbers;
- irregular water management, which can result in water levels being too high, flooding nests, or too low allowing predators to walk across to breeding colonies; and
- weed encroachment, which often leads to nest sites being overgrown by vegetation rendering them unsuitable for breeding.

Based on the available information for the Australian Fairy Tern, including its preferred foraging and breeding habitat, and known records, it is unlikely that the Project will have a significant impact on this species. In accordance with the EPBC Act an assessment of the likelihood of impacts in accordance with the SIG 1.1 guidelines is provided in **Appendix P**.

9.4.2.5 Western Whipbird (eastern)

There are three (3) isolated regional populations of the Western Whipbird (eastern) in SA one (1) of which is on the Eyre Peninsula (DAWE 2020d).

The habitat of the Western Whipbird (eastern) was observed as low Mallee, generally Eucalyptus *diversifolia* (Vegetation Association 3) and Eucalyptus *angulosa* low (Vegetation Association 4) Mallee. This habitat is extensive and widespread in the Whalers Way area being the dominant cover for areas interacting with the Project Footprint particularly within low Mallee vegetation with an average height of 1.5 metres and above.

Targeted surveys observed the Western Whipbird regularly by call within and near the Project Footprint. The Project Footprint includes 23.76 hectares of suitable habitat for this species that will be required to be cleared for the Project.

The major threats to the Western Whipbird (eastern) (DAWE 2020d; DELWP 2016) are:

- broad scale clearing of mallee habitats;
- extensive wildfires which lead to isolation and fragmentation and removal of suitable habitat; and
- climate change resulting in increased risk of bushfires, heatwaves, floods, and drought which may influence the availability of food resources particularly for populations that are already isolated by broad-scale clearing (DELWP 2016).

The Project includes clearing 23.76 hectares of Western Whipbird (eastern) habitat, with potential ongoing impacts from noise and lighting during operation. In consideration of the SIG 1.1 criteria, the Project is considered to have the potential to have a significant impact to the Western Whipbird (eastern). In accordance with the EPBC Act an assessment of the likelihood of impacts in accordance with the SIG 1.1 guidelines is provided in **Appendix P**.

9.4.2.6 Southern Emu-wren (Eyre Peninsula)

The Southern Emu-wren (Eyre Peninsula) is endemic to the southern tip of the Eyre Peninsula in South Australia. The Project includes clearing of 23.76 hectares of suitable habitat for this species. Targeted surveys identified 18 individual birds, consisting of four (4) pairs, one (1) group of three (3) and the seven (7) singles.

The main identified threats to the Southern Emu-wren (Eyre Peninsula) (DotE 2013a) are:

- bushfire causing widespread habitat loss;
- land clearance/fragmentation due to poor dispersal ability;
- predation by European Red Foxes (Vulpes vulpes) and likely also feral cats (*Stipiturus malachurus parimeda*);

- climate change due to exposure to increase in frequency and intensity of fires;
- grazing by kangaroos (Macropus spp.) and emus (*Dromaius novaehollandiae*); and
- land development.

The Project is located at Whalers Way which supports a large population of the Southern Emu-wren (Eyre Peninsula), recognised for its size and importance (DAWE 2020e; Pickett 2016). Any clearing of vegetation or risk of increased mortality is likely to be considered a significant impact. There is potential for that indirect impacts from construction and operational activities may lead to behavioural changes which may disrupt the breeding cycle or cause further reduction in habitat availability.

In consideration of the SIG 1.1 criteria, the Project is likely to have a significant impact to the Southern Emu-wren (Eyre Peninsula). In accordance with the EPBC Act an assessment of the likelihood of impacts in accordance with the SIG 1.1 guidelines is provided in **Appendix P**.

9.4.2.7 Impacts on Marine Fauna

The following impacts on the marine environment have been considered in the Marine Ecological Assessment contained in **Appendix S**:

- Operational impacts:
  - collision of debris with fauna; and
  - other impacts associated with debris.
- Impacts associated with noise and vibration are addressed in **Section 9.4.5.2**.

<u>Collision of debris with fauna</u>

Several scenarios could result in fauna being struck by high-speed projectiles associated with a rocket launch:

- Nominal success: orbit achieved with slight variations in trajectory – some stages fall to earth at distances of 3–8 and 40–150 kilometres for suborbital rockets and >500 kilometres for orbital rockets.
- Failure – air burst: a launch vehicle explodes while in the air. This results in the launch vehicle breaking up into a number of pieces and landing over a large area. This can be the result of a manual detonation of a rocket (using a flight termination system) that is not behaving as expected.
- Failure – ground burst: launch vehicles motors fail shortly after lift-off. The flight termination system fails, and the vehicle remains whole as it falls to the ground/water and explodes on impact.

Debris, functioning as a high-speed projectile, would not have any significant impact on marine life below the surface because of rapid attenuation of its kinetic energy on entering seawater.

Rockets launched from either launch station with Polar or Sun Synchronous trajectories are the most likely to pass close enough to Liguanea Island to present a risk of debris falling onto the island. No impacts are expected from successful launches because suborbital rockets would not be launched with a trajectory near Liguanea Island, and the first stage from orbital rockets would fall more than 500 kilometres offshore.

Flight safety risk analysis using processes set out by the Federal Aviation Authority and Flight Safety Code has been undertaken using established frameworks for estimating the probability of human casualties, applied to seals. The details are provided within an Appendix of **Appendix S**). The probabilities are expressed as the average number of launches expected between seal casualties for scenarios for each of the micro, mini and small size classes.

The modelling is conservative in many respects, including:

- The assumption that the modelled number of seals are all on land, when many would be foraging at sea, particularly outside of the breeding season.
- The use of near worst-case (99.5th percentile) of debris interactions with Liguanea Island, rather than mean, to calculate expected casualties
- The assumption that all debris striking with energy greater than 15 joules would be fatal.

An air burst would result in a scatter of debris over an area that would increase with distance from the launch. For a debris fragment to collide with fauna on Liguanea Island, it would require not only failure of the rocket, but at such a precise time as would result in fallout over the island, and one (1) or more of the few fragments falling on the island to coincide with the sparsely distributed fauna.

The risk analysis modelling predicted that an air burst would have an average frequency of LNFS and ASL casualties of one (1) every 3,375 and 194,470 launches, respectively, for small rockets. For mini or micro rockets, expected to collectively account for 95 per cent of launches, the frequency would be 30 or 100 times lower, respectively. The low number of casualties per air burst for both species suggests that there would be no impact at sub-population level for either species.

Table 9.1: Potential for Pinniped casualty per number of launches from an air burst.

	LNFS			ASL	
Vehicle	1 Accident per [X] Launches	Casualties per air burst	1 Casualty per [X] Launches	Casualties per air burst	1 Casualty per [X] Launches
Small	11,764	3.48	3375	0.0604	194,470
Mini	7407	0.07	105,814	0.0012	6,170,000
Micro	7407	0.02	370,350	0.0004	18,510,000

Vehicles are fitted with Flight Termination Systems (FTS) which seek to reduce the risk to life and property on the ground in the event of a failure. An FTS is a safety critical system and is subject to the same level of design scrutiny and certification as ABS brakes. FTS work in multiple ways which can include, but is not limited to:

1. Guiding the vehicle to a lower risk location prior to it intersecting the ground; or
2. Turning off the rocket engines so the rocket falls back to Earth; or
3. A controlled destruction of the vehicle mid-flight.

Rockets can be installed with a flight termination system (FTS) that allows the rocket to be detonated in mid-air in the event of unexpected and undesirable behaviour. Explosion of a rocket on Liguanea Island would require failure of the FTS, in addition to other factors such as launch failure at the precise time that resulted in a collision with Liguanea Island.

The risk analysis modelling predicted that a ground burst would occur about every 4.7 million launches for a small rocket and every three (3) million launches for mini or micro rockets, with an average frequency of LNFS and ASL casualties of one (1) every 7,700 and 445,000 launches, respectively, for small rockets and almost twice as many launches for mini or micro rockets.

Table 9.2: Potential for pinniped casualty per number of launches from a ground burst.

	LNFS			ASL	
Vehicle	1 Accident per [X] Launches	Casualties per ground burst	1 Casualty per [X] Launches	Casualties per ground burst	1 Casualty per [X] Launches
Small	4,716,981	613	7,694	10.6	444,998
Mini	2,914,176	226	12,894	3.9	747,224
Micro	2,914,176	199	14,644	3.4	857,110

Although ground bursts are much less likely than air bursts, the number of casualties can be much higher. Potential impacts at sub-population level can be explored by comparing with population viability analysis previously undertaken in the context of assessing the impact of fisheries bycatch on seals (refer to **Appendix S**).

For LNFS, more than 1,000 additional mortalities of immature females would be required annually to drive the Liguanea Island sub-population to extinction over 32 years, compared with 613 mortalities (all age and sex, so less for immature females) for the worst-case predicted mortalities per ground burst. Therefore, there would be no sub-population level impact on LNFS. For ASL, two (2) additional mortalities of immature females would be required annually to drive the Liguanea Island sub-population, already assumed to be in decline, to extinction over 46 years, or for a sub-population of the current size of Liguanea Island, 1.3 additional annual mortalities over 32 years. This suggests that the worst-case ground burst mortalities of about 11 (all age and sex, so less for immature females) may have a minor impact on pup production over six (6) years but there would be no long-term sub-population level impact.

Within the Southern Ocean, including the waters of the Thorny Passage Marine Park surrounding Liguanea Island, there may be occasional debris strike impacts on individual animals on the sea surface but no impact at population level. Further discussion is provided within **Section 22** of this report.

Other impacts associated with debris

The impacts of debris following contact with the sea surface depend on the nature of the rocket components of which the debris is comprised, which is described in **Section 22**. Key points include:

- All component materials are inert and harmless to the marine environment except lithium (within batteries) and copper (within electrical wiring).
- Fuels would be expended before contact with the sea floor, or would burn, remain inert (rubber-based solid fuel) or vaporise (liquid fuels).
- Most materials would sink, except rubber-based solid fuels (and liquid fuels prior to vaporisation) and some small pressure vessels which have not been punctured.
- Casings that have not already broken up during re-entry would generally shatter into thousands of pieces on impact with sea surface, with the possible exception of some thick carbon fibre components.

Copper fragments would sink to the seafloor where their slow dissolution may have long-term local effects on sediment in fauna, or be dispersed from areas of hard substrate, adding a very low total mass of copper relative to natural oceanic copper quantities. Lithium, ion batteries (about the size of two (2) car batteries in volume) would likely rupture on impact with the sea surface or at depth. Lithium is already elevated in seawater and is not toxic but would react with seawater and in sufficient quantity could cause alkaline conditions with localised, short-term toxic effects.

The descent of debris to the sea floor is expected to slow enough to be avoided by mobile fauna, but sessile organisms may be impacted by larger items of debris or accumulations of fragments settling on the seafloor. Fragile biota may be damaged or destroyed, and feeding or respiration may be inhibited, but the area impacted would be insignificant compared to the extent of the receiving environment. Particles would be created that are small enough for pelagic and benthic fauna to digest, potentially impacting individuals but with negligible impact at population level. The settlement of larger fragments of debris on soft sediment could result in a shift to benthic communities requiring hard surfaces, and floating debris may provide shelter for pelagic organisms and substrate for attachment and dispersion of sessile organisms. Noise associated with debris striking the sea surface may have short-term impacts on individuals of air-breathing or pelagic fauna near the surface.

Any of the above impacts would be highly localised, the area impacted would be insignificant in comparison to the extent of the receiving environment and population level effects would be negligible.

9.4.3 Guideline 3.3

3.3. Identify the effect of the proposal on terrestrial habitat fragmentation including the ability of populations or individuals to recover during both construction and operation.

As previously discussed in Section 9.4.2.1, habitat fragmentation relates to the physical dividing up of a continuous habitat into separate smaller fragments (Fahrig 2002). The habitat situated between fragments is often artificial and less suitable to the species remaining within these fragments (Bennett 1990).

Habitat fragmentation as a result of vegetation clearing for the Project is considered localised. The habitat in the local area is contiguous and provides ample connectivity across Whalers Way. It is unlikely that vegetation clearing will result in any species to becoming genetically isolated and lead to sub-populations in the local area.

The widening of tracks and the construction of the launch pads may lead to local fragmentation, however the majority of species at Whalers Way are mobile and are able to traverse the distance a track represents. Fragmentation is therefore considered limited and unlikely to be considered significant.

This is detailed further within AECOM's Terrestrial Ecological Assessment contained in **Appendix P**.

9.4.4 Guideline 3.4

3.4. Identify the potential impact of fire and explosion on native fauna, and the effects of fire risk management processes during both construction, operation and maintenance.

The Project may increase the risk of fire due to hot works during construction activities and the chance of sparks occurring off the rocket launches during times of hot and dry conditions.

The change in vegetation structure caused by fire decreases habitat availability for many native species and is likely to increase stress and resource pressure on fauna species. The loss of these habitat features may also increase the risk of predation of species by both native and introduced fauna.

Fire protection mitigation measures include:

- Firebreaks incorporated along fences to protect and mitigate one (1) of the primary threats to species present.

- All buildings and facilities are sited within the Project Footprint to achieve suitable clearance from vegetation for fire mitigation purposes. The siting of all buildings and facilities within the Project Footprint achieves the minimum fire clearance requirements under the National Construction Code.
- Assembly Building, Fuel Pad and Oxidiser Pad will have firefighting services as per legislative requirements.
- Adequate water supply for firefighting will be available at each site including water stored in 25,000 litre tanks at initial stages and then significant water supply through the dam and detention basins once established.
- Bush fire risks will be mitigated through the installation of firefighting equipment at every launch event. Initial firefighting capabilities during rocket launch attempts will be augmented by local Country Fire Service (CFS) crews. Sufficient water will be located onsite to successfully control and contain any unexpected fire. There will also be a fire truck on site during launches.

Fire risk management processes are to be incorporated into the CEMP and OEMP and are further detailed in **Section 20.0** and **Section 23.0**.

9.4.5 Guideline 3.5

3.5. Identify the potential impact of noise and vibrations on terrestrial, coastal and marine native fauna, and the mitigation and monitoring strategies during both construction and operational phases.

9.4.5.1 Terrestrial Fauna

The impacts of noise and vibration on terrestrial fauna is detailed in **Section 8.0** (Noise and Vibration) within this report, and further detailed within AECOM's Terrestrial Ecological Assessment contained in **Appendix P**.

9.4.5.2 Marine Fauna

Acoustic energy from in-air noise does not effectively transfer across the sea surface meaning that most of the noise is reflected off the water surface. Therefore, noise and vibration impacts from the launch are unlikely to result in impacts on marine fauna below the surface.

Noise from launches would temporarily alter the quiet setting of the natural environment for one (1) to two (2) minutes during launches. The maximum instantaneous sound pressure level during a launch would be 125 dBA at the closest shoreline to either launch site, less than 95 and 100 dBA at Cape Wiles for launches from Site A and Site B, respectively, and about 95 dBA at the northern end of Liguanea Island (slightly higher for Site A launches) (Figure 11, AECOM 2020). Sound exposure levels (SELs), representing the sound level of a constant sound that would generate the same acoustical energy in one (1) second as the actual time-varying noise event, were typically 15 dBA higher than the maximum sound pressure levels (refer **Appendix O**).

Based on published noise thresholds (refer **Appendix P**), birds on Liguanea Island (including Short-tailed Shearwaters and Crested Terns) would not incur permanent hearing loss. Birds towards the northern end of the Island would be exposed to noise levels close to the threshold for temporary hearing loss and behavioural change, but these impacts are unlikely because the threshold is derived from studies with continuous noise exposure of 12–72 hours duration, rather than less than two (2) minutes.

Similarly, published hearing loss thresholds for seals would not be exceeded anywhere on Liguanea Island or at Cape Wiles. Behavioural impacts are possible for animals towards the north of the Island. Seals have been known to move both on land and occasionally into the water in response to launches in northern America but return within minutes to two (2) hours. In the event that seals were sufficiently startled to stampede towards the water, pups are unlikely to be injured by trampling because the narrow habitat does not allow for a sufficiently dense concentration of seals, and after their first month, the pups are quite robust.

Noise mitigation measures at the launch site may reduce behavioural impacts on species on Liguanea Island, and avoidance of particular periods in the breeding cycles would further mitigate any potential impacts.

Noise impacts from sonic booms would be limited to behavioural impacts but are considered unlikely to occur on the coast or Liguanea Island. Sonic booms would be generated several kilometres offshore during ascent but are typically directed in front of the rocket and would not be close enough or strong enough, due to the relatively small size of the rockets, to reach the earth's surface (refer **Appendix O**).

Noise impacts associated with testing have not been considered as the noise would be for a shorter duration (15 seconds) and further from the marine environment and at maximum levels of 10–20 dB lower than the launch scenarios.

Construction activities

No impacts on marine species are expected from noise associated with construction activities.

Sound pressure levels of 143 dB would not be experienced anywhere other than the launch site and would decrease significantly as proximity to the launch site increases. Therefore, due to their distance separation, no impact is expected on the hearing of ASL or LNFS on Liguanea Island, or LNFS hauled-out at Cape Wiles.

9.4.6 Guideline 3.6

3.6.	*Detail appropriate buffer distances that would be required between proposed development (including coastal access points) and threatened terrestrial and marine species, including feeding areas, nesting sites and roosting sites.*

Design buffers have been applied in the Project Footprints of each facility and access roads in order to limit indirect impacts to vegetation, flora and fauna in the vicinity.

A 5.0 metre vegetation clearance buffer from has been applied to the Project Footprint for fire safety purposes. All buildings and infrastructure are all sited with a minimum 5.0 metre setback from the Project Footprint boundary, and in some instances up to 20 metres from the boundary dependant on form of batters.

All roads have a 3.0 metre buffer applied to each side of the road; however, this may increase to 6.0 metres on one (1) side of the road, dependent on the bends in roads and terrain encountered. This is also provided to allow for the addition of power and water easements.

Signage and exclusion barriers/bunting will be installed around areas of known fauna habitat prior to the commencement of any construction works in or within 200 metres of these areas. This includes identification and fencing (or marking of buffer areas) around protected species nests that are known in the area.

Revegetation is to occur through natural regeneration as well as through assisted planting to create a vegetated buffer between the disturbance footprint and adjacent values. Plantings (tube stock and seed) to consist of native species analogous to adjacent vegetation community.

9.4.7 Guideline 3.7

3.7. Outline measures to avoid, minimise, mitigate, and monitor the effects on native fauna, including any compensatory activities.

The mitigation hierarchy as devised by the NVC (NVC 2017) has been applied during the design of the Project. This included reducing the footprint as far as practicable to avoid clearing fauna habitat and implementing the CEMP and OEMP to manage direct and indirect impacts.

In order to avoid (where possible), manage and mitigate project risks and potential impacts during all phases of the Project, mitigation measures are to be adopted and detailed within the CEMP and OEMP. These proposed mitigation measures respond to project specific issues and opportunities, address legislative requirements, and incorporate industry standard practice.

These proposed mitigation measures have been segregated by implementation phase:

- detailed design;
- pre-construction;
- construction;
- post-construction rehabilitation of disturbed areas from construction activities where not required for ongoing operations such as temporary laydown areas, hardstands etc. Land will be returned to a post-disturbance condition that is safe, stable, non-polluting and able to sustain the proposed land use with only minor maintenance required into perpetuity; and
- operation.

9.4.7.1 Detailed Design

Minimisation of impacts to ecological value

- Portions of the Project are located within existing access tracks and wherever possible, have been aligned to be co-located with existing access tracks to limit the amount of native vegetation and fauna habitat to be cleared. Tracks will be formalised initially into gravel roads and upgraded to asphalt in the future, which will minimise the generation of dust and potential impacts to surrounding vegetation and fauna habitat.
- The size of the Project Footprint has been reduced in size from 70.58 hectares to 23.76 hectares through design considerations, in particular the re-design of Infrastructure Site D to position the footprint into more degraded vegetation. Southern Launch will undertake detailed design and/or construction planning to minimise the construction footprint and avoid impacts to vegetation as far as practicable.
- Disturbance footprints will be limited to those areas required to construct and operate the works, as practical for safety, especially in regard to the clearing of native vegetation.
- Fencing around the Launch Sites A and B, Infrastructure Site D and Range Control Site E will be incorporated into the design to minimise risk to fauna and channel fauna toward safe movement opportunities. An 1,800-millimetre chain mesh fence with three (3) strands of barbed wire will be installed to ensure threatened bird species can't fly through or get caught in the fencing.
- Firebreaks incorporated along fences to protect and mitigate one (1) of the primary threats to EPBC listed species present.
- The Project will be designed to only support micro-lift and small-lift rocket vehicles not requiring the development of large infrastructure that may have a greater impact on the surrounding environment.
- Where necessary and possible geo-barriers will be employed to limit the potential damage from a spill or leak of liquids.
- The proposed detention basins and dam will be lined with a polymer lining, an 1,800-millimetre chain mesh fence with three (3) strands of barbed wire will be installed around all the three (3) open water bodies and they will be covered with a geotextile tarp or shade cloth to detract bird species and keep pest species and native ground dwelling fauna species out of the open water bodies.
- The CEMP and OEMP will require the inclusion of any Commonwealth and State approval conditions stipulated for vegetation clearing with regards to fauna management. This may include a trapping program, presence of wildlife spotters onsite during clearing, and clearing being undertaken from disturbed areas toward undisturbed areas to encourage fauna to move away from the clearing operation.

Pest Species

- A Weeds and Pests Sub-plan will be developed as a component of the CEMP and OEMP in accordance with the Development Act, the NV Act and relevant LSA board recommendations.
- The Weeds and Pests Sub-plan will ensure weed control methods for threatened species will be done in accordance with the relevant Recovery Plan for the species (i.e., the Western Whipbird (eastern) National Recovery Plan).

Noise

- A water deluge system and flame trench has been included in the design to mitigate noise impacts, which reduce the noise level by approximately 5-10dB.

Post construction - rehabilitation

- A Rehabilitation Management Sub-plan will be developed for the Project, as a component of the CEMP and OEMP. As a minimum it will establish the following:
    - location-specific objectives for rehabilitation of temporarily disturbed areas, reinstatement and/or stabilisation;
    - timeframes for rehabilitation and/or reinstatement/stabilisation works to be achieved;
    - details of the actions and responsibilities to progressively rehabilitate, regenerate, and/or revegetate areas, consistent with the agreed objectives;
    - consideration for maintenance or performance issues of rehabilitation e.g., vegetation that does not grow and obscure signals or impact the longevity of rail infrastructure;
    - procedures, timeframes, measurable performance objectives and responsibilities for monitoring the success of rehabilitation and/or reinstatement/stabilisation areas; and
    - where temporary construction facilities are required, land shall be returned to a stable condition that complies with the conditions of applicable regulatory approvals.

Offsets

- Restriction of the Project Footprint as far as practical, to safely and efficiently construct and operate the Project. In doing so, avoid areas of MNES, NPW Act listed receptors and their associated habitat, where possible, thereby minimising significant adverse residual impacts to these matters.
- A biodiversity and native vegetation offset strategy will be developed in consultation with the NVC (SA) and the DAWE (Commonwealth), only if required.

9.4.7.2 Pre-construction/Construction

Native Fauna

- Scheduling of clearing activities will be done to avoid breeding seasons as far as reasonably practical. Where this is not practical, and where breeding sites are identified within the corridor during pre-clearance surveys, a suitably qualified person will provide mitigation measures for hazardous zones/ relocation requirements relevant to the specific species identified.
- Any required fauna fencing will be installed in accordance with the fencing strategy which will be finalised and documented in the detailed design.
- A suitably qualified ecologist to complete a site survey prior to the commencement of clearing to identify and mark high-value fauna habitat trees which are not to be removed with flagging tape (or other appropriate marking method), trees that are not to be felled without the presence of a spotter-catcher (where clearing cannot be avoided and the tree is an identified habitat trees), and to identify habitat features suitable for relocation to no disturbed areas immediately adjacent to the disturbance footprint.
- Display a fact sheet on expected fauna on site notice boards and in lunchrooms, in particular threatened species such as the Western Whipbird (eastern) and Southern Emu-wren (Eyre Peninsula).
- Install signage and exclusion barriers/bunting around areas of known fauna habitat prior to the commencement of any construction works in or within 200 metres of these areas. This includes identify and fence or mark buffer areas around protected species nests that are known in the area.
- Check all vegetation (trees, bushes, shrubs, and grassland) for fauna, immediately prior to any vegetation removal or clearing and grubbing works.
- Construct windrows (small soil berms) on the edge of access tracks and hardstands to delineate the boundary and prevent vehicles and construction equipment damaging habitat beyond the construction impact zone.
- All trenches will be closed / backfilled as soon as possible and will not remain open for more than 48 hours, where possible.
- All trenches and excavations will have an escape route (e.g., soil ramp) to allow entrapped fauna to escape, where practicable.
- All trenches and excavations will be checked for trapped fauna first thing in the morning and again in the afternoon prior to works finishing for the day and any trapped fauna will be released.
- All cable junction pits (which may be required to stay open for extended amounts of time) will be covered and/or fenced off to prevent inadvertent trapping of fauna.

- If any threatened fauna species are observed during construction, work will cease in the immediate vicinity of the sighting until it has relocated, or it has been removed by a suitably qualified spotter-catcher. The fauna spotter-catcher will provide a suitable record to the Site Supervisor.
- Any fauna that requires relocation shall be relocated using appropriate animal hygiene. These include:
    - wash hands between handling of different animals;
    - handling of frogs will be done with the use of disposable and pre-rinsed vinyl gloves. Do not handle multiple individuals wearing the same gloves; and
    - animals are to be immediately bagged in a suitably sized calico bag or plastic zip lock bag for amphibians. Do not reuse bags or use a single bag for multiple individuals.
- Any fauna which are relocated will be documented throughout the course of construction and operation. This record will include:
    - species;
    - location found;
    - location of relocation area; and
    - condition of the animal.
- Ensure all physical fauna control measures, such as windrows, sediment fencing, signage and exclusion barriers/bunting are checked and maintained on a regular basis (weekly as a minimum).
- Speed limits to be reduced in the areas close to Launch Site A and Launch Site B to limit the likelihood of vehicle strike with wildlife.
- If fauna is accidentally killed, in particular Western Whipbird, Southern Emu-wren or Rock Parrot bodies are collected, reported to DEW and frozen for the SA Museum.

<u>Pest Species</u>

- The Weeds and Pest Sub-plan, as a component of the CEMP and OEMP, will be implemented (refer above).
- Ensure construction compounds are kept neat and tidy at all times, to prevent pest animals from inhabiting the area.
- Ensure food waste is placed in enclosed / covered bins, to prevent pest animals from accessing it.
- Report and record rabbit/hare/fox/feral cat sightings.

<u>Noise</u>

- Locate haul routes and construction laydown areas away from sensitive receptors.
- Use off-site construction or other alternative processes that eliminate or lessen resulting noise.
- Avoid blasting.
- Limit construction activities to daytime unless they are unavoidable.
- Plan for quieter working methods, i.e., bored piles rather than driven piles.
- Consider using site structures as a method of acoustic screening.
- A noise gas gun will be used to 'scare' any fauna that are near the immediate area prior to launch in accordance with SA EPA Environmental Noise Guidelines – Audible Bird Scaring Devices (EPA 2007). This mitigation measure will reduce the number of faunae in the immediate noise zone close to the launch pad.

9.4.7.3 Post Construction

Rehabilitation of disturbed areas

- All disturbed land will be rehabilitated to achieve stable and sustainable conditions of soil cover and vegetation.
- Topsoil and vegetation temporarily disturbed to support the construction of temporary laydown areas, hardstands and utilities trenching activities will be temporarily stockpiled separately to subsoil material and will be utilised to support the reestablishment of the soil profile and rehabilitation of these locations. Soil and vegetation removed for these activities will be supported to remain along the length of the disturbance footprint where the placement of the excavated material does not impact on remnant areas.
- Selected logs and branches from the cleared trees (where not otherwise habitat features) are to be stockpiled in designated stockpile areas for use in rehabilitation in areas with existing tree cover (where practicable, e.g., where the action of stockpiling does not create a fire risk).
- Revegetation is to occur through natural regeneration as well as through assisted planting to create a vegetated buffer between the disturbance footprint and adjacent values. Plantings (tube stock and seed) to consist of native species analogous to adjacent vegetation community.
- All rehabilitation works to be consistent with bushfire and operational safety requirements.

9.4.7.4 Operation

Minimisation of impacts to ecological value

- Manage visitors to the site through formalisation of tracks and signage as well as rubbish management.
- Engage with LSA bodies to join region wide initiatives.
- Bush fire risks will be mitigated through the installation of Southern Launch firefighting equipment at every launch event. Initial firefighting capabilities during rocket launch attempts will be augmented by local Country Fire Service (CFS) crews. Sufficient water will be located onsite to successfully control and contain any unexpected fire. There will also be a fire truck on site during launches.
- Annual investigations into the effect rocket launch activities have on the local fauna and flora with subsequent recommendations on the best methods to protect the regional fauna and flora. Southern Launch is currently in negotiations with University of Adelaide and University of SA with a view to sponsoring one (1) or two (2) PhD candidates to undertake their thesis on the Project Site in respect of impacts on flora/fauna. This study/s will take approximately four (4) years. This will result in a strong understanding of the impacts of operations on local flora/fauna. In respect of baseline information - the detailed studies already undertaken on the Project site as part of the Development Approval process forms that baseline.

Native Fauna

- Any fauna that requires relocation shall be relocated using appropriate animal hygiene. These include:
  - wash hands between handling of different animals;
  - handling of frogs will be done with the use of disposable and pre-rinsed vinyl gloves. Do not handle multiple individuals wearing the same gloves; and
  - animals are to be immediately bagged in a suitably sized calico bag or plastic zip lock bag for amphibians. Do not reuse bags or use a single bag for multiple individuals.
- Any fauna which are relocated will be documented throughout the course of construction and operation. This record will include:
  - species;
  - location found;
  - location of relocation area; and
  - condition of the animal.

- Ensure all physical fauna control measures, such as windrows, sediment fencing, signage and exclusion barriers/bunting are checked and maintained on a regular basis (weekly as a minimum).
- If any fauna needs to be destroyed under a Permit to Destroy Wildlife to reduce their impacts on wind farm infrastructure, destruction will be humane and comply with the *Animal Welfare Act 1985* and codes of practice.
- Speed limits to be reduced in the areas close to Launch Site A and Launch Site B to limit the likelihood of vehicle strike with wildlife.
- If fauna is accidentally killed, in particular Western Whipbird, Southern Emu-wren or Rock Parrot bodies are collected, reported to DEW and frozen for the SA Museum.

Pest Species

- Control pest animal species (especially rabbits, foxes, and feral cats) that may proliferate as a result of site activities. Ensure rabbit control is in accordance with the Threat abatement plan for competition and land degradation by rabbits (DotEE 2016).
- Ensure waste is unable to be accessed by pest animals.

Noise

- Use earth bunds to reduce noise during rocket take-off.
- Use site structures as a method of acoustic screening for noisy equipment.
- Implementation of a water deluge and flame trench, which reduce the noise level by approximately 5-10dB.
- Locate launch sites as far away from residential and other sensitive areas as possible.

Offsets

- Ensure all monitoring, auditing, and reporting requirements detailed in the biodiversity and native vegetation offset strategy are implemented during the operation phase of the Project.

9.4.7.5 Construction Environment Management Plan

A draft version of the CEMP is contained within **Appendix AD** of this report.

Environmental Management Measures

Activities associated with the construction of WWOLC have the potential to cause impact on native fauna. The CEMP identifies the main areas of potential impact and sets out the environmental values, objectives, and environmental management measures applicable to each.

The main areas addressed in the Plan include:

- Land disturbance associated with site preparation for construction and activities and road construction. Potential impacts associated with these aspects include:
  - loss of additional vegetation beyond the remnant native vegetation (very poor to good condition) identified in the site footprint;
  - loss of fauna habitat; and
  - potential for introduction of pest plant species or disease through contaminated soil on vehicles, construction equipment and landscaping materials, including plants.
- Interaction with terrestrial fauna arising from vehicle movement, vegetation removal and general noise and activity. Potential impacts include:
  - impacts on native animals that potentially inhabit the site;
  - displacement of native fauna during construction;
  - road kills of native fauna; and
  - disturbance to fauna, particularly the Western Whipbird (eastern) and the Emu Wren (Eyre Peninsula).
- Wastes and discharges arising from stormwater, and potential contamination for fuels and hazardous substances. Potential impacts associated with these aspects include:
  - the mobilisation of potentially contaminated sediments during construction activities;
  - erosion/pollution due to stormwater runoff;
  - generation of wastes requiring disposal;
  - accidental release/spill of chemicals/fuels/diesel resulting in soil contamination;
  - biosecurity associated with construction operations; and
  - marine pollution and effects on marine communities.

Roles and Responsibilities

All personnel involved in the Project including Southern Launch employees, contractors, and sub-contractors, will be required to work in accordance with the CEMP, and in accordance with all relevant Acts, Policies and Regulations. The draft CEMP outlines the roles and responsibilities for the implementation of the CEMP. Throughout detailed planning and construction phases, names will be allocated to the roles prescribed in the CEMP.

All staff and contractors will be required to undertake training in environmental management as part of their induction to the site and its activities before their participation in any construction activities can begin.

Southern Launch will also ensure that its employees have relevant permits and that contractors provide copies of their permits and licences to Southern Launch. Contractors would also be required to be responsible for ensuring their staff had relevant permits and licences before they commence work on the development.

The CEMP would adhere to the conditions of these licences, ensuring that all onsite operations are compliant.

9.4.7.6 Operational Environment Management Plan

A draft version of the OEMP is contained within **Appendix AE** of this report.

Environmental Management Measures

Activities associated with the operation of WWOLC have the potential to cause impact on native fauna. The draft OEMP identifies the main areas of potential impact and sets out the mitigation methods and the various management procedures and plans that will be in place to respond to these risks.

The main areas addressed in the Plan are summarised as follows:

- Terrestrial Fauna.
- Risks to terrestrial fauna around the area of works from vehicle movements, noise generation, and the generation of wastes that might attract feral predators. Potential impacts associated with these aspects include:
  - impacts on native animals that potentially inhabit the site;
  - disturbance of native fauna during launch;
  - road kills of native fauna; and
  - increase in feral predators resulting in increased kills of native animals.
- Mitigation and management strategies would be developed through specific management plans including:
  - Native Vegetation Management Plan;
  - Flora and Fauna Management Plan; and
  - Waste Management Plan.
- Waste and Discharges

Wastes and discharges arising from stormwater, and potential contamination from fuels and hazardous substances. Potential impacts associated with these aspects include:

- erosion/pollution due to stormwater runoff;
- generation of wastes requiring disposal;

- accidental release/spill of chemicals/fuels/diesel resulting in soil contamination;
- biosecurity associated with construction operations; and
- marine pollution and effects on marine communities.

Mitigation and management strategies would be developed through specific management plans including:

- Stormwater Management Plan;
- Operational Management Plan;
- Biosecurity Management Plan and Response Procedure;
- Waste Management and Minimisation Plan;
- Water Quality Management Plan;
- Emergency Response Management Plan; and
- Fuel and Chemical Storage and Handling Plan.

Roles and Responsibilities

All personnel involved in the Project including Southern Launch employees, contractors and sub-contractors will be required to work in accordance with the OEMP and in accordance with all relevant Acts and Regulations. The draft OEMP outlines the roles and responsibilities for the implementation of the OEMP. Throughout detailed planning and construction phases, prior to operation of the site commencing, names will be allocated to the roles prescribed in the OEMP.

All staff and contractors will be required to undertake training in environmental management as part of their induction to the site and its activities before their participation in any construction activities can begin.

Southern Launch will also ensure that its employees have relevant permits and that contractors provide copies of their permits and licences to Southern Launch. Contractors would also be required to be responsible for ensuring their staff had relevant permits and licences before they commence work on the development.

The OEMP would adhere to the conditions of these licences, ensuring that all onsite operations are compliant.

9.4.7.7 Specific Operational Management Plans and Procedures

In addition to the CEMP and OEMP, a number of detailed stand-alone management plans and/or procedures are required to provide more detailed processes in relation to matters identified in the OEMP.

The documents identified are summarised as follows (subject to additional inclusions during development):

- Emergency Response Management Plan.
- Bushfire Hazard Management Plan.
- Waste Management and Minimisation Plan.
- Biosecurity Management Plan (which includes the Biosecurity Response Procedure (see OEMP.
- Spill Response Plan.
- Heritage Management Plan.
- Planting Guide.
- Contamination Management Plan.
- Coastal Acid Sulfate Soil (CASS) Management Plan.
- Stormwater Management Plan.
- Flora and Fauna Management Plan.
- Offset Implementation Plan.
- Native Vegetation Management Plan (to address SEB requirements).
- Water Quality Management Plan.

9.4.7.8 Eastern Osprey and White-bellied Sea Eagle Impact Mitigation Options

The Coastal Raptor Assessment (**Appendix R**) provides specialist assessment of the impacts on the Coastal Raptor Species, these being the Eastern Osprey and the White-bellied Sea Eagle. This assessment outlines some tailored mitigation strategies (in additional to those previously listed) relevant to these Coastal Raptor species. As such this report has considered these separately.

In respect to the Western Whipbird (eastern) and Southern Emu-wren (Eyre Peninsula), the impact mitigation strategies to be adopted in relation to these species are addressed within the preceding sections and as such have not been addressed under separate heading.

<u>Eastern Osprey</u>

Whilst no active nests are known for the proposed location, it is acknowledged that Eastern Osprey have historically been present in the immediate region. The last official record of Eastern Osprey presence in the area being in September 2014 (Birdlife data).

The distance of the Project Footprint from the known location (but abandoned) Eastern Osprey nests are as follows:

- The distance from launch Site B to Nest Site A (1) is approximately 4,070 metres.
- The distance from launch Site B to Nest Site B (2) is approximately 2,000 metres.
- The distance from Site A to Nest Site A (1) is approximately 4,990 metres.
- The distance from Site A to Nest Site B (1) is approximately 2,975 metres.

These distances to unoccupied /abandoned nests are all at or larger than the state-wide buffer (2,000 metres) that is recommended to be avoided during the core breeding period of active nests to avoid human induced disturbance impacts.

The Coastal Raptor Assessment (**Appendix R**) considers that the standard mitigation strategies as outlined in the preceding sections will appropriately mitigate impacts on the Eastern Osprey without recommendation of further tailored mitigation strategies.

The assessment concludes that, whilst there is potential for at least one (1) Osprey pair to utilise the habitat near the site, the Project location does not have a known nesting pair and the specific location is not key to the whole SA population. Potential impacts are related to noise disturbance, noting that an active nest persists at the nearby busy Port Lincoln Marina (27 kilometres away) and that the noise impacts that may occur for the Southern Launch operations would occur at infrequent and irregular intervals at the Project Site.

Noise impacts would be most significant to an individual nesting pair (if located within 2.0 kilometres of the launch pads) during the critical breeding period. In addition, the launch pad and other infrastructure location are not within the line of site of a known nesting pair. Based on this, it is considered that project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species, in this case Eastern Osprey.

White-bellied Sea Eagle

The Coastal Raptor Assessment (**Appendix R**) provides a range of impact mitigation recommendations to minimise negative impacts on White-bellied Sea Eagle breeding and activities within the Whalers Way Regions. Key mitigation options for avoiding impacts to White-bellied Sea Eagles, relevant to the site, include:

- Adopting state-wide 2,000 metre disturbance buffers (based on recommendations in Dennis et al. 2011b, Dennis et al 2012) from known active nests, particularly during the breeding season.

- Where there are known nests or territories, construction should occur from mid-January to May, if outside this period (breeding season from May to September) then a precautionary approach would involve receiving confirmation in confidence to understand the exact location and activities (of any eagles) occurring in the area. It is noted that Dennis et al. 2015 and Dennis et al. 2012 distinguishes between critical breeding mid-May to mid-September and entire breeding season May to December.
- Note that line of sight is critical to disturbance. Not conducting disturbance activities within the line of sight of breeding White-bellied Sea Eagles. i.e., as per criteria in Dennis et al. 2011b, not within 1,000 metres of a primary nest.

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10 INTRODUCED PLANT & ANIMAL SPECIES

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10.0 INTRODUCED PLANT AND ANIMAL SPECIES

10.1 Summary

The EIS Guidelines require analysis of the manner in which the introduction of pest plant and animal species will be avoided or minimised during both the construction and operational phases of the Project.

The potential impacts of the unintended introduction of pest plant and animal species include the degradation of native flora and fauna.

The minimisation of risk of introduction of pest plant and animal species will be avoided through the implementation of environmental management policies and procedures during both the construction and operational phases of the Project.

10.2 Methodology

The risk of introduction of pest plant and animal species is mitigated through appropriate design techniques and through the implementation of environmental management policies and procedures during both the construction and operational phases.

The assessment of risk of introduction or new or dispersal of existing pest plant and animal species has been considered by AECOM in their Terrestrial Ecological Assessment (**Appendix P**). As discussed in previous sections, the methodology adopted by AECOM for this assessment has comprised of two (2) key components, described as follows:

- A terrestrial biodiversity assessment, consisting of:
  - desktop site assessment and literature review;
  - a series of field surveys; and
  - targeted Fauna (Bird) and Flora surveys.
- An impact assessment, which:
  - considered the impacts of planned and unplanned activities;
  - considered the impacts against the EPBC Act guidelines to determine the likelihood of significant impact;
  - considered the EIS assessment criteria; and
  - outline project justification and responses.

The AECOM assessment also outlined a series of mitigation and management methods relating the control of pest plant and animals' species to be implemented by the Project. These mitigation strategies are also supplemented by those outlined within the following documentation:

- Draft Construction Environmental Management Plan (**Appendix AD**); and
- Draft Operational Environmental Management Plan (**Appendix AE)**.

The content of these two (2) documents are considered in further detail in **Section 23**, Construction and Operational Environmental Management.

10.3 Relevant EIS Guidelines

Assessment Requirement 10: *The proposed development has the potential for the spread of introduced or nuisance plants and animals and soil pathogens such as Phytophthora.*

10.1 *Identify the potential for the introduction or dispersal of new pest or nuisance plant and animal species, and soil pathogens and the associated implications for native species and habitat.*

10.2 *Identify the potential for increased distribution and abundance of existing pest or nuisance plants, and soil pathogens and the associated implications for terrestrial and coastal environments.*

10.3 *Outline mitigation measures and their effectiveness in reducing or avoiding the introduction or spread of pest or nuisance plant and animal species.*

10.4 Analysis

10.4.1 Guideline 10.1

10.1 *Identify the potential for the introduction or dispersal of new pest or nuisance plant and animal species, and soil pathogens and the associated implications for native species and habitat.*

The introduction of pest plant and animal species to the site has the potential to occur through two (2) key changes as a result of the development:

- design elements which increase the attractiveness of the site to flora and fauna communities which are not currently native to the site; and
- operations of the site which result in flora and fauna which are not currently native to the site being transported to the site.

Design elements which have the potential to increase the attractiveness of the site to flora and fauna which are not currently native to the site include the construction of accessible water bodies, the intentional introduction of new species (i.e., through landscaping) and changes in the environment though elements such as additional lighting.

Design elements are fixed during the design process, and once embedded in the development, will continue to have an impact until they are mitigated through alterations to the facility. The potential risk of adverse outcomes is high, however, can be mitigated through careful consideration through the design process.

Operational elements which have the potential to disperse or directly introduce non-native flora and fauna to the site include the introduction of new food sources, the introduction of accessible waste streams, and the accidental transportation of flora and fauna to the site during construction and operation.

The most likely cause of weed dispersal and introduction associated with the Project include earthworks, movement and disturbance of soil, and attachment of seed (and other propagules) to vehicles and machinery entering and manoeuvring in the site during all project phases. Weed dispersal by vehicles along access tracks and roads is a key source of weed invasion.

Having regard to the logistic focussed nature of the proposed operations, the potential risk of adverse outcomes is high, however, can be effectively mitigated through the implementation of detailed processes and procedures and good site hygiene being practised at all times during both construction and operation.

The implications of increased abundance of pest flora and fauna is increased competition for flora and fauna which is native to the site, resulting in a reduction in the existing level of biodiversity.

In respect to exotic fauna, four (4) exotic species listed as Declared Pests under the LSA Act were sighted, or evidence of their existence was sighted:

- Domestic Cat tracks were observed frequently;
- European Rabbit, which is an introduced pest species common in all states, was widespread and common;
- Red Fox was observed from numerous scats; and
- Common Starling (bird) was sighted.

The potential for increased abundance of existing pest and nuisance plants and animals is considered to be low to moderate. The proposal will result in direct impacts on only a small proportion of the site. Access to the remainder of the site will be limited, lowering the risk of activity associated with the development resulting in increased distribution and abundance of existing pest and nuisance plants and animals.

It is noted that the existing use of the land for tourism and recreational purposes has historically resulted in dumping and waste left on the site for extended periods. Waste is known to attract pest fauna species. The stricter management procedures (discussed in **Section 10.4.3**) and the reduced accessibility to the land because of this proposal may therefore have a positive effect in reducing the distribution of pest fauna species in the area.

10.4.2 Guideline 10.2

10.2 Identify the potential for increased distribution and abundance of existing pest or nuisance plants, and soil pathogens and the associated implications for terrestrial and coastal environments.

10.4.2.1 Existing Distribution of Introduced Plant Species

During site surveys undertaken as part of the Terrestrial Ecological Assessment (**Appendix P**) exotic plant and animal species were observed as sparsely present during the baseline field survey of the Project Footprint.

Five (5) non-native weed species have been recorded within the Project Footprint. One (1) Weed of National Significance (WONS) was recorded, namely, Bridal Creeper at Launch Site B. The Bridal Creeper is also listed as Declared Weed under the *Landscape South Australia Act 2019* (LSA Act). The most common exotic flora species was Sea Lavender, which is not listed as a WONS or a Declared Weed under the LSA Act. All Exotic flora species that were recorded included:

- Bridal Creeper;
- Horehound;
- Onion Weed;
- Sea Lavender; and
- Stinkweed.

The highest density of exotic flora was observed at Launch Site B where community structure was noted as highly disturbed. This area of the site has a high intensity of use by recreational and tourism visitors to the site at the present time.

10.4.2.2 Potential Dispersal of Existing Introduced Plant Species

The most likely causes of dispersal of existing weed populations include earthworks, movement and disturbance of soil, and attachment of seed (and other propagules) to vehicles and machinery (Birdsall et al 2012). Unmitigated project activities also have the potential to disperse pest species from the Project Area into the surrounding landscape. Construction of access tracks and the rocket launch pad facilities, and the movement of operational and construction vehicles through areas of intact native vegetation may result in the dispersal of pest species into these areas, primarily along access roads.

The Project may also result in other tangential impacts that allow for the dispersal and expansion of existing weed and pest species. One such potential impact is edge effects. Edge effects refer to the changes in environmental conditions (e.g., altered light levels, wind speed, temperature) that occur along the edges of habitats. Due to the clearance of vegetation to accommodate the Project Footprint the Project will create new edges in the vegetation. These new environmental conditions along habitat edges can promote the growth of different vegetation types (including weed species).

10.4.3 Guideline 10.3

10.3 Outline mitigation measures and their effectiveness in reducing or avoiding the introduction or spread of pest or nuisance plant and animal species.

Mitigation methods will be applied to all project activities to minimise the potential for the displacement of flora species through the invasion of pest and weed species. These will cover all project phases. The mitigation strategies and methods within each respective project phase are detailed as follows:

10.4.3.1 Design Phase Pest Mitigation Strategies

A series of mitigation measures, as described below, has been integrated into the design of the site to reduce the potential for the introduction and spread of pest flora and fauna.

- A Weeds and Pests Sub-plan will be developed as a component of the CEMP and OEMP in accordance with the Development Act, the NV Act and relevant LSA board recommendations.
- The Weeds and Pests Sub-plan will ensure weed control methods for threatened species will be done in accordance with the relevant Recovery Plan for the species (i.e., the Western Whipbird (eastern) National Recovery Plan).
- The site footprints of Launch Sites A and B, Infrastructure Site D and Range Control Site E all include perimeter fencing which is designed to be impenetrable to the majority of ground dwelling animals.
- All water bodies on Launch Sites A and B, Infrastructure Site D will be covered to make them inaccessible to birds and other fauna.
- The stormwater systems have been designed to retain water for reuse to avoid increasing the amount of runoff travelling to other areas of the site, and, therefore, changing the volume of surface water available to flora and fauna.
- Landscaping will seek to utilise native plants which are endemic to the site and local area to avoid introducing new species which have the potential to become mobile and compete with existing flora.

- The extent of lighting has been minimised where possible, particularly continuous lighting during night-time periods.

10.4.3.2 Pre-construction/Construction Phase Pest Mitigation Strategies

A series of mitigations measures, as described below, will be included in the construction and operational management of the site to reduce the potential for the introduction and spread of pest flora and fauna. Mitigation measures during pre-construction/construction phases of the Project are summarised as follows:

- During construction, training and induction addressing biosecurity risks will be required for all staff and contractors operating on site.
- Induction and training will include identification of risks, mitigation of risks through operational procedures and ongoing review and monitoring to ensure that all requirements are being met on a consistent basis.
- Construction sites will be clearly delineated, and personnel will not be permitted to move beyond the boundaries of designated construction sites, particularly into areas of remnant vegetation.
- To the extent possible, construction machinery will be based on the site for the duration of construction, and not removed from the site to other locations.
- Ensure construction compounds are kept neat and tidy at all times, to prevent pest animals from inhabiting the area.
- Ensure food waste is placed in enclosed/covered bins, to prevent pest animals from accessing it.
- Report and record rabbit/hare/fox/feral cat sightings.
- Undertake a weed survey within and immediately adjacent to the construction impact zone prior to construction commencing, to understand existing weed conditions and potential impacts (e.g., spread) during construction.
- Remove or destroy all WONS and Declared and/or environmental weeds located within the construction impact zone, prior to construction commencing.
- Undertake weed control such as (but not limited to) slashing, spraying, or physical removal, prior to the weeds setting seed. Ensure weed control methods within threatened species habitat areas are in accordance with the relevant National Recovery Plan for the species.
- Display a fact sheet on Declared and environmental weeds known to occur within the construction impact zone, on site notice boards and in lunchrooms.

- Ensure all vehicles and construction equipment are clean and free of soil material containing weed seed or propagules, prior to arriving on site. If vegetative material or earth is present, ensure that the equipment is taken away and washed down at an appropriate facility to prevent vegetative material or earth potentially containing weed seeds being brought into the site.
- Install a designated wash-down bay to clean vehicles and construction equipment during construction works and prior to leaving site.
- Ensure all earthmoving equipment is clean and free of soil material prior to commencing earthworks within known threatened species habitat.
- Ensure all fill materials (e.g., sand, aggregate) imported to site are sourced from weed and pathogen free sites.
- Locate stockpiles of clean, weed free soil or fill material away from areas of weed infestation.
- If stockpiling of weed infested material is required, ensure it is stored on a constructed hardstand and separated from clean, weed free materials.
- If soil or fill material stockpiles become infested with weeds, undertake weed control (spray with herbicide) as soon as practicable and at least 10 – 14 days prior to moving material.
- Store construction vehicles and equipment on constructed hardstands, away from areas of weed infestation.

10.4.3.3 Operation Phase Pest Mitigation Strategies

Mitigation measures to be adopted during the operational phase of the Project are summarised as follows:

- During operation, training and induction addressing biosecurity risks will be required for all staff and contractors operating on site.
- Induction and training will include identification of risks, mitigation of risks through operational procedures and ongoing review and monitoring to ensure that all requirements are being met on a consistent basis.
- Sites will be clearly delineated through boundary fencing, and personnel will not be permitted to move beyond the boundaries of designated sites, particularly into areas of remnant vegetation.
- Improved management of persons accessing the areas of the site covered by remnant vegetation will occur.

- Vehicles and equipment being brought to the site will be required to be in clean condition before entering the site, with regular inspections being carried out to ensure that all requirements are being met on a consistent basis.
- Annual surveys of the site will seek to identify if any pest flora or fauna have become established, allowing management programs to be implemented or modified in suitable timeframe to reduce or avoid impacts on the existing terrestrial and/or marine environments.
- Improved management of the areas of the site covered by remnant vegetation will be implemented.
- Prevent establishment of new weed species and/or infestations during the operational phase by implementing standard hygiene practices when bringing equipment, vehicles and other materials which have the potential to harbour weed seed or propagules, onto the site (e.g., for maintenance purposes) and by practicing minimal disturbance methods.
- Conduct an annual survey to identify and monitor the location, extent, and abundance of weed species, particularly WONS and Declared weed species.
- Control pest animal species (especially rabbits, foxes, and feral cats) that may proliferate as a result of site activities. Ensure rabbit control is in accordance with the threat abatement plan for competition and land degradation by rabbits.
- Ensure waste is unable to be accessed by pest animals.

At the present time the site presents opportunities for members of the public to visit the site. Through the implementation of security at the entrance to the site, and a reduction in the unfettered and unaccompanied use of the site, the proposed development provides for the implementation of a management regime which will potentially result in a reduction in the potential risk of pest flora and fauna being transported to and/or dispersed within the site.

Additionally, through improved management, particularly around the management of waste, the proposed development offers the opportunity to reduce the presence of food sources which are attractive to pest fauna.

Mitigation measures will be further developed in operational documentation developed prior to the commencement of construction and the commencement of operations.

Mitigation measures are further detailed in **Section 23** - Construction and Operational Environmental Management.

11 EFFECT ON CONSERVATION VALUES

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11.0 EFFECT ON CONSERVATION VALUES

11.1 Summary

The Whalers Way region is recognised as being an area of high ecological value as key coastal conservation area. A key consideration for this project is therefore the potential impact on the conservation values of the site, comprise of terrestrial flora and fauna populations, its landscape value, and the nearby marine environments. The EIS guidelines recognise the importance of this terrestrial and marine environment for significant flora and fauna species and the seek to understand what potential impacts this project may present on its conservation value.

The discussion hereunder considers the finding of key specialist investigations related to both marine and terrestrial ecology and landscape. Primarily this section considers Guidelines 1.1 to 1.6 and Assessment Requirement 1.

11.2 Methodology

The key studies considered in the assessment of the projects effects on conservation values include the following:

- Terrestrial Ecological Assessment (**Appendix P**);
- Marine Ecological Assessment (**Appendix S**);
- Coastal Raptor Assessment (**Appendix R**);
- Noise and Vibration Assessment (**Appendix O**);
- Geotechnical Assessment (**Appendix T**); and
- Stormwater Assessment (**Appendix U**).

The section herein provides a summary of the methodology adopted in these technical investigations. An analysis of the methodology adopted in a number of these investigations has been outlined in detailed within previous Chapters of this report. In order to avoid repetition, where this is the case a high-level summary of the methodology is provided along with a reference to the relevant Chapter where the full analysis is provided.

11.2.1 Terrestrial Ecological Assessment

The methodology applied in the Terrestrial Ecological Assessment is addressed in **Chapter 7.0** (Native Vegetation), **Chapter 8.0** (Noise Impacts) and **Chapter 9.0** (Native Fauna), as well as being documented in **Appendix P**. At a high level, the Terrestrial Ecological Assessment comprises of two key steps, a terrestrial biodiversity assessment and an impact assessment.

The terrestrial biodiversity assessment analysed existing literature and data and primary source data obtained through a series of site surveys to quantify and develop an understanding of the existing environment of the Whalers Way area. This related to both the natural environment, vegetation, and flora and fauna populations of the area.

The impact assessment considered all activities likely to occur as a result of the project across all its construction and operational stages. The investigation considered the likelihood of impacts occurring and the relevant consequences. This formed a basis to determine necessary mitigation strategies.

11.2.2 Marine Ecological Assessment

The methodology applied in the Marine Ecological Assessment is addressed in **Chapter 7.0** (Marine Flora) and **Chapter 9.0** (Marine Fauna), as well as being documented in **Appendix S**.

The methodology adopted in the Marine Ecological Assessment comprised of two (2) components, an analysis of the ecological values of the local marine environment, and an impact assessment considering the impacts of the proposal on the marine environment.

In order to determine the ecological values of the marine environment the investigation considered a variety of desktop resources in order to determine the ecological values of the Thorny Passage Marine Park and the Southern Ocean, including the habitats that are present, the marine fauna, avifauna, and mammal populations known to inhabit the area.

The impact assessment considered all activities likely to impact on the marine environment. The investigation considered the likelihood of impacts from noise, launch failures, and debris from spent (discarded) rockets settling on the sea floor.

11.2.3 Coastal Raptor Assessment

The methodology applied in the Coastal Raptor Assessment is addressed in **Chapter 9.0** (Native Fauna), as well as being documented in **Appendix R**.

The coastal raptor assessment analysed the distribution and prevalence of Osprey and White-bellied Sea Eagle populations in the area and considered the impacts that the project may present on these populations and any necessary mitigation strategies. This investigation was undertaken to supplement and corroborate the findings of the Terrestrial Ecological Assessment in respect to Coastal Raptor species.

11.2.4 Noise and Vibration Assessment

The methodology applied in the Noise and Vibration Assessment is addressed in **Chapter 8.0**, as well as being documented in **Appendix O**. The methodology adopted in this assessment was undertaken in the following stages:

- Baseline conditions: Overview of the project study area, sensitive receptor locations and baseline noise levels.
- Assessment criteria: A summary of the acceptable noise and vibration limits (criteria) set out in relevant policies and guidelines.
- Impact assessment: Desktop assessment to determine likely construction and operational impacts.
- Mitigation measures: Description of mitigation measures to be used where impacts are predicted to exceed the noise and vibration criteria.

11.2.5 Geotechnical Assessment

A Geotechnical Assessment (**Appendix T**) was undertaken by WGA to assess and analyse the subsurface conditions on the subject land. This information was utilised to inform preliminary recommendations relating to the design of footings, pavements, and earthworks. The methodology adopted in this investigation consisted of two parts, a field investigation, and a laboratory testing program.

11.2.5.1 Field Investigations

The field investigation was carried out from 21 to 23 July 2020 and comprised drilling 11 boreholes in various locations on the site. The boreholes were positioned on site to provide a broad coverage of the proposed development areas, subject to restrictions imposed by the existing site features. It is noted that some sites were not readily accessible due to vegetation or uneven/rocky terrain.

The soil profile encountered in the boreholes was logged on site by a Hydrogeologist and recorded and described within **Appendix T**.

11.2.5.2 Laboratory Testing

The laboratory testing program conducted on soil samples that were obtained on site comprised of the following:

- A four-day soaked California Bearing Ratio (CBR) test and associated Standard compaction test on a soil sample recovered from one (1) site; and
- Atterberg limits, particle size distribution and Emerson dispersion on one (1) sample recovered from another site.

The laboratory testing was performed in the National Association of Testing Authorities (NATA) accredited Adelaide laboratory of Lab and Field. The laboratory test results sheets are presented within **Appendix T**.

11.2.6 Stormwater Assessment

A Stormwater Assessment (**Appendix U**) was prepared by WGA to assess and analyse the likely stormwater implications the project would have in respect to runoff levels and quality on the subject site.

This investigation related only to the management of stormwater runoff from the surfaces of the proposed launch sites within the launch complex and did not extend to wastewater management.

The assessment outlines a sustainable stormwater management approach for the site which has sought to ensure that all water generated on site will be retained and managed to avoid environmental risk. The intent of assessment is to provide an outline of the management principles as they relate to the following:

- a general overview of the stormwater internal network drainage design (for each complex of sites);
- preliminary sizing of retention basins for each site within the complex (where proposed);
- management of stormwater runoff during the construction and operational phases; and
- the incorporation of all above elements within a Total Surface Water Cycle Management (TSCM) Framework.

11.3 Relevant EIS Guidelines

Assessment Requirement 1: *The subject site adjoins the Thorny Passage Marine Park which is a significant flora and fauna marine environment. The Jussieu Peninsula to Coffin Bay Peninsula is a significant Biodiversity Area which encompasses the subject site and contains a large tract of remnant native vegetation. The site is also located approximately 3.6 km from the offshore island Liguanea Island, which contains an Australian Sealion colony and Short-Tailed Shearwater colony. Liguanea Island is located within the Lincoln National Park. The conservation values of these areas are to be quantified and protected.*

1.1. Identify the existing terrestrial and marine environments and species that are known and likely to occur on the subject site and surrounds. Detail the conservation values for the Thorny Passage Marine Park, Jussieu Peninsula to Coffin Bay Peninsula Biodiversity Area and Lincoln National Park (including species listed in the SA National Parks and Wildlife Act 1972.

1.2. Detail the potential impacts on terrestrial and marine habitat for each potential launching site and associated impact area, including runoff from storm and wastewater into the marine environment due to the increase in impervious surfaces, impacts from noise and vibration during launches and impacts of the exhaust from rockets. Both terrestrial and marine ecosystems must be considered for all operational activities. Provide adequate mitigation and management measures for each area in turn.

1.3. Identify the potential trajectory of launched vehicles and likely location, extent, composition and amount of debris and spent componentry anticipated to impact on the surrounding area, including the adjoining Marine Park. Propose operational management strategies to limit the impacts on the quantified conservation values.

1.4. Describe the rationale for the major design elements of the proposed development and measures to mitigate the impact.

1.5. Describe the effect of the proposed development on coastal clifftop dunes, cliffs, limestone and calcrete formations of the site, and associated heathland shrubland communities, and outline management and rehabilitation measures for these areas.

1.6. Describe any alterations to the physical landforms by the construction (e.g., levelling of sand dunes, filling of low-lying areas) and describe management and rehabilitation measures for these areas.

11.4 Analysis

11.4.1 Guideline 1.1

1.1. Identify the existing terrestrial and marine environments and species that are known and likely to occur on the subject site and surrounds. Detail the conservation values for the Thorny Passage Marine Park, Jussieu Peninsula to Coffin Bay Peninsula Biodiversity Area and Lincoln National Park (including species listed in the SA National Parks and Wildlife Act 1972.

11.4.1.1 Terrestrial Environment

The Project Area covers 23.76 hectares of native vegetation. Vegetation community composition at Whalers Way (i.e., the Project Area and surrounds) was transitional dependent on two (2) major factors; exposure to salt laden winds, and soil type and depth. The elevation of the area ranged from 50 to 120 metres above sea level.

Soil types within this area ranged from bare sheet limestone to moderately mobile sand dunes. Between these extremes, the large part of the area was highly alkaline decomposed limestone and light grey loams. Some lower elevation areas within these were grey silty loams that retained water for short periods evidenced by heavier vegetation and the presence of bog tolerant species such as Creeping brooklime and Stonecrop.

Six vegetation associations were observed within the Project Area (**Appendix P**). Vegetation gradually transitions from one association to another, effectively causing a mosaic landscape lacking distinct changes in vegetation. The seven associations are all considered typical of coastal communities that occur along the southern Eyre Peninsula.

During field surveys a total of 34 fauna species were recorded on the land. This included 28 bird species, four (4) mammal species, and two (2) reptile species.

One native mammal species was recorded throughout the Project Area being the Western Grey Kangaroo (*Macropus fuliginosus*).

Three exotic mammal species listed as Declared Pests under the LSA Act were recorded:

- Domestic Cat (*Felis catus*) tracks were observed frequently;
- European Rabbit (*Oryctolagus cuniculus*), which is an introduced pest species common in all states, was widespread and common; and
- Red Fox (*Vulpes vulpes*) was observed from numerous scats.

Two (2) reptile species were confirmed. The Shingleback Lizard (*Tiliqua rugosa*) is common to the Project Area habitat types and was commonly observed. The Mallee Heath Dragon (*Ctenophorus chapmani*) was common and widespread. Numerous skinks (not able to be identified) were noted.

Of the 30 bird species recorded one was a Declared Pest under the LSA Act, namely, the Common Starling (*Sturnus vulgaris*). Four (4) of the bird species were associated with the cliffs in the south, and four (4) were associated with inland vegetation. The remaining species were common and widespread.

A comprehensive species list is presented in Appendix E of the Terrestrial Biodiversity Assessment, contained in **Appendix P** of this report.

11.4.1.2 Marine Environment

Based on the possible launch arc trajectories a potential marine impact zone (PMIZ) extends for 1,000 kilometres seaward from the launch sites. Marine parks overlapping the PMIZ include:

- South-west Marine Parks Network (Director of National Parks 2018):
  - Great Australian Bight Marine Park;
  - Western Eyre Marine Park;
  - Western Kangaroo Island Marine Park; and
  - Southern Kangaroo Island Marine Park.
- South-east Marine Parks Network (Director of National Parks 2013):
  - Murray Marine Reserve.

The Thorny Passage Marine Park covers 2,472 square kilometres and is located in the Eyre Bioregion, which extends from Cape Bauer near Streaky Bay into southern Spencer Gulf and along the south coast of Kangaroo Island. The marine park includes the waters off lower Eyre Peninsula, extending from Frenchman Bluff to Memory Cove with discrete offshore sections overlaying Rocky and Greenly Islands.

PMIZ overlaps an area towards the south-east of the Park, including parts of Cape Carnot and Liguanea Island. Many of the key features of the Park are situated outside the PMIZ, and are therefore excluded from this assessment, including all other islands, Coffin Bay (with four (4) Sanctuary Zones), the marine waters offshore from Coffin Bay National Park, Sanctuary Zones at Gunyah Beach and Sleaford Bay, and the marine waters surrounding the Memory Cove Wilderness Area and the main body of Lincoln National Park, noting that Liguanea Island itself is a discrete component of that Park.

The western and eastern coasts and part of the southern coast (Cape Wiles and between Cowrie Beach and Groper Bay) of the Whalers Way site are comprised of ramping (5–30° slope) bedrock platforms of granite at the base of calcarenite cliffs of height 40, 130 and 80 metres, respectively.

The majority (80 per cent) of the subtidal habitats in the TPMP have not been mapped (Bryars et al. 2016). Broad scale (1:100,000) mapping using satellite imagery showed that the western and southern coasts of Whalers Way were surrounded by granite reef for 200–700 metres offshore on the western and southern coasts, with sand beyond the reef on the western coast, and unmapped area on the southern coast (DEWNR 2015e, Edyvane 1999.). Dive surveys by Shepherd et al. (2005) at Redbanks encountered both granite and calcareous reef, dominated by large brown canopy-forming macroalgae including common kelp.

11.4.2 Guideline 1.2

1.2.	*Detail the potential impacts on terrestrial and marine habitat for each potential launching site and associated impact area, including runoff from storm and wastewater into the marine environment due to the increase in impervious surfaces, impacts from noise and vibration during launches and impacts of the exhaust from rockets. Both terrestrial and marine ecosystems must be considered for all operational activities. Provide adequate mitigation and management measures for each area in turn.*

11.4.2.1 Stormwater Runoff

The design basis behind the Total Surface Water Cycle Management (TSCM) for each of the sites is based on the principal design philosophy that no site generated surface runoff will be permitted to leave each site. All sites will incorporate a retention basin designed to capture and store all site generated runoff. The design basis behind each basin and any other stormwater management element is outlined in this section.

The TSCM will incorporate the following stormwater management elements within each site:

- retention Basins;
- onsite stormwater re-use;
- open drainage swales;
- spill management (where required), and
- surface grading throughout each site.

The stormwater management strategy is centred on ensuring that all site generated rainfall and runoff is captured within the TSCM framework. Therefore, the primary focus of the stormwater quality management basis is to prevent any potential pollutants in stormwater from entering the receiving environment.

11.4.2.2 Wastewater Runoff

The proposed use is not anticipated to generate large quantities of wastewater, which will predominantly derive from toilet and kitchen facilities. Site operations, other than the deluge water for the launches, the management of which is addressed separately, will have a low water demand and therefore low generation of wastewater. The site will have a package wastewater treatment system with the capacity to cater for the requirements of 50 people. An aerobic system which irrigates onto landscaped areas of the launch site is anticipated to be used.

11.4.3 Guideline 1.3

1.3.	*Identify the potential trajectory of launched vehicles and likely location, extent, composition and amount of debris and spent componentry anticipated to impact on the surrounding area, including the adjoining Marine Park. Propose operational management strategies to limit the impacts on the quantified conservation values.*

Although the infrastructure, including two (2) launch sites, will be entirely on land, the trajectory of rockets will be over the Southern Ocean. Based on the possible launch arc trajectories a potential marine impact zone (PMIZ) extends for 1,000 kilometres (**Figure 11.1**).

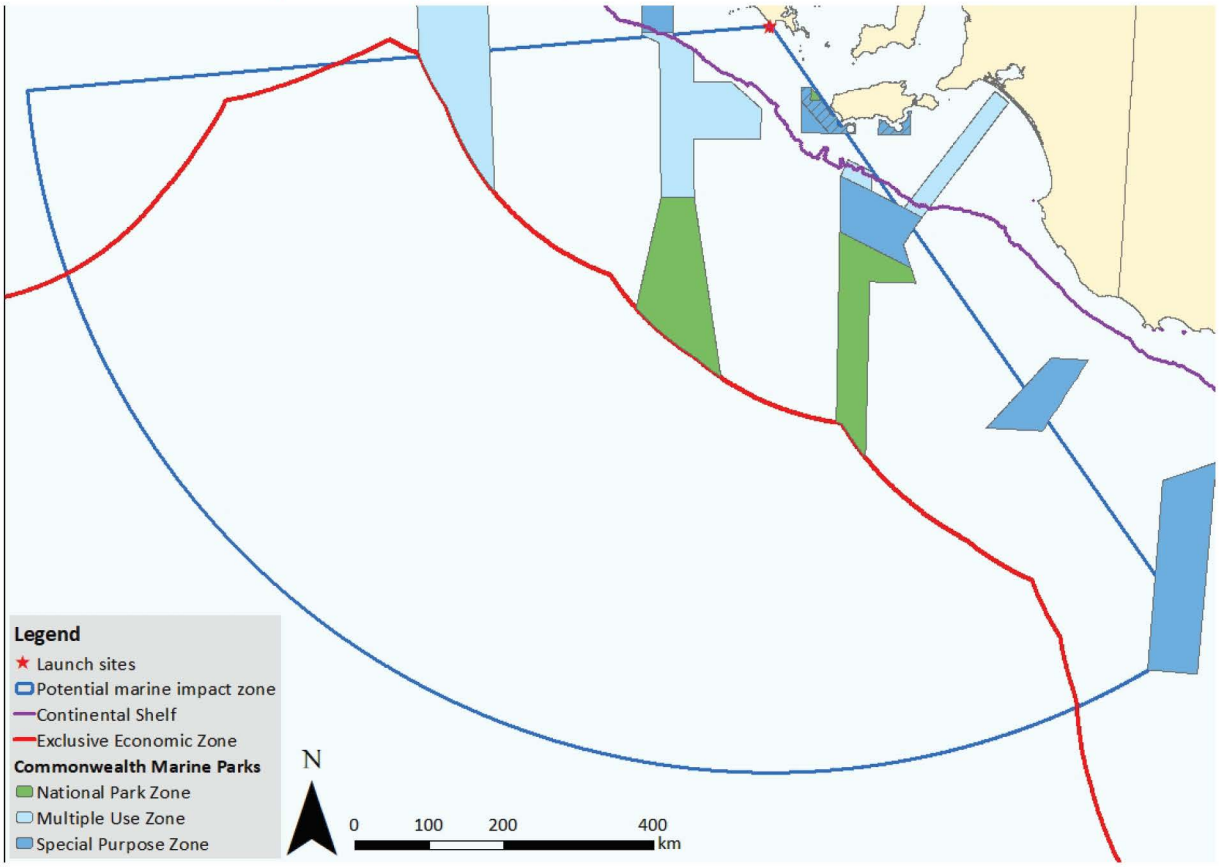

FIGURE 11.1

COMMONWEALTH MARINE PARKS

SOURCE: DAWE

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Rockets are constructed from inert materials including carbon fibre with some metal, including aluminium, stainless steel and titanium, and would not result in negative impacts on ocean water quality. There may be batteries of similar volume to a couple of car batteries, which would be expected to have minor, very localised impact. All rocket fragments will sink, with the possible exception of some small pressure vessels, which would be expected to have negligible impact.

11.4.4 Guideline 1.4

1.4. Describe the rationale for the major design elements of the proposed development and measures to mitigate the impact.

11.4.4.1 Siting

The various sites have been selected due to the flat topography and minimal site works requires to accommodate the proposed infrastructure. Minimal earthworks will be required to be undertaken in some locations.

The project sites were selected to utilise areas that presented a lower vegetation condition rating and lower coverage of vegetation as possible, that still satisfied project operational requirements. This assisted in reducing the total amount of high value vegetation to be cleared as part of this project.

While the coastal landscape of the subject land is sensitive to visual and landscape change, the scale and separated locations of the development sites help to limit and fragment the potential effect. Given the contained visibility of the sites, the potential impacts are mitigated by the surrounding topography to the east and west.

11.4.4.2 Built Form

The use of low-reflective material will be applied to all built structures. Colour schemes will mimic the existing landscape and tones evident in the locality. A revegetation program will further assist in integrating built structures into the landscape.

The most significant built elements comprise of permanent launch facility infrastructure such as buildings which have a maximum height of 10 metres, and 23-metre-high elevated water tanks. Launch gantries which will reach a height of 30 metres will only be evident during launch operations. Sites A and B both contain a 40 metre lightening tower. Tall infrastructure is largely of a slender appearance and/or not permanent, and as such is unlikely to cause a visual effect in the locality.

On balance, the slight to moderate visual impacts and contained visibility, as well as the potential to deliver a range of mitigation measures, will ensure that the degree of visual effect of the proposed built form on the existing landscape of the subject land will be minimised.

11.4.5 Guideline 1.5

1.5. Describe the effect of the proposed development on coastal clifftop dunes, cliffs, limestone and calcrete formations of the site, and associated heathland shrubland communities, and outline management and rehabilitation measures for these areas.

The proposed development is not expected to have any impact on the coastal cliff environment. On the natural terrestrial landscape will be limited to the specific sites themselves.

The Project will require clearing 23.76 hectares of native vegetation for construction including launch pads, access tracks and associated laydown areas. The Project Area has been refined during the design phase to reduce the amount of native vegetation to be cleared in areas of lower condition rating as far as practicable.

The clearance of 23.76 hectares will be offset through a biodiversity offset program developed in accordance with NVC guidelines outlined. Construction and operation of the Project will be managed in accordance with a CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures outlined in Table 20 of Section 8 within **Appendix P**.

A Significant Environmental Benefit (SEB) is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that a SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

The overall SEB requirement for this Project currently stands at $965,407.77. Southern Launch will provide a SEB in the form of an inground offset provided by SEB credit providers within the region.

11.4.6 Guideline 1.6

1.6. Describe any alterations to the physical landforms by the construction (e.g., levelling of sand dunes, filling of low-lying areas) and describe management and rehabilitation measures for these areas.

The various sites have been selected due to the flat topography and minimal site works are required to accommodate the proposed infrastructure. Minimal earthworks will be required in some locations. These works are depicted within the Proposal Plan set prepared by WGA, which includes section diagrams depicting the level of earthworks required (Refer to **Appendix M**).

12 EFFECT ON THE PHYSICAL ENVIRONMENT, WATER & AIR QUALITY

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12.0 EFFECT ON THE PHYSICAL ENVIRONMENT, WATER AND AIR QUALITY

12.1 Summary

The EIS guidelines seek to understand the potential for the proposed WWOLC to alter the natural landform, affect water quality in the vicinity, introduce air quality impacts, and release greenhouse gas.

The potential effects on the physical environment, water and air quality presented by the proposed WWOLC project and the response to mitigate these impacts have been addressed in a series of technical investigations. This section distils the relevant findings and responses from these supporting reports.

12.2 Methodology

To determine the effect on the physical environment, water, and air quality a series of technical investigations have been conducted, including the following:

- Air Quality Assessment (**Appendix W**);
- Stormwater Assessment (**Appendix U**);
- Greenhouse Gas Assessment (**Appendix X**); and
- Geotechnical Assessment (**Appendix T**).

These technical assessments and their findings have informed the development and planning of the design, construction, and operational stages of proposed project.

12.2.1 Air Quality Assessment

An air quality assessment prepared by SLR provides an assessment of the likely air quality impacts presented by the rocket launch and testing activities to be undertaken on the site (**Appendix W**).

For this air quality assessment emissions were estimated using dispersion modelling on a worst-case basis, taking into account the size of rockets and type of fuels. This included emissions from launches from Launch Site B (located closest to the nearest receptors) and rocket engine tests at the engine test facility located at Launch Site A for all times of day (24/7 operations).

The assessment considers worst-case impacts from the proposed operations which will include very short duration emission events on an infrequent basis.

12.2.2 Stormwater Assessment

A stormwater management strategy has been prepared for this project by WGA and is provided in **Appendix U**. The purpose of this strategy is to ensure that stormwater generated from the development is managed in an environmentally responsible manner that appropriately addresses identified risks. The strategy proposed in this report applies to the management of stormwater runoff from the surfaces of the proposed launch sites within the launch complex.

The stormwater management strategy aims to adopt sustainable management principles where all water generated on site will be retained and managed to avoid environmental risk. The strategy provides an outline of the management principles as they relate to the following:

- A general overview of the stormwater internal network drainage design (for each complex of sites).
- Preliminary sizing of retention basins for each site within the complex (where proposed).
- Management of stormwater runoff during the construction and operational phases.
- The incorporation of all above elements within a Total Surface Water Cycle Management (TSCM) Framework.

The stormwater management strategy presented is intended to demonstrate responsive performance outcomes. This is supported by relevant calculations and a concept layout.

12.2.3 Greenhouse Gas Assessment

Greenhouse Gas Emissions have been investigated by SLR (refer to **Appendix X**). Greenhouse Gas Emissions were estimated for both construction and operation activities associated with the Project. Construction and operational phase emission sources were identified by review of the Project description. The emissions associated with the construction and operational phases that were considered include:

- Construction.
- Land clearing.
- Construction.
- Vehicle movements:
  - Power generation;
  - Production and supply; and
  - Haulage of materials.
- Operations:
  - Launches;
  - Vehicle movements;
  - Production and supply; and
  - Haulage of materials.

The Greenhouse Gas (GHG) assessment estimated emissions during construction and operations and compared these to the State and National GHF emission inventories to assess the potential significance of the Project in the context of Australia's annual GHG emissions.

12.2.4 Geotechnical Investigations

A preliminary Geotechnical Investigation has been undertaken by WGA (refer to **Appendix T**). The field investigation was carried out and comprised of drilling 11 boreholes with boreholes positioned on site to provide a broad coverage of the proposed development areas, subject to restrictions imposed by accessibility. The soil profile encountered in the boreholes was logged on site by a Hydrogeologist.

12.3 Relevant EIS Guidelines

Assessment Requirement 8: *The proposed development has the potential to alter the natural landform, introduce air quality impacts, release greenhouse emissions and affect water quality in the vicinity.*

8.1. Describe the nature and condition of the existing physical environment in the proposal's environs, including reference to geology, geomorphology, soils, hydrology, and atmosphere. Include any baseline data or monitoring established prior to development on the site.

8.2. Identify the potential for pollution (e.g., fuel spills and launch debris) of watercourses, coastal drainage and groundwater, and what design, construction and management measures will be adopted to minimise such impacts. Document mitigation and monitoring strategies to limit any adverse impacts.

8.3. Evaluate the potential for air quality to be impacted as a result of the proposal (e.g., fuel emissions, combustion products and generators, gases, steam etc.) and describe any sensitive receivers (including residents, land uses or environments) and the extent to which they may be impacted. Air quality impacts need to be assessed against the Environment Protection (Air Quality) Policy 2016 in accordance with the EPA Ambient Air Quality Assessment 2016 publication. Document mitigation and monitoring strategies to limit any adverse impacts.

8.4. Identify the potential for soil/surface erosion and sand drift hazard, including the implications of these processes. Describe measures for the remediation of erosion or sand drift should it occur within the clifftop dune system as a result of the development.

8.5. Describe stormwater and wastewater management and the potential impact on groundwater resources, surface water resources and the marine and coastal environment, in particular with regard to fuel and chemicals used in the operation of the development. Include measures proposed to manage stormwater and wastewater.

8.6. Undertake a high level estimate of whole of life greenhouse gas emissions associated with the construction and operation of the facility and outline measures to minimise emissions through material selection including recycled products, operating methods, and offsets. Estimates shall cover Scope 1, 2 and 3 emissions and as a minimum include:

- *embodied emissions of construction materials used in construction of the facility and consumables during operation (e.g., quarry products, concrete, asphalt, metals, fuels);*
- *extraction, production, transportation of fuels;*
- *transportation of purchased materials and waste;*
- *disposal of waste; and*
- *electricity.*

12.4 Analysis

12.4.1 Guideline 8.1

8.1. Describe the nature and condition of the existing physical environment in the proposal's environs, including reference to geology, geomorphology, soils, hydrology, and atmosphere. Include any baseline data or monitoring established prior to development on the site.

The Project Site is located at the southern tip of the Eyre Peninsula in Sleaford, commonly known as Whalers Way. It is approximately 25 kilometres south-west of Port Lincoln in South Australia (SA), in the District Council of Lower Eyre Peninsula.

The site is predominantly an undeveloped vegetated coastal area, punctuated by access tracks, open areas including car parking and recreational infrastructure. Around the majority of the site, the coastal interface is in the form of cliffs of varying heights and rocky outcrops, with a few areas also having coved beaches.

The remnant vegetation on the site varies in form primarily based on the distance from the coastline and the nature of the ground conditions. Some areas appear to have been historically cleared, with varying degrees of regrowth evident. The character of the land could be summarised as a largely undeveloped vegetated coastal area, with a material degree of human modification to support access and passive recreational uses.

Climate at Whalers Way is classified as Csb under the Koppen and Geiger system. This depicts it as warm-summer Mediterranean Climate temperature, precipitation in driest month of summer half of the year is less than 30 millimetres and less than one-third of the wettest month of the winter half, temperature of each of four (4) warmest months 10 °C or above but warmest month less than 22 °C.

Vegetation community composition at Whalers Way (i.e., the Project Site and surrounds) was transitional dependent on two (2) major factors; exposure to salt laden winds, and soil type and depth. The elevation of the area ranged from 50 to 120 metres above sea level.

Six (6) vegetation associations were observed within the Project Footprint. Vegetation gradually transitions from one (1) association to another, effectively causing a mosaic landscape lacking distinct changes in vegetation. The six (6) associations are all considered typical of coastal communities that occur along the southern Eyre Peninsula.

Soil types within this area ranged from bare sheet limestone to moderately mobile sand dunes. Between these extremes, the large part of the area was highly alkaline decomposed limestone and light grey loams. Some lower elevation areas within these were grey silty loams that retained water for short periods evidenced by heavier vegetation and the presence of bog tolerant species such as Creeping brooklime (*Samolus repens*) and Stonecrop (*Crassula sp*.).

12.4.2 Guideline 8.2

8.2.	*Identify the potential for pollution (e.g., fuel spills and launch debris) of watercourses, coastal drainage and groundwater, and what design, construction and management measures will be adopted to minimise such impacts. Document mitigation and monitoring strategies to limit any adverse impacts.*

12.4.2.1 Stormwater Runoff

Refer to the Stormwater Management Plan prepared by WGA (**Appendix U**).

The design basis behind the Total Surface Water Cycle Management (TSCM) for each of the sites are based on the principal design philosophy that no site generated surface runoff will be permitted to leave each site. All sites will incorporate a retention basin designed to capture and store all site generated runoff. The design basis behind each basin and any other stormwater management element is outlined in this section.

The TSCM will incorporate the following stormwater management elements within each site:

- retention basins;
- onsite stormwater re-use;
- open drainage swales;
- spill management (where required), and
- surface grading throughout each site.

The stormwater management strategy is centred on ensuring that all site generated rainfall and runoff is captured within the TSCM framework. Therefore, the primary focus of the stormwater quality management basis is to prevent any potential pollutants in stormwater from entering the receiving environment.

12.4.2.2 Wastewater Runoff

The proposed use is not anticipated to generate large quantities of wastewater. The wastewater that is generated will predominantly derive from toilet and kitchen facilities. Site operations, other than the deluge water for the launches, the management of which is addressed separately, will have a low water demand and therefore low generation of wastewater. The sites will have a package wastewater treatment system with the capacity to cater for the requirements of 50 people. An aerobic system which irrigates onto landscaped areas of the launch site is anticipated to be used.

12.4.2.3 Air Pollution

Refer to the Air Quality Assessment (**Appendix W**) and a Greenhouse Gas Assessment (**Appendix X**) both prepared by SLR.

Air quality assessment emissions were estimated for dispersion modelling on a worst-case basis for the proposed operations considering the size of rockets and type of fuels. This included emissions from launches from Launch Site B (located closest to the nearest receptors) and rocket engine tests at the engine test facility located at Launch Site A for all times of day (24/7 operations).

Considering the relatively small number of launch and engine test events compared to the number of events assessed in all dispersion conditions it is unlikely that a launch or engine test would co-occur with the worst dispersion conditions and result in ground level concentrations as predicted. The emissions from the operations are expected to mostly occur in average dispersion conditions producing lower ground level concentrations than what was presented in the results.

The air quality impact assessment shows that there is a low risk associated with air quality impacts from the proposed orbital launch complex as assessed.

12.4.2.4 Launch Debris

Rockets are constructed from inert materials including carbon fibre with some metal, including aluminium, stainless steel and titanium, and would not result in negative impacts on ocean water quality. There may be batteries of similar volume to several car batteries, which would be expected to have minor, very localised impact. All rocket fragments will sink, with the possible exception of some small pressure vessels, which would be expected to have negligible impact.

12.4.3 Guideline 8.3

8.3.	*Evaluate the potential for air quality to be impacted as a result of the proposal (e.g., fuel emissions, combustion products and generators, gases, steam etc.) and describe any sensitive receivers (including residents, land uses or environments) and the extent to which they may be impacted. Air quality impacts need to be assessed against the Environment Protection (Air Quality)*

Policy 2016 in accordance with the EPA Ambient Air Quality Assessment 2016 publication. Document mitigation and monitoring strategies to limit any adverse impacts.

Refer to discussion **Section 12.4.2** above and **Appendix W**.

12.4.4 Guideline 8.4

8.4. Identify the potential for soil/surface erosion and sand drift hazard, including the implications of these processes. Describe measures for the remediation of erosion or sand drift should it occur within the clifftop dune system as a result of the development.

Geotechnical Investigation prepared by WGA is provided within **Appendix T**. Geology of the lower Eyre Peninsula is made up of three (3) distinct geological units, the Semaphore Sand, Bridgewater Formation, and the Carnot Gneiss.

The geological survey of South Australia Lincoln Map Sheet (2003) indicates that the site is underlain at shallow depth by calcareous aeolianite with a travertine crust (Qpe) and the surface exposures at the site comprise Semaphore Sand (Qhcks), which is described as "*foredune and dune sand, white to cream quartz and shelly sand*".

The proposed launch pad sites will cover an area of approximately 100 metres x 400 metres and are required to be relatively flat. Geotechnical issues considered in the site selection for the proposed launch pads were:

- the earthworks quantities required to generate a balanced cut-to-fill earthworks pad at each site;
- the presence of rock strength materials which may hamper excavations for bulk earthworks, footings, and service trenches;
- the suitability of the excavated soil and rock materials to be re-used as engineered fill beneath the development;
- allowable bearing pressures for footings within the natural materials and engineered fill;
- the stability of the soil and rock in short term excavations and permanent batter slopes;
- the potential for voids within the natural materials;
- the potential for erosion of the exposed soil surface;
- percolation rates for subsurface disposal of wastewater from septic tanks; and
- site drainage to prevent the ingress of surface water which could result in softening of the uncemented or weakly cemented soils.

Detailed design documentation of the proposed development is yet to be finalised at this stage and as a result a detailed Safety in Design assessment in respect to erosion and footing design has not been undertaken. Structural loads from the launch pad, assembly shed, and ancillary structures are still to be quantified, however, it is anticipated that shallow spread footings will be utilised as the most appropriate footing system for this geotechnical environment.

While the coastal landscape of the subject land is sensitive to erosion, the scale and separated locations of the development sites help to limit the potential effect. The Project sites were selected to utilise areas that presented a lower environmental condition and were predominately flat and limited the need for significant earthworks to accommodate the respective facilities. Neither the construction nor operation of the WWOLC is expected to result in material erosion of the coastal clifftop dune environment.

12.4.5 Guideline 8.5

8.5.	*Describe stormwater and wastewater management and the potential impact on groundwater resources, surface water resources and the marine and coastal environment, in particular with regard to fuel and chemicals used in the operation of the development. Include measures proposed to manage stormwater and wastewater.*

Refer to discussion in **Section 12.4.2** above and **Appendix U**.

12.4.6 Guideline 8.6

8.6.	*Undertake a high level estimate of whole of life greenhouse gas emissions associated with the construction and operation of the facility and outline measures to minimise emissions through material selection including recycled products, operating methods, and offsets. Estimates shall cover Scope 1, 2 and 3 emissions and as a minimum include:*

- *embodied emissions of construction materials used in construction of the facility and consumables during operation (e.g., quarry products, concrete, asphalt, metals, fuels);*
- *extraction, production, transportation of fuels;*
- *transportation of purchased materials and waste;*
- *disposal of waste; and*
- *electricity.*

12.4.6.1 Rocket Launch Emissions

The air quality related emissions of significance for the proposed orbital launch complex are from the rocket launches and engine tests. It is understood that there may be up to 36 launches per year when the facility is fully developed and a smaller number of engine tests, mostly smaller in scale. Considering this, emissions were estimated for two (2) emissions scenarios:

- Rocket launch.
- Engine test.

The duration of each emission event is very short considering the speed at which rockets accelerate and gain altitude. Typically, orbital launch vehicle rockets are launched with three (3) stage burns (three (3) stage motors).

For assessment of air quality in relation to implications for ground level concentrations it is only the portion of engine exhausts that are emitted below the mixing height that has the potential to be mixed to ground level.

As such, emissions were estimated for the portion of emissions from the Stage 1 burn up to an altitude of 3,000 metres (which is the upper level of mixing height as typically set in CALPUFF). The duration to reach 3,000 metres altitude for the launch vehicles that are being considered is approximately 30 seconds. Typically, the Stage 1 engine burn lasts for about 2.5 minutes.

The emission rates for each pollutant depend on the size of the rocket (engine capacity) and the rocket fuel type. In essence there are two (2) types for rocket fuels: liquid fuels and solid fuels.

From a review of rocket engine exhaust emissions data. the following pollutants were identified as relevant to include in the assessment to cover both liquid and solid fuel emissions:

- Carbon monoxide (CO) – combustion product from liquid RP1 (kerosene) fuel.
- Nitrogen oxides as nitrogen dioxide (NO_2) – combustion product from liquid RP1 (kerosene) fuel.
- Hydrogen chloride (HCl) – emitted from certain solid fuel engines.
- Particulate matter (PM) as for combustion emissions assumed to be fine particulate matter ($PM_{2.5}$) – emitted as part of all combustion however worst-case emissions are from solid fuels.

Due to operational circumstances, a rocket could be launched at any time of day. As such, it was conservatively assumed that emissions would occur all times of day.

The table below outlines the emissions rate calculations for the different fuel sources, liquid fuel (**Table 12.2**) and solid fuel (**Table 12.1**):

Table 12.1: Emission Rate Calculations Based on Solid Fuel (SLR, 2020, pg. 13).

Scenario	Pollutant	Launch vehicle mass (including fuel) (t)	Fuel consumption rate (kg/s)	Pollutant exhaust mass fraction	Time to 3,000 m (s)	Emission rate (kg/s)	Emissions to reach 3,000 m (kg)
Launch	HCL	41 [a]	338 [a]	21.4% [b]	24	72.3	1,705.2
Launch	PM			28.4% [b]		95.9	2,263.0
[a] Source: Southern Launch [b] Source: (D. Schuch, 2017) Table 1							

Table 12.2: Emission Rate Calculations Based on Liquid Fuel (SLR,2020, pg. 13).

Scenario	Pollutant	Launch vehicle mass (including fuel) (t)	Fuel consumption rate (kg/s)	Pollutant exhaust mass fraction/ mass	Time to 3,000 m (s)	Emission rate (kg/s)	Emissions to reach 3,000 m (kg)	Time for Stage 1 burn (s)	Emissions for Stage 1 burn (kg)
Launch Engine test	CO	58 [a]	420 [a]	24.76% [b]	27	104.0	2816.5	100	10,399.2
Launch Engine test	NO_x as 100% NO_2			2.313 lb/s		2.2 [d]	60.5		223.5
Engine test	PM			0.5 % [b]		2.1	NA		210.0

[a] Source: Southern Launch
[b] Source: (Federal Aviation Administration, 2020) Table 4.1 at engine exit before after burn in exhaust plume[2]
[c] Source: (Federal Aviation Administration, 2020) Table 4.1
[d] Calculated as scaled on engine exhaust/fuel consumption rates and converted to 100% NO_2 from 100% NO

12.4.6.2 Greenhouse Gas Emissions

Construction Emissions

Construction phase emission sources have been identified by review of the Project description. The emissions associated with the construction phases that were considered comprised of the following:

- Land clearing;
- Construction (emissions from construction equipment);
- Vehicle movements;
- Power generation;
- Production and supply of fuel; and
- Haulage of materials.

Operational (non-launch) Emissions

Operational phase emission sources have been identified by review of the Project description. The emissions associated with the operational phases that were considered included:

- Rocket launch and testing;
- Vehicle movements;
- Production and supply of fuel; and
- Haulage of materials.

The main contributor to the estimated GHG inventory is emissions from the combustion of diesel used for stationary purposes, which accounts for 60 per cent of the total estimated GHG emissions. The second contributor is diesel consumption for electricity generation purposes, which is estimated to account for 11 per cent of the total combined emissions.

Direct emissions of GHG are termed Scope 1. Indirect emissions are generated in the wider economy as a consequence of an organisation's activities are termed Scope 2 and 3.

The Scope 2 category of indirect emissions is from the consumption of purchased electricity. As Southern Launch will not be connected to the grid, Scope 2 emissions have not been considered further.

Scope 3 indirect emissions are related to the upstream emissions generated in the extraction and production of fossil fuels and in the emissions from contracted/outsourced activities.

The total direct (Scope 1) emissions from Southern Launch construction and operations are estimated to be approximately 359,432 tCO2-e, while the estimated Scope 3 emissions are approximately an additional 36,386 tCO2-e, equating to a total of 395,818 tCO2-e.

The contributions of the predicted annual GHG emissions resulting from the Project are detailed in the following **Table 12.3**. As can be seen, the emissions are a relatively small proportion of both the Australian and South Australia total emissions, accounting for less than 0.1 per cent of total Australian GHG production. It should be noted, that should the Project not proceed, the demand for the launches which would have occurred at the WWOLC will most likely be met through launches on other locations. As such, it is considered that the small amount of GHG emissions generated by the Project will have a minor effect on global climate change.

Table 12.3: Southern Launch GHG Emissions Contribution to State and National Annual Emission Totals (SLR 2020, p.25)

SOUTHERN LAUNCH		TOTAL EMISSIONS - 2018	
		AUSTRALIA	SOUTH AUSTRALIA
Construction and Operations (tCO_2-e)	395,819	537,446,390	24,241,070
Percentage of National/ State Inventory	-	0.07%	1.6%

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13 ECONOMIC EFFECTS

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13.0 ECONOMIC EFFECTS

13.1 Summary

The evolution of the rocket launch and satellite industry (outlined in **Section 2** of this EIS) has created the market conditions and opportunities for the establishment of a launch facility for Low Earth Orbit satellites in high latitude locations around the world.

The lack of population centres, major air routes and maritime transportation routes to its south makes the southern coast of South Australia an attractive potential launch site. Southern Launch is proposing to take advantage of this emerging market by developing a launch facility at Whalers Way south of Port Lincoln.

Southern Launch is proposing to take advantage of this emerging market by developing a launch facility at Sleaford, south of Port Lincoln. This launch facility would be made available to third-party rocket manufacturers who would be responsible for securing their own payloads. Numerous clients have been identified whose launch vehicles are at an advanced stage of development, who are all very keen to use the proposed WWOLC to operate from.

To understand the potential impacts of the proposed launch activities, Southern Launch commissioned the SA Centre for Economic Studies ("SACES") to undertake an Economic Impact Analysis which is reproduced in **Appendix N**. The data and key assumptions made around the potential activities associated with the launches, and associated visitor numbers were provided to SACES by Southern Launch.

Three (3) primary areas of potential economic impact arise from the Project as follows:

- Southern Launch's direct operations.
- the capital works required to establish a launch facility.
- the potential visitor numbers associated with the launches.

Should the launch facility be successfully established it is possible that there will be spin-off benefits with one (1) or more launch vehicle manufacturers relocating either final assembly, or their full manufacturing operations, to South Australia. It is not possible to assess the likelihood of this occurring and so these potential impacts are not included in the main analysis; however, estimates of this impact have been undertaken and are summarised in this analysis.

In summary, the following economic impacts of the Project are estimated:

Table 13.1: Project only Employment and Gross State Product effects.

	SOUTHERN LAUNCH FACILITY ONLY	SOUTHERN LAUNCH FACILITY PLUS EMPLOYEE CONSUMPTION
FTE's	59.7 after 10 years	76.2 after 10 years
GSP	Year 1 -$0.3M	-
	Year 2 +$3.5M	-
	Year 10 +$35.4M	Year 10 +$53.4M

If additional spin-off industries are attracted to South Australia, additional economic impact is estimated as follows:

Table 13.2: Additional Employment and Gross State Product effects from spin-off industries.

	FTE'S BY YEAR 10	ANNUAL GSP	GSP BY YEAR 10
Final assembly and testing facility	142	$20M per year	$90.2M
Launch vehicle manufacturer	568	$79M per year	$318.4M

It is noted that time has elapsed since the preparation of the SACES report. The impact years in the SACES report were based on an earlier timescale of the development proceeding into construction and subsequent operation. Thus, the years outlined below should be read as 2020/2021 being the first year of operations, and subsequent years being the relevant number of years after operations commence (for example 2025/2026 would be the sixth year of operations).

The estimated gross employment and production impact of Southern Launch's own operation would be to increase employment by 20.1 FTE positions in 2020/21, the first year of operations. In this first year with substantial activity contracted out (e.g., for safety and environmental assessments) direct employment only accounts for around 40 per cent of the total. By 2025/26 (year six) the impact is expected to reach 59.6 FTEs.

There are also one-off employment impacts in 2020/21 (year one) and 2021/22 (year two) as a result of the construction of the launch facility, with an expected impact of 9.1 FTEs in 2020/21 (year one).

Finally, there will be on-going impacts from 2021/22 (year two) onwards associated with the spending by visitors associated with the launches, which are expected to result in a gross increase in employment of 6.9 FTEs in 2021/22 (year two).

The average gross impact on employment over the ten-year analysis period (including one-off impacts and increased business visitors) is expected to be 59.7 FTE positions.

The estimated gross on-going impact on economic activity of Southern Launch's on-going operations would be to *decrease* real GSP by -$0.3 million in 2020/21, the first year of operations (see **Table 13.2**), due to the loss Southern Launch is expecting to record in that year being greater than the expected GSP impact from its operations. In the following year with the first launches occurring, the gross impact on GSP from Southern Launch's on-going operations is expected to be $3.5 million and will increase in the later years of the analysis period.

There are also one-off impacts in 2020/21 (year one) and 2021/22 (year two) as a result of the capital expenditures associated with establishing the launch facilities in Port Lincoln.

Finally, there will be on-going impacts from 2021/22 (year two) onwards associated with increased business visitor nights attributed to staff of launch vehicle manufacturers both prior to and associated with the launches, with an expected annual contribution to GSP of $0.9 million in the first year of launches. Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7.0 per cent, the gross impact on GSP (including the impact of capital works) has a present value of $35.4 million in 2018/19 values. If consumption impacts from workers at Southern Launch and its supply chain are included then the average employment impact would be 76.2 FTE positions, with the present value of the impact on GSP being $53.4 million, in 2018/19 values (refer Appendix A of **Appendix N**).

13.2 Methodology

The gross economic impact of Southern Launch's proposed activities on the South Australian economy has been assessed using an input-output (IO) model. The methodology employed involves estimating the total direct and indirect employment and gross state product (GSP) arising from the production operations and sustainment investment activities. GSP is the State equivalent to gross domestic product.

The modelling and the parameters chosen, have been undertaken independently by SACES and reflect their considered view as to the most likely impacts given activities of the scale described in the inputs provided by Southern Launch.

An input-output table has been prepared (refer **Appendix N**) which describes the linkages between sectors of the economy based on their patterns of purchase and supply. For each of the sectors in the economy (e.g., agriculture, pipe manufacturing, utilities, transport, and storage etc.), the table details the inputs the sector uses (to produce output in the case of producing sectors; for consumption in the case of "*consumer*" sectors), and what sectors it sells its output to.

There are two (2) types of impacts which are commonly considered, differing in terms of the flow-ons which are accounted for. The first, having a narrower extent, is the "*production impact*". The production impact is the impact of the initial expenditure upon primary factor incomes and employment, derived by tracing through the chain of intermediate usage (i.e., supply chain effects). However, no allowance is made for expenditure of primary incomes. The second, with a broader coverage, encompasses production and "*consumption*" impacts. The consumption impact arises when primary factors (e.g., households) in receipt of wage income spend the incomes they receive.

The gross production and consumption impacts arising from the output of an industry can be calculated using coefficients and multipliers derived from the input-output tables. In addition to the overall impact, multipliers can show separately the production and consumption impacts described above. Multipliers can be derived to show how a change in output for an industry affects a particular economic variable, such as output, value added (i.e., GSP), income or employment.

The concept of input-output multipliers, assumptions, and limitations is discussed in more detail in Section 3 of **Appendix N**.

The IO modelling process generates estimates of gross impact in the sense that the IO model does not incorporate any displacement of other activities. This will be strictly valid only if all the resources that are required for the activity being modelled are freely available without diverting them from other uses within the regional economy of interest or changing their prices. It will rarely be the case that this requirement is met strictly, but for small regions with sufficient underutilised labour and capital suitable for the new activity it may be met approximately, with the IO model thus generating estimates that are approximately right. Given the extent of underemployment in South Australia, and the continued net interstate migration of younger more skilled individuals out of South Australia, there is considerable scope for additional economic activity without substantial displacement.

Capital works (including approvals processes) to establish the launch facility will be undertaken over the first 16 months of the analysis period.

Financial data has been provided by the proponent covering the first 36 months of operations, with employment projections provided for the first six (6) years. At the time of preparation of the SACES report, the Projected timeline had activity commencing in July 2020, and projected dates are based on that commencement date. As noted above, for current purposes, 2020/2021 will be referred to as year one of operation and the reference point for future year analyses.

It is noted the Whalers Way Orbital Launch Complex was deemed a Major Project by the South Australian State Government following the preparation of the economic analysis by SACES. It is expected the Majop Projects status will result in higher costs associated with the approvals and construction process than that originally considered by SACES and therefore larger potential economic impacts than were modelled by SACES are expected.

13.3 Relevant EIS Guidelines

***Assessment Requirement 5**: The proposal will have an impact on the local and State's economy during construction and operations and may result in immediate and long term effects on residents, businesses and surrounding uses.*

5.1 Describe the proposal's anticipated effect on State and local investment, research and development, educational effects, employment generation and flow-on impacts on business.

5.2 Describe potential employment opportunities and the expected impacts on the local workforce during construction and operational stages.

5.3 Identify any potential economic effects on tourism, recreation, mining and petroleum related activities.

5.4 Identify any secondary economic effects, including the potential to attract new industries and commercial ventures. Describe the positive and negative effects of this, including the current situation.

5.5 Identify any economic implications for the State and the region if the proposal does not proceed.

5.6 Consider and quantify the impacts of the development on commercial fishing areas during operations i.e., impacts on business if there is a need for temporary exclusion zones.

5.7 Document the consultation undertaken with mining and petroleum tenement holders (onshore and offshore). Describe how the development is anticipated to interact with mining and petroleum interests and operations, during the construction and operational phase.

13.4 Analysis

13.4.1 Guidelines 5.1, 5.2, 5.4

5.1 Describe the proposal's anticipated effect on State and local investment, research and development, educational effects, employment generation and flow-on impacts on business.

5.2. Describe potential employment opportunities and the expected impacts on the local workforce during construction and operational stages.

5.4 Identify any secondary economic effects, including the potential to attract new industries and commercial ventures. Describe the positive and negative effects of this, including the current situation.

13.4.1.1 Impact of Southern Launch's Private Sector Launch Operations

The economic impact of Southern Launch's proposal was modelled using the 60-industry sector South Australian Input Output tables developed by SACES, modified to adjust for actual and projected changes in the composition of employees by sector. Only the private sector launch operations were included in the analysis, with the defence launches and engine testing being out of scope.

Only production impacts were included in the main analysis (e.g., the impact of South Australian based suppliers to Southern Launch purchasing goods and services from other South Australian firms, and then those firms purchasing inputs from local suppliers and so on). Estimated turnover was provided by the proponent for the first 36 months. Beyond year three it was assumed that turnover would grow with projected employment for the next three (3) years and then at a rate consistent with keeping employment constant at the year six level.

Economic impact expected from additional business visitor nights (and associated spending) in the State associated with the launches relate primarily to employees of the launch vehicle manufacturers visiting to undertake preparatory work, and then to undertake the launch. Estimated spending per visitor night was taken from Tourism Research Australia (2017) estimates, as outlined in **Appendix N**, of the spending by 'Business visitors' visiting South Australia ($146.00 per visitor night) and Southern Launch's estimate of the number of visitor nights associated with each launch and their projected number of launches.

The estimated impact on gross value added was adjusted to real 2018/19 values based on the actual changes in the GDP deflator (ABS 2019a, **Appendix N**), and SACES projections for the growth of GSP over the remainder of the analysis period consistent with the time of preparation of the economic analysis.

The estimated gross direct and production impact[1] of Southern Launch's own operation would be to increase employment by 20.1 FTE positions as shown in **Table 13.1** in the first year of operations (identified in the table as 2020/21). In this first year with substantial activity contracted out (e.g., for safety and environmental assessments) direct employment would account for around only 40 per cent of the total. By year six (shown in the table as 2025/26) the impact is expected to reach 59.6 FTEs.

There are also one-off employment impacts in years one and two (2020/21 and 2021/22 in the table) as a result of the construction of the launch facility, with an expected impact of 9.1 FTEs in year one (2020/21 in **Table 13.3**).

[1] **Production effects refer to the second order impacts flowing from South Australian based firms which supply Southern Launch purchasing goods and services from other South Australian based firms as inputs into their supply to Southern Launch, and so on down the supply chain.**

There will be on-going impacts from year two (2021/22 in the table) onwards associated with the spending by visitors associated with the launches, which are expected to result in a gross increase in employment of 6.9 FTEs in year two.

Table 13.3: Estimated gross additional employment impact of Southern Launch, full time equivalent (FTE) employees.

Financial year	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
On-going operations										
Direct employment (FTE)**	8.0	11.0	17.0	20.0	28.0	31.0	31.0	31.0	31.0	31.0
Production impacts (FTE)	12.1	15.4	16.4	19.0	26.2	28.6	29.2	28.6	28.6	28.6
Sub-total, on-going operations	20.1	26.4	33.4	39.0	54.2	59.6	60.2	59.6	59.6	59.6
Impact of other expenditures										
Capital spending, direct and indirect impacts (FTE)	9.1	3.0								
Launch vehicle staff spending, direct and indirect impacts		6.9	9.2	10.3	14.1	15.2	15.0	14.5	14.2	13.9
Total gross impact on employment (FTE)	29.3	36.3	42.6	49.3	68.3	74.8	75.2	74.1	73.8	73.4
Average employment impact over period (FTE)	59.7									

**Note: Direct employment only includes those employed directly by Southern Launch, with employees of subcontractors employed on the launch site included in the Production Impacts, this is why our estimate of direct employment from 2023/24 is 31.0 FTEs rather than the 35 FTEs reported in the Southern Launch business case.

The average gross impact on employment over the ten-year analysis period (including one-off impacts and increased business visitors) is expected to be 59.7 FTE positions.

The estimated gross on-going impact on economic activity of Southern Launch's on-going operations would be to decrease real GSP by -$0.3 million in the first year of operations (see **Table 13.4**) due to the loss Southern Launch is expecting to record in that year being greater than the expected GSP impact from its operations. In the following year with the first launches occurring, the gross impact on GSP from Southern Launch's on-going operations is expected to be $3.5 million and will increase in the later years of the analysis period.

There are also one-off impacts in the first two years as a result of the capital expenditures associated with establishing the launch facilities in Port Lincoln.

Finally, there will be on-going impacts from year two onwards associated with increased business visitor nights associated with staff of launch vehicle manufacturers both prior to and associated with the launches, with an expected annual contribution to GSP of $0.9 million in the first year of launches.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP (including the impact of capital works) has a present value (2018/19) of $35.4 million.

Table 13.4: Estimated gross direct and production impacts on economic output of Southern Launch ($'million).

Financial year	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
GSP impact of ongoing operations ($million)	-0.3	3.5	3.3	3.8	5.1	5.6	5.5	5.5	5.5	5.5
GSP impact of one-off construction costs ($ million)	2.0	0.6								
GSP impact of launch vehicle staff expenditures ($ million)		0.9	1.2	1.4	1.9	2.0	2.0	1.9	1.9	1.9
Total gross impact on Gross State Product ($ million) **	**1.6**	**5.1**	**4.5**	**5.2**	**7.0**	**7.6**	**7.5**	**7.5**	**7.4**	**7.4**
Present value of GSP impact over period ($ million)	**35.4**									

****Note:** Impact on Gross State Product is expressed in real 2018/19 values.

The Project would also have a positive economic impact for the recreation sector generally in terms of spin-off activities from tourists attracted to the area specifically or primarily to visit the facility and/or observe launch events. This would include additional visitor nights for accommodation, increased activity for shopping and hospitality sectors, and potential increased patronage of existing and future tourist operations.

Current recreational activities on the subject land will cease on commencement of the Project; however, similar opportunities for camping and recreation are available extensively throughout the region and would be able to be accommodated without any substantive loss to the overall level of economic activity currently generated in the region.

Analysis of impacts in relation to mining and petroleum activities are discussed separately in **Section 13.4.4** below.

13.4.1.2 Additional Economic Impact from Potential Spin-Off Operations

The potential economic impacts described above only relate to the operations of the launch facility itself and its associated supply chain. As noted above there is the potential for the existence of the launch facility to attract one (1) or more of the launch vehicle operators using the facility to establish either a 'final assembly and testing' facility, or a 'full launch vehicle manufacturing' facility. If this does occur it will significantly increase the benefits for the state from the launch facility.

Should a final assembly and testing facility be attracted to South Australia it is estimated there would be potentially an additional increase in on-going employment of 142 FTE positions once it is operational (assumed to be from 2022/23 in the SACES analysis, **Appendix N**, Table B.1).

The estimated gross on-going impact on economic activity of a launch vehicle manufacturer establishing their final assembly and testing operations in South Australia would be to increase real GSP by $20 million per year once it is operational. Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $90.2 million in 2018/19 values. As was the case with the employment impacts, this most likely understates the potential impact of final assembly of a launch vehicle as its activities are only captured in eight of the ten years of the Southern Launch analysis period.

The potential impact of a launch vehicle manufacturer being attracted to South Australia is still larger, with on-going employment in the manufacturer and its South Australian supply chain expected to be 568 FTE positions once the manufacturing facility were fully operational (assumed to be from 2023/24 in the SACES analysis, **Appendix N**, Table C.1). This additional economic activity of a full manufacturing facility should it be attracted to South Australia, would increase real GSP by $79 million per year once it was fully operational.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $318.4 million in 2018/19 values. As was the case with the employment impacts, this most likely understates the potential impact of final assembly of a launch vehicle as the full manufacturing operations are only captured in eight (8) of the ten years of the Southern Launch analysis period.

It is possible to extend the input output analysis to include what is known as 'consumption' impact. As well as the direct and production impacts discussed above, consumption impacts also include the impact on South Australia from local spending of any additional labour and capital income received by South Australians as a result of the Project.

As noted in **Appendix N** the consumption impacts need to be interpreted with a degree of caution as it is even more difficult to identify the extent to which they are truly additional to what would have happened had the Project not gone ahead. This is because it is not only necessary to assess the extent to which any economic activity resulting directly or indirectly from the Project is truly additional (as is the case with direct and production impacts) but also to assess the extent to which any increase in spending is going to be additional.

The estimated gross on-going impact on economic activity of a launch vehicle manufacturer establishing their final assembly and testing operations in South Australia would be to increase real GSP by $20 million in 2022/23, the first year of launch operations. If consumption impacts are included, then the estimated impact would be $8 million higher in 2022/23.

13.4.1.3 Potential Impacts if Consumption Impacts are Included

It is possible to extend the input-output analysis to include what is known as 'consumption' impact. As well as the direct and production impacts predicted, consumption impacts also include the impact on South Australia from local spending of any additional labour and capital income received by South Australians as a result of the Project.

As noted above, consumption impacts need to be interpreted with a degree of caution as it is more difficult to identify the extent to which they are truly additional to what would have happened had the Project not gone ahead.

Appendix A of the SACES report (**Appendix N**) provides an analysis of potential additional economic impact if consumption impacts from workers at Southern Launch and its supply chain were to be considered.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP when consumption impacts are included has a present value of $53.4 million in 2018/19 values.

Appendix B of the SACES report (**Appendix N**) provides an analysis of potential additional economic impact if consumption impacts were considered from the establishment of final assembly and testing facilities were attracted to South Australia.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP when consumption impacts are included has a present value of $127.5 million in 2018/19 values.

Appendix C of the SACES report (**Appendix N**) provides an analysis of potential additional economic impact if consumption impacts were considered from a launch vehicle manufacturer being attracted to South Australia.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of 7 per cent, the gross impact on GSP when consumption impacts are included has a present value of $450.2 million in 2018/19 values.

13.4.2 Guideline 5.5

5.5 Identify any economic implications for the State and the region if the proposal does not proceed.

In recent years significant advancements have been made in satellite technologies to enable cost effective Low Earth Orbit micro-satellites as a cheaper and easier alternative to the traditional method of using large spacecraft operating in Geostationary Earth Orbits. This new technology allows a greater number of missions and a substantial reduction in resources required in the achievement of the same objectives. It also provides for a range of capabilities not previously available to traditional higher orbit satellites.

This revolutionary shift in satellite launch and orbit inclination has resulted in significant global demand for suitably located launch facilities that are designed to cater for these low orbit satellites and launches. The market to launch the estimated 6,200 small satellites needed between 2017 – 2026 is US $30.1 billion and has spawned the creation of over seventy-nine companies developing infrastructure to meet this demand. It is estimated that the market Southern Launch can address is approximately US $15.05 billion.

As previously discussed, this economic opportunity has the potential to substantially contribute to South Australia's GSP across the lifetime of the facility and will present a variety of spin-off economic opportunities for the State and the Eyre Peninsula region.

Given the growing demand for facilities of this nature and the economic opportunities presented, it is a rational assumption that, should this facility not proceed at Whalers Way, the opportunity will be realised elsewhere, be that elsewhere within South Australia or interstate. As outlined in **Section 4.0** of this report, other potential location options with reasonable potential are available.

Given that the low orbit satellite industry is still in its relative infancy, many innovations and opportunities arising out of this industry are yet to be matured, industrialised, or commercialised, but likely will be in time.

It is considered, therefore, that there is presently a short-term gap in the global launch industry, to which Australia is strategically positioned to respond to. South Australia in particular is ideally located to satisfy a number of critical locational criteria for a launch facility of this nature in respect to its latitude, coastal location, launch trajectory options, and lack of intervening land masses and human populations to the south.

It is likely that the State which most proactively and efficiently moves to capitalise on this opportunity will be best positioned to take advantage the substantial growth potential within the Australian space industry moving forward. Therefore, if the facility were not to proceed as proposed herein, it would represent a significant missed opportunity for the Region and the State to establish itself as a leader in the space industry.

13.4.3 Guideline 5.6

5.6	*Consider and quantify the impacts of the development on commercial fishing areas during operations i.e. impacts on business if there is a need for temporary exclusion zones.*

It is noted in **Section 18.4.5** that access and use of surrounding coastal waters will largely be undisturbed by the proposed operations, save for access to certain areas during specific launch events. Rocket launches are controlled by the Australian Space Agency which ensures that the ocean and airspace areas directly affected by Launch Exclusion Areas are cordoned off. Any Launch Exclusion Area or Corridor will be off limits when the Australian Space Agency mandates that they be free of any non-authorised person.

Launch Exclusion Zones associated with the Project are discussed in **Section 6.5, 6.6,** and **6.7** of this EIS.

The exact extent of Launch Exclusion Areas will be dependent on the particular launch but will extend over the ocean. This will potentially impact on commercial fishing operations on an intermittent basis as operators will be excluded from entering the Exclusion Zones.

It is anticipated there will be up to approximately 42 conventional and sounding rocket launches per annum requiring implementation of an Exclusion Zone over a portion of the sea. Exclusion zones will be enforced for the minimum amount of time possible to ensure the least disruption to commercial fishing (and other marine based activities) and notified through Notice to Mariners (NOTMAR).

With these management measures in place, and the intermittent requirement for implementation of the Exclusion Zones, impact on commercial fishing operations should be minimised as much as possible and with appropriate planning should not be detrimental to the economic conditions currently experienced.

As there are no aquaculture zones within the marine area likely to be impacted by Exclusion Zones associated with launch events, there will be no direct impact on the commercial aquaculture sector. It is understood aquaculture related boat movements occur in the locality (e.g., towing tuna pens, transit to fishing grounds) the same arrangements for notification to the commercial fishing industry will also apply to the commercial aquaculture sector. Under such arrangements there is no reason why the industry should be detrimentally affected by operation of the launch facility.

Southern Launch has undertaken ongoing engagement with the commercial fishing industry as the Project has progressed. With the concept now being finalised, Southern Launch will progress discussions with representative bodies of the commercial fishing industry contemporaneously with the exhibition of the EIS.

Given the infrequent and temporal nature of exclusion areas over the sea, it is considered that suitable operational arrangements agreed between Southern Launch and the commercial fishing industry will be able to ensure that the requirements of both parties are adequately met.

13.4.4 Guidelines 5.3, 5.7

5.3	*Identify any potential economic effects on tourism, recreation, mining and petroleum related activities.*
5.7	*Document the consultation undertaken with mining and petroleum tenement holders (onshore and offshore). Describe how the development is anticipated to interact with mining and petroleum interests and operations, during the construction and operational phase.*

This discussion focuses on economic effects on mining and petroleum related activities in the surrounding area and consultation that has or will be undertaken with the proponents behind these activities. The general economic effects on tourism and recreational activities is addressed in **Section 13.4.1.1** and as such has not been reiterated herein.

A review of the the Department of Energy and Mining (DEM) database has been undertaken to determine the status of existing minerals and petroleum exploration and mining activities in the area that may be impacted by the Southern Launch facility. DEM's database identifies a minerals Exploration Licence (EL), an Extractive Mineral Lease (EML), and three (3) Exploration Permits for Petroleum (EPPs) activities that may be impacted by the Project. These activities comprise of the following:

- Mining Activities:
  - ML5561, ML5562, RL66, RL67, EL6224 - Quantum Graphite Tenements; and
  - EML 6510 - Theakstone Sands Tenement.
- Petroleum Activities:
  - EPP46 – Karoon Gas Browse Basin Pty Ltd;
  - EPP41 – Bight Petroleum Pty Ltd; and
  - EPP 42 – Bight Petroleum Pty Ltd.

A detailed description of these activities and their location in relation to the site is provided within **Section 14.4.1** of this report and should be referred to for further information.

Potential Impacts on Quantum Graphite's Mining and Exploration Activities

The southernmost portion of EL6224 lies within the Project area and one (1) potential drilling target area is located adjacent the launch safety zones. If Quantum Graphite continues their exploration within EL6224, their exploration activities have the potential to interact with the Southern Launch project area and operation in the future, particularly if the upcoming drilling campaign is successful and the company proceeds to develop the "*Fisher*" deposit to a working mine. If Quantum Graphite wish to explore the EL that is contained within the Project area, they will be required to submit a Notice of Entry to the landowner (in this case Southern Launch) 42 days before commencing exploration activities.

The selection of the second drilling target has not yet been made, but the timing of the drilling campaign is likely to be in the second half of 2021. An extract from the Mining Register shows that the one-year exploration expenditure commitment from 13 October 2020 is $140,000.

Given the location of the mining and retention leases, it is unlikely that any future operations will be impacted by the construction and/or operation of the Project area. The mining and retention leases are currently under care and maintenance, and it is unclear when mining activities will recommence in the future. Before mining operations recommence, Quantum Graphite will be required to submit a new or updated Program for Environmental Protection and Rehabilitation (PEPR) to DEM, which would include consultation with adjacent landholders such as Southern Launch.

The timing of any further exploration drilling and/or mine development is unknown. Southern Launch will further consult with Quantum Graphite with the view to establish a communication protocol and management plan to establish a relationship and control potential future operational interactions.

The WWOLC will not interact with any other of Quantum Graphite's leases and as such no other impacts are considered to apply.

Potential Impacts on Theakstone Sand's Mining Activities

EML6510 is north of the Project area and unlikely to be impacted by the operation of the Southern Launch project area. As part of their EML application preparation, the proponents had communicated with adjacent landholders including Southern Launch, so would be aware of the Project. In respect to consultation, As Theakstone Sands is associated with the landowner of the Subject Allotment, Theakstone Sands are aware of the WWOLC proposal and there is an established communication protocol between the two (2) parties.

Potential Impacts on Bight Petroleum's Petroleum Exploration Activities

EPP41 and EPP42 are listed on both the SARIG and NOPTA databases as active, however, it was announced on 13 February 2021 that NOPTA had rejected Bight Petroleum's application to extend their work program, which could have a significant implication for any future attempts to renew their exploration leases.

Given the above, it is therefore unlikely that operation of the Project area will impact future exploration activities by Bight Petroleum, particularly if they surrender their tenements.

Total indicative expenditure for the work program was $63,649,750 for EPP41 (including $45,000,000 for an exploration well) and $3,975,000 for EPP42.It is unknown how many of the activities were completed.

Southern Launch will consult with Bight Petroleum to confirm current operational status. Southern Launch will also periodically investigate the status of EPP41 and EPP42 to determine if the tenements have been surrendered, or there has been a change in operational status or ownership.

Potential Impacts on Karoon's Petroleum Exploration Activities

EPP46 is listed on both the SARIG and NOPTA databases as active, however, on Karoon Energy Ltd's website, it is stated that:

> *"Karoon was awarded exploration permit EPP46 during October 2016. The permit covers 17,793 square kilometres of Australia's most prospective frontier oil exploration province, the Ceduna Sub-Basin, in the Great Australian Bight ('GAB'), offshore South Australia. Due to the difficulties associated with regulatory approvals to conduct operations, Karoon submitted a formal request with the regulatory authorities to surrender exploration permit EPP46 during the December quarter 2019."*

Given the above, it is therefore unlikely that operation of the Project area will impact future exploration activities by Karoon, particularly if they have surrendered their tenement. Total indicative expenditure for the work program was $143,355,000 (including $115,000,000 for the exploration well). It is unknown how many of the activities were completed.

Southern Launch will periodically investigate the status of EPP46 to determine if the tenements have been surrendered, or there has been a change in operational status or ownership.

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14 LAND USE EFFECTS

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14.0 LAND USE EFFECTS

14.1 Summary

The effects of land use change on the existing site users, the immediate locality, and the wider region have been considered in this section. The likely effects of the proposed land use are well documented within the series of technical investigations provided within the appendices of the EIS. Further desktop analysis has been undertaken where necessary to support the findings of these investigations and develop an understanding of the key implications of the proposed land use change.

The discussion hereunder considers the finding of key specialist investigations related to the likely impacts of the proposal as well as primary investigation findings. Primarily this section considers and responds to Guidelines 16.1 to 16.6 and Assessment Requirement 16.

14.2 Methodology

An analysis of the existing land use, tenure, and the likely impacts of the proposed land use within the study area was identified through a mix of desktop and on-site analysis, comprising of:

- Desktop review and on-site investigation of the subject land and surrounding locality.
- Review of the PlanSA public register for Land Use applications (1 January 2010 – present).
- Review of the PlanSA public register for Land Division applications (1 January 2003 - present).
- Site Search of Lower Eyre Peninsula Council Development Application Register (2014 – 2020).
- Examination of Crown leases within the designated area.
- Search and review of all relevant titles and deposited plans, including detailed review of all easements and dealings attached to the land, including a Heritage Agreement pursuant to the *South Australian Heritage Act, 1978*, for the purposes of the conservation of native vegetation and native fauna.
- Review of the the Department for Energy and Mining (DEM) database has been undertaken to determine the status and activity of any relevant existing minerals and petroleum exploration and mining activities in the area that may be impacted by the Southern Launch facility.

- Review of supporting assessment reports and documents in respect to land use effects and mitigation methods, including:
  - Noise and Vibration Assessment (**Appendix O**);
  - Landscape Character and Probable Visual Effect Assessment (**Appendix Z**);
  - Terrestrial Ecological Assessment (**Appendix P**);
  - Cultural Heritage Assessment (**Appendix Y**);
  - Draft Construction Environmental Management Plan (**Appendix AD**); and
  - Draft Operational Environmental Management Plan (**Appendix AE**).
- Review of historic and current zoning and planning policy context obtained from Lower Eyre Peninsula Council Development Plan and Phase 2 of the Planning and Design Code.

14.3 Relevant EIS Guidelines

Assessment Requirement 16: *The proposal will have an impact on land owners and surrounding uses, in the immediate and long term.*

16.1. Identify the existing land uses of the subject site and surrounds (e.g., coastal conservation, tourism, mining, and petroleum related activities).

16.2. Describe the new land uses proposed for the subject site (e.g., launch complex, helicopter landing pads, electricity generation etc.).

16.3. Identify the types and extent of land tenure in broad terms, including reference to Crown Land. Outline any implications for Native Title and Native Vegetation Heritage Agreements.

16.4. Identify the level of interference to landowners, land uses and activities in the immediate and surrounding environs.

16.5. Evaluate the change in land use, resulting in a loss of coastal conservation area, visual and amenity impacts being introduced and impact on mining and petroleum related activities.

16.6. Outline any mitigation measures to alleviate or avoid impacts on land owners and land uses.

14.4 Analysis

14.4.1 Guideline 16.1

16.1. Identify the existing land uses of the subject site and surrounds (e.g., coastal conservation, tourism, mining, and petroleum related activities).

14.4.1.1 Existing Land Uses of the Subject Site

The Project is proposed on land located at the southern tip of the Eyre Peninsula in the area named Sleaford and known as 'Whalers Way'. The Project Site is predominantly an undeveloped vegetated coastal area. The existing use of the subject site consists of recreational, and tourism uses within a freehold allotment. Site users pay a nominal fee to the landowner to enter the site and utilise it for these purposes. Existing infrastructure and site features associated with this prevailing use consists of access tracks, open areas including car parking and picnic/camping areas together with supporting infrastructure such as tables, bins, signage, and fencing.

Built form development on the site is limited, and principally involves structures associated with the historic tourist and recreational uses of the site. Built form and site infrastructure includes (but is not limited to):

- the building at the site entrance;
- signage – wayfinding and interpretive;
- fencing – notably in certain 'cliff edge' locations;
- toilets;
- rubbish bins;
- tables and seating;
- windmill, pump, and tank infrastructure;
- water piping; and
- a monument.

Much of the infrastructure on the site appears to have been developed many years ago, and conditions of buildings and infrastructure range from fair to poor. The condition of a number of the buildings, including ablutions is marginal as to whether they remain fit-for-purpose and safe.

The character of the land could be summarised as an undeveloped vegetated coastal area, with a material degree of human modification to support access and passive recreational uses having occurred over many years. Much of the existing infrastructure supporting passive recreational uses is reaching the end of its economic life and is in only fair to poor condition. The existing environment is subject to a degree of environmental degradation as a result of its historic tourism and recreational uses, with a substantial degree of dumping of waste from visitors having accumulated in some areas of the site and also evidence off-road vehicle use having impacted on some of the vegetation.

The prevailing land use and condition of the site is longstanding. No records of historic use of the land have been identified. A review of State and Local Government development registers for recent years yielded no record of any development applications or land division applications that have been approved or lodged in respect to this site. It is noted that a Heritage Agreement which covers the majority of the site has been in place since 1988 preventing much of the land from being subject to any significant development since that time.

The Cape Wiles HF Ocean Radar Site is located on the top of cliffs in the south-eastern corner of the site. The equipment consists of several containers and two (2) arrays of whip type antennas located across the cliffs.

14.4.1.2 Existing Surrounding Land Uses

The nature of the locality reflects the condition and nature of the subject land. The southern tip of the Eyre Peninsula can be characterised as an undeveloped vegetated coastal area, transitioning to more agricultural character to the north.

Key land uses within the locality, that do not comprise a part of the identified site where development is proposed, include:

- The Cape Willes HF Ocean Radar Site:
  - this is a doppler radar weather monitoring station operated by DEW;
  - the ocean radar acquires data related to ocean conditions with a range of approximately 200 kilometres;
  - the equipment consists of several containers and two (2) arrays of whip type antennas located across the cliffs;
  - the station is sited within the adjacent Crown Land Allotment 102 – CR 5993/375, or the Coastal Reserve. Although south of the identified site boundary, this allotment is excluded from the subject land; and
  - access by DEW staff to the station is irregular (occurring two (2) to three (3) times per year) but will be maintain during the construction and operational stages of the Project. The only restriction to access will occur on launch days.
- The Cathedral Rocks wind farm:
  - located on costal land to the north-west of the site;
  - comprising of 33 Wind Turbines; and
  - the windfarm is the most substantial built form element in the area.
- Former Fishery Bay Whaling Station:
  - located on land abutting the north-eastern boundary of the site; and
  - a State Heritage listed place (State Heritage ID: 10223).

- The closest habitable dwelling is over 400 metres from the north-eastern boundary of the allotment.
- The closest urban centre is Port Lincoln approximately 25 kilometres to the north-east of the site.
- The following conservation reserves are located within the vicinity of the Project Area:
    - Thorny Passage Marine Park located approximately 500 metres south of the Project Area;
    - Sleaford Mere Conservation Park located 8.0 kilometres north-east of the Project Area;
    - Lincoln National Park located approximately 8.0 kilometres north-east of the Project Area; and
    - Lincoln Conservation Park located approximately 13 kilometres north of the Project Area.

In broad terms, the locality transitions heading north of the subject site with an increasing proportion of cleared farmland used for a mixture of broadacre cropping and grazing, with both sheep and cattle in evidence on multiple properties.

Throughout the locality there are a range of European built form elements, including roads, infrastructure, fencing, farm buildings, water tanks, troughs and pipelines and a number of dwellings. Heading north of the site, the first four (4) kilometres along the road towards Port Lincoln features dense roadside vegetation, which largely obscures vegetation beyond. Further north, open fields become more evident, initially punctuating the roadside vegetation and steadily becoming the predominant disposition of the land.

14.4.1.3 Mining Related Activities in the Locality

A review of the the DEM database has been undertaken to determine the status of any relevant existing mining activities in the area that may be impacted by the Southern Launch facility. DEM's database identifies a minerals Exploration Licence (EL) and an Extractive Mineral Lease (EML) that may be impacted by the Project.

Quantum Graphite Tenements

Exploration Licence (EL) 6224 was first granted on 13 October 2016 and is held 100 per cent by Quantum Graphite Operations Pty Ltd ("Quantum Graphite"), a subsidiary of Quantum Graphite Limited. EL 6224 is an expansive lease covering land between the southern tip of Eyre Peninsula (the Project Site) and Lincoln Conservation Park. The EL lease (and other related leases) is depicted in **Figure 14.1**.

In addition to EL6224, Quantum Graphite also holds two (2) Mining Leases (MLs) and two (2) Retention Leases (RLs) located in the northern part of EL6224 and together with EL6224 are described as the "Uley Graphite Project" by Quantum Graphite. The status and details for each of these tenement details is depicted in **Table 14.1**.

Table 14.1: Tenement Details (Quantum Graphite, SARIG).

TENEMENT	AREA	EXPIRY	WITHIN PROJECT SITE?	STATUS
ML5561	44 hectares	16 March 2024	No	Care and maintenance
ML5562	22 hectares	16 March 2024	No	Care and maintenance
RL66	225 hectares	1 October 2021	No	Care and maintenance
RL67	187.5 hectares	1 October 2021	No	Care and maintenance
EL6224	75 km^2	12 October 2021	Partially	Active

In accordance with rights granted under the *Mining Act 1971* (Mining Act), the EL allows Quantum Graphite to undertake exploration activities within the EL area. Early exploration activities can include:

- Visual inspection by land or air.
- Aboriginal heritage surveys or work area clearances.
- Geological mapping.
- Geochemical surveys by surface sampling, geophysical surveys, vegetation sampling, rock-chip sampling and sampling using handheld augers.
- Overnight camps or short-term campsites.
- Use of 4WD vehicles off existing tracks.

Advanced exploration programs test potential mineral resource targets identified during the early exploration phase. Advanced exploration activities can include:

- Drilling of holes, potentially at depth.
- Earthworks or trenches.
- Establishment of temporary camps and lay down areas for equipment storage.
- Use of machinery to create temporary tracks and traverses.

- Use of water tanks to store water for drilling activities.
- Rehabilitation of areas that have been drilled.

Explorers are required to consult landowners and provide notices of entry before they commence exploration activities.

The Uley graphite deposit located in the north of EL6224 has been mined historically and is included within the MLs and RLs as shown in **Table 14.1**. Quantum Graphite has recently undertaken capital raising ($2M) to continue their ongoing research and development into processing flake graphite for thermal energy storage applications. In addition, the capital raised will also fund an exploration drilling campaign.

The target of the drilling campaign is primarily the Uley deposit in the very north of the tenement (as shown in **Figure 14.1**), which is approximately 15 kilometres north of the Project Site; however, a second target will likely be included as part of the campaign and will be one (1) of three (3) "*high grade envelopes*" (shown in orange in **Figure 14.1**). The southernmost high-grade envelope "*Fishery*" is located partly within the Project Site but appears to be just outside of the "*Launch Safety Zones*" as identified in the EIS and shown in **Figure 14.2**.

Theakstone Sands Tenement

Theakstone Sands Pty Ltd holds the Extractive Minerals Lease (EML) 6510, which is located north of the Project area (refer to **Figure 14.2** for location). The EML was granted in May 2020 for a period of 21 years with the operational name "*Kooinda Sands 1*". The purpose of the EML is to extract sand for use in building and road construction and for laying of pipes. EML6510 is 36.29 hectares in size and the estimated life of the mine is more than 50 years.

The size of the resource is estimated at 950,000 tonnes of sand with extraction to be undertaken in six (6) stages, via strip mining at a rate of 5,000 to 10,000 tonnes per year. Mining commenced in the northern end of the EML and will progress in a southerly direction. Topsoil will be stripped and stockpiled and then used for rehabilitation at the end of each stage.

Daily truck movements are between one (1) and five (5) trucks per day of 10 to 30-tonne trucks, with hours of operation 8.00 am to 5.00 pm Monday to Saturday. Access to the mine site is via Fishery Bay Road.

Types of equipment that are used on the mine site are a front-end loader, truck, and screening plant.

The final depth of quarrying below the surrounding ground level is two (2) to three (3) metres, post rehabilitation the final landform will be approximately one (1) to two (2) metres in height.

14.4.1.4 Petroleum Related Activities in the Locality

Review of the the DEM database has been undertaken to determine the status of any relevant existing petroleum exploration and extraction activities in the area that may be impacted by the Southern Launch facility. DEM's database identifies three (3) Exploration Permits for Petroleum (EPPs) that may be impacted by the Project, these being:

- EPP46 – Karoon Gas Browse Basin Pty Ltd.
- EPP41 – Bight Petroleum Pty Ltd.
- EPP 42 – Bight Petroleum Pty Ltd.

The location of these Exploration Permits are identified in **Figure 14.3**.

Offshore petroleum activities are regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) and offshore petroleum tenements are regulated by the National Offshore Petroleum Tenement Authority (NOPTA). Offshore exploration activities which could be impacted by operation of the Project area include:

- Seismic surveying by specialised ship that acquires data over a defined grid and can take several months.
- Exploration drilling using drill ships or platforms which would typically be on location for up to two (2) months.

<u>Bight Petroleum Pty Ltd</u>

EPP41 and EPP42 have been held by Bight Petroleum Pty Ltd since 7 July 2011, with expiry by 7 June 2024. Bight Petroleum Pty Ltd is owned by Canadian firm Bight Petroleum Corporation.

Bight Petroleum stated that their "*initial commitment term consists of acquiring 1,031 square kilometres of 3D seismic over the permit area. The proposed 3D program will cover both shallow and deep-water prospective targets and will allow Bight Petroleum to further assess the overall prospectivity of these blocks. Currently Bight Petroleum is preparing for 3D seismic operations, in consultation with relevant stakeholders and under regulatory oversight*".

A search on the National Offshore Petroleum Titles Administrator (NOPTA) database indicates that Bight Petroleum had a scheduled works program from 2011 until mid-2021 that included:

- Acquisition of new 3D seismic survey.
- Licence reprocessed 2D seismic data (for EPP41 only).
- Geological and geotechnical studies including 3D seismic interpretation, basin modelling, reservoir, and fault seal modelling.
- Exploration well (for EPP41 only).

Karoon Gas Browse Basin Pty Ltd

Karoon Gas Browse Basin Pty Ltd (Karoon) is a subsidiary of Karoon Energy Ltd, a global oil and gas exploration and production company headquartered in Melbourne, Australia, with country offices in Brazil and Peru.

EPP46 was granted on 6 October 2016 with expiry on 5 October 2022.

A search on the NOPTA database indicates that Karoon had a scheduled works program from October 2016 until October 2022 that included:

- Acquire or licence new 2D seismic survey.
- Acquire or licence new 2D gravity, magnetic and bathymetric survey.
- PreSDM processing of new 2D seismic data.
- Reprocessing existing 2D seismic data.
- Acquire or licence new 3D broadband seismic survey.
- Acquire or licence new 3D gravity, magnetic and bathymetric survey.
- PreSDM processing new 3D seismic data.
- Geotechnical studies including interpretation of all seismic data, petroleum systems evaluation, QI and maturing of prospect and lead inventory.
- Prospect maturing and well planning studies.
- Exploration well.
- Post well geotechnical studies.

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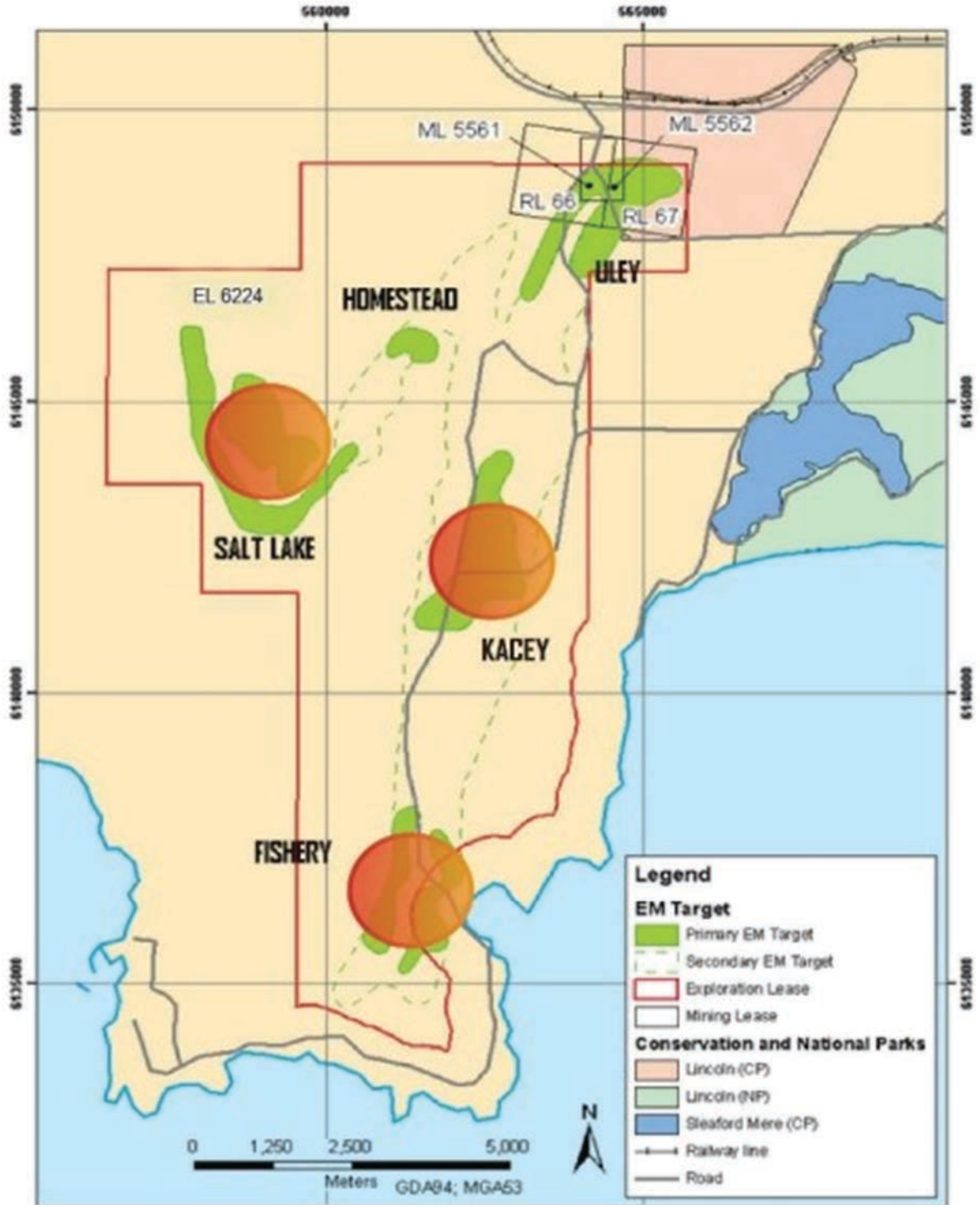

FIGURE 14.1

QUANTUM GRAPHICS MININGS LICENCES

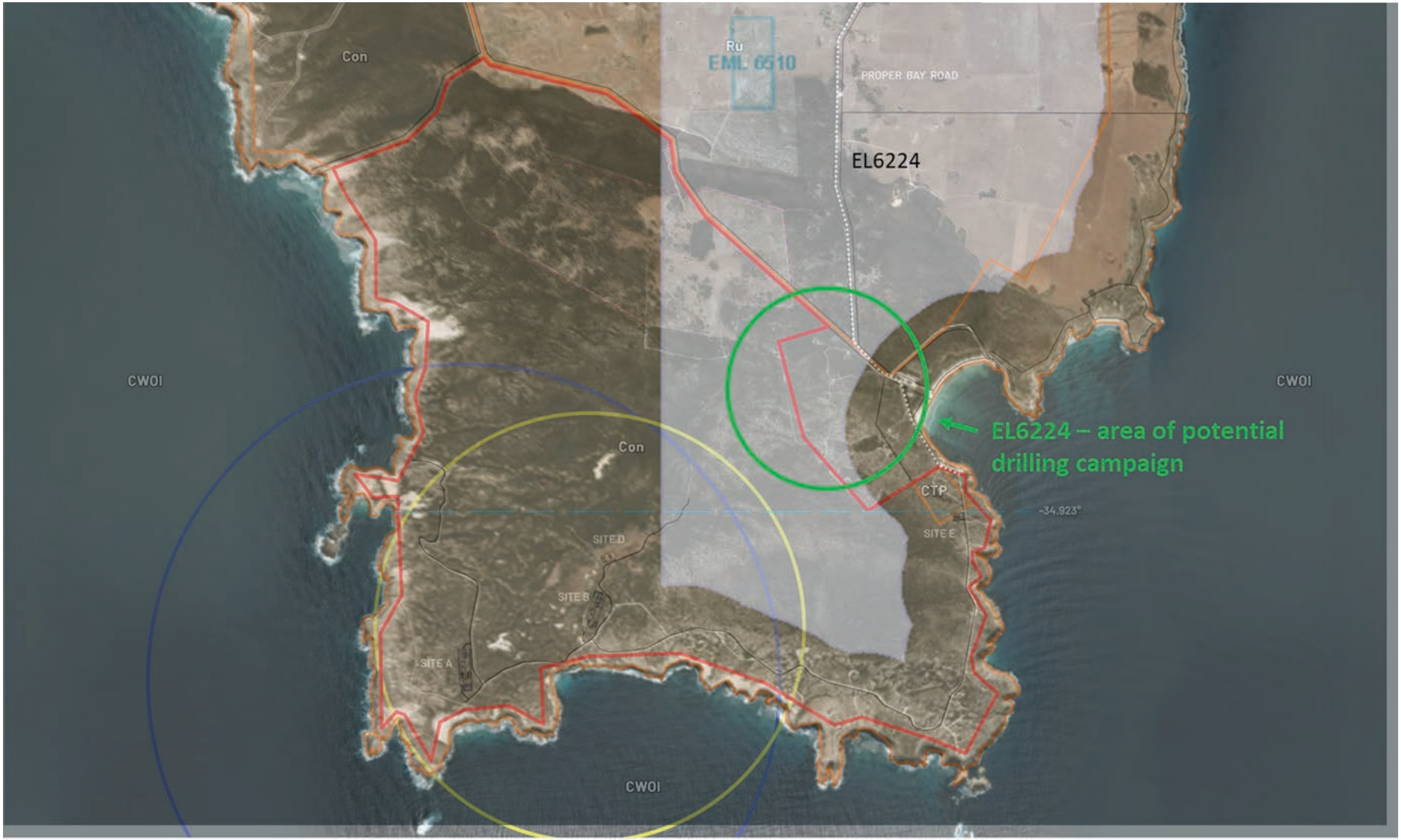

FIGURE 14.2

MINING LICENCES IN PROXIMITY TO THE PROJECT SITE

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FIGURE 14.3

PETROLEUM EXPLORATION PERMITS

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14.4.2 Guideline 16.2

16.2.	*Describe the new land uses proposed for the subject site (e.g., launch complex, helicopter landing pads, electricity generation etc.).*

The Project will consist of four (4) sites, comprising of two (2) launch sites (Site A and B), Infrastructure Area (Site D), a range control facility (Site E). A detailed description of each site and the associated infrastructure located there is provided within **Section 5.0**. A brief summary is provided **below**.

14.4.2.1 Site A and B – Launch Sites

Each launch site will be rectangular in shape and range in size from 36,000 square metres to 100,000 square metres. Each launch site will have its own perimeter security fencing and contain the following three (3) main components:

- a dedicated assembly facility;
- launch pad, lightning rods and anemometer tower; and
- propellant, water storage and pumping.

The launch facilities will be designed and constructed to meet safety and National Security international obligations and liability considerations, and appropriately separated from each other to meet current State and Federal explosives and WHS safety requirements.

The key infrastructure and elements provided at the launch sites is as follows:

- Assembly building.
- Internal access and runway.
- Stormwater capture and detention basin.
- Water deluge system.
- Launch pad.
- Flame trench.
- Launch pad lightning rods.
- Propellant, water storage and pumping.
- Fuel and oxidiser bunds.
- Flare stack and cold box.
- Blast walls.

- Secure block house.
- Utilities:
  - power (diesel generator);
  - wastewater (on-site aerobic system);
  - fire (two (2) 150,000 litre tanks, fire hydrants, and pumps); and
  - irrigation (landscaped areas to be irrigated with water source from wastewater/detention basin).
- Helipad (emergency service access only).
- Lidar and radar pad.
- Camera towers.
- Commercial vehicle access and parking.
- Site fencing.
- Waste storage area.
- Landscaping.

14.4.2.2 Site D – Infrastructure Site

The infrastructure site is a construction compound proposed to accommodate activities and facilities that will support the construction and on-going maintenance of the overall complex. Site D will consist of:

- A quarry (to produce engineered pavement materials in the initial stage of the development), which will subsequently be converted to a water storage dam.
- Water storage dam – 30 megalitre capacity.
- Pump Station.
- Workshop.
- Provision for future Electrical Generation or Storage Site.
- The site will be enclosed by an 1,800-millimetre-high chain wire mesh fence topped with three (3) stands of barbed wire and a lockable double gate.

14.4.2.3 Site E - Range Control Facility

Site E will accommodate the range control building to house the operational, security and emergency services of the complex which will oversee all operations on the site.

The building will be positioned close to the entry to the site from Right Whale Road. It is envisaged the facility will accommodate up to 40 staff, and an additional maximum of 20 invited guests may be accommodated to observe launch events. The site will provide a bitumen paved carpark for staff and visitors, bus parking, and accessible parking spaces.

14.4.2.4 Temporary Infrastructure

Temporary infrastructure will be established during the construction phase of the Project. Some of the temporary infrastructure to be established will include, but is not limited to:

- temporary concrete batching plant;
- temporary site and construction offices and facilities;
- temporary laydown areas; and
- temporary access tracks.

14.4.2.5 Launch Operations

The WWOLC project is proposed to establish a multi-user rocket launch facility that will service the growing demand for the launch of domestic and international vehicles for Polar and Sun Synchronous orbit satellite insertion. The facility will be utilised by Southern Launch's customers for satellite launch purposes. Each of the sites described above will play an integral role in the overall operation of the WWOLC facility.

It is expected the of operation of the WWOLC will accommodate in the order of one (1) rocket launch per fortnight to a maximum of 36 launches per year. Whilst several weeks of preparation will be involved in preparing for a launch, the actual launch itself, from ignition to orbit, will take approximately 45 minutes.

14.4.3 Guideline 16.3

16.3.	*Identify the types and extent of land tenure in broad terms, including reference to Crown Land. Outline any implications for Native Title and Native Vegetation Heritage Agreements.*

14.4.3.1 Summary of Land Tenure

In summary, the land tenure is described as follows:

- The Project Site comprises that portion of the allotment contained in Certificate of Title Volume 5993 Folio 374 that is situated below the -34.923-degree line of latitude.
- The registered Proprietor of the land is Theakstone Property Pty Ltd.

- Southern Launch Space Pty Ltd have entered into a Commercial Access License (The License) with Theakstone Property Pty Ltd for specified purposes associated with the Southern Launch proposal.
- The Project Area is subject to a Heritage Agreement (Dealing Number 6456268 listed on the Certificate of Title) for the conservation of native vegetation and native fauna.

14.4.3.2 Implications for the Heritage Agreement

A Heritage Agreement covering the Project Area was put in place in 1988 and established under the former *SA Heritage Act 1978* (now replaced by the *Heritage Places Act 1993*). The Agreement is registered as dealing number 6456268 listed on the Certificate of Title for the purposes of a Native Vegetation Heritage Agreement HA 148. The Agreement is now protected under the *Native Vegetation Act 1991*. Under the above agreement the land (being the land subject to the agreement as depicted on the 'Plan for Heritage Agreement') is dedicated to the conservation of native vegetation and native fauna.

The Heritage Agreement document states that the landholder shall not, without the written consent of the Minister, undertake or permit within the Heritage Agreement area the clearance of native vegetation; the planting of vegetation, whether native or exotic; the construction of a building or other structure; the grazing of stock or any other activity that, in the opinion of the Minister, is likely to damage, injure or endanger the native vegetation or native fauna within the Heritage Agreement area. The clearance of native vegetation for major projects within areas subject to a Heritage Agreement is precluded by the *Native Vegetation Regulations 2017*.

Analysis of spatial mapping of the Heritage Agreement area (refer to **Appendix M**) indicates a number of exempt areas within the Project Site that are excluded from the Heritage Agreement, and therefore not subject to the same restrictions in respect to native vegetation clearance or procedural challenges. At present these exclusion areas do not include the selected project sites.

The proponent has undertaken engagement with the Native Vegetation Council (NVC) in respect to the Heritage Agreement with the view to amend the Agreement so as to relocate and consolidate the exclusion areas to cover the selected project sites.

NVC have indicated that in the event approval for the Project is granted, NVC would agree to vary the Agreement in this manner, subject to the following considerations:

- The overall size of the Heritage Agreement remains largely the same.
- The layout and design of the proposed development and the likely impacts on native vegetation as presented to the NVC at that time, remains largely unchanged.
- The Varied Heritage Agreement is to include a clause requiring the development and implementation of a plan to actively manage the Heritage Agreement area for improved ecological outcomes.

- Sufficient actions being committed to as part of the development application to manage and mitigate the impacts of both construction and operation of the rocket launching facility on native fauna.

Furthermore, the successful approval of any native vegetation clearance within the exclusion areas will require the NVC endorsement of a sufficient Significant Environmental Benefit (SEB) offset. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that a SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance. The SEB offset calculation is discussed further in **Section 7.0** of this report.

14.4.3.3 Implications for Native Title

Native title is the recognition that Aboriginal and Torres Strait Islander people have rights and interests to land and waters according to their traditional law and customs as set out in Australian Law. Native Title is governed by the *Native Title Act 1993*. Native title may include rights to:

- Live on the area.
- Access the area.
- Visit and protect important places and sites.
- Teach law, custom and engage in cultural activities in the area.

The subject site is freehold land and therefore native title rights over the site have been extinguished.

The site area is located within the traditional lands of Nauo speaking people. The ancestral association of Nauo people to these lands is well documented in academic literature and also noted in a recent determination of native title by the Federal Court of Australia (regarding the neighbouring Barngarla land).

Site investigations and assessment were undertaken by representatives of the Nauo Native Title Claimant Group to inspect the site for sites or items of Aboriginal heritage significance on the 6 April 2019. This investigation and its findings are documented with a Cultural Heritage assessment prepared by Archaeologist and Anthropologist, Scott Cane (see **Appendix Y**).

No sites with Aboriginal heritage significance were identified to be directly affected or disturbed by the proposal.

14.4.4 Guideline 16.4

16.4. Identify the level of interference to landowners, land uses and activities in the immediate and surrounding environs.

There are a variety of tangential and direct interference impacts that the Project will have on immediate and surrounding land uses. In summary, these impacts are expected to include:

- Inhibiting public access for current site users (recreational tourism, camping, hiking, animal watching).
- Noise and vibration impact on sensitive receptors in proximity to launch activities (Discussed in **Section 8.0**).
- Dust emissions, noise, vibration and lighting during construction of the facility.
- Interference to nearby landowners through increased construction activity and associated activities (i.e., greater number of truck and heavy vehicle movements through local roads).
- Effect on utilities.

The level of interference caused by the Project to current land users will be substantial as the Project will result in the termination of all use of the developed portions of the Whalers Way site for the tourism and recreational purposes previously undertaken. However, this interference is limited to within the Project Footprint boundaries and existing uses outside of the Project Footprint will be able to continue largely unaffected from a land use perspective outside of the times when actual launches are to take place.

The primary interference to adjoining landowners and land users outside of the Project allotment will be through noise from launch activities. The WWOLC will generate noise levels equivalent to a small warehouse for the vast majority of time (more than 99.9 per cent of the time). The facility will generate a large level of noise for approximately 75 seconds, approximately 36 times per year (once every three (3) weeks). This high-level noise would be brief, but similar to the noise of a large aeroplane.

The total annual time of this high-level noise generation is approximately 45 minutes per year and represents 0.007 per cent of the time. The high-level noise would be a maximum of 130-140 dB, if based on the largest rocket that may be launched occasionally, at the launch site, but more often smaller rockets will be launched. Impacts from this noise would be dissipated by a blast walls and water deluge (e.g., reducing the noise near the source by 5-10 dB). The noise from construction through to operation and launch has been modelled to dissipate to acceptable levels to the nearest human receivers. At any distance from the launch site, the noise levels will be significantly lower.

14.4.5 Guideline 16.5

16.5.	*Evaluate the change in land use, resulting in a loss of coastal conservation area, visual and amenity impacts being introduced and impact on mining and petroleum related activities.*

14.4.5.1 General Impacts on the Locality

The proposed launch sites and supporting infrastructure will a occupy a small percentage of the Whalers Way area at the southern tip of the Eyre Peninsula. The proposed locations for these sites use areas that primarily exhibit natural clearings and lower order vegetation condition, which were selected in order to minimise the disruption to the natural environment. The expected level of clearance will be in the order of 23.76 hectares, within a project site of approximately 1,000 hectares and an allotment of 2640 hectares.

The WWOLC does not result in the loss of a coastal reserve area. The land is a privately held allotment utilised for tourism purposes at the discretion of the landowner and is not a National Park or Conservation Park. It is noted that the net total area of land protected for conservation purposes under the Heritage Agreement will not be affected in the proposed arrangement once agreement of the Native Vegetation Council is confirmed for the relocation of exclusion zones to cover the Project Footprint.

Amenity impacts on human settlements in the locality are largely constrained to noise impacts resulting from launch and testing activities. Detailed discussion on noise related impacts is provided within **Section 8.0** of this report.

A Visual Impact Assessment has been undertaken by WAX (refer to **Appendix Z**). The development seeks to protect the scenically attractive coastal location through the use of low building forms and associated infrastructure. Taller elements within the proposal will be of a slender appearance and/or will only be utilised during launch operations, limiting the visual impact these will have on the surrounding area.

The development site is located a substantial distance from surrounding towns and dwellings, which further helps to limit the impact on the visual character. While the coastal landscape of the subject land is sensitive to visual and landscape change, the scale and separated locations of the development sites help to limit and fragment the potential effect. Given the constrained visibility of the sites, the potential impacts are further mitigated by the surrounding topography to the east and west.

14.4.5.2 Impact on Mining Activities in the Area

Refer to the discussion **Section 14.4.1** for details on the location and nature of mining activities in the locality. The following discussion addresses the potential impacts to these identified mining activities.

Potential Impacts on Quantum Graphite's Mining and Exploration Activities

The southernmost portion of EL6224 lies within the Project area and one (1) potential drilling target area is located adjacent the launch safety zones. If Quantum Graphite continues their exploration within EL6224, their exploration activities have the potential to interact with the Southern Launch project area and operation in the future, particularly if the upcoming drilling campaign is successful and the company proceeds to develop the "*Fisher*" deposit to a working mine. If Quantum Graphite wish to explore the EL that is contained within the Project area, they will be required to submit a Notice of Entry to the landowner (in this case Southern Launch) 42 days before commencing exploration activities.

Given the location of the mining and retention leases, it is unlikely that any future operations will be impacted by the construction and/or operation of the Project area. The mining and retention leases are currently under care and maintenance, and it is unclear when mining activities will recommence in the future. Before mining operations recommence, Quantum Graphite will be required to submit a new or updated Program for Environmental Protection and Rehabilitation (PEPR) to DEM, which would include consultation with adjacent landholders such as Southern Launch.

The timing of any further exploration drilling and/or mine development is unknown. Southern Launch will further consult with Quantum Graphite with the view to establish a communication protocol and management plan to establish a relationship and control potential future operational interactions.

Potential Impacts on Theakstone Sand's Mining Activities

EML6510 is north of the Project area and unlikely to be impacted by the operation of the Southern Launch project area. As part of their EML application preparation, the proponents had communicated with adjacent landholders including Southern Launch, so would be aware of the Project. Southern Launch will establish a communication protocol to manage information exchange between the two (2) parties.

14.4.5.3 Impact on Petroleum Activities in the Area

Refer to the discussion **Section 14.4.1** for details on the location and nature of Petroleum extraction and exploration activities in the locality. The following discussion addresses the potential impacts to these identified activities.

Potential Impacts on Bight Petroleum's Petroleum Exploration Activities

EPP41 and EPP42 are listed on both the SARIG and NOPTA databases as active, however, it was announced on 13 February 2021 that NOPTA had rejected Bight Petroleum's application to extend their work program, which could have a significant implication for any future attempts to renew their exploration leases.

Given the above, it is therefore unlikely that operation of the Project area will impact future exploration activities by Bight Petroleum, particularly if they surrender their tenements.

Southern Launch will consult with Bight Petroleum to confirm current operational status. Southern Launch will also periodically investigate the status of EPP41 and EPP42 to determine if the tenements have been surrendered, or there has been a change in operational status or ownership.

Potential Impacts on Karoon's Petroleum Exploration Activities

EPP46 is listed on both the SARIG and NOPTA databases as active, however on Karoon Energy Ltd's website, it is stated that:

> *"Karoon was awarded exploration permit EPP46 during October 2016. The permit covers 17,793 square kilometres of Australia's most prospective frontier oil exploration province, the Ceduna Sub-Basin, in the Great Australian Bight ('GAB'), offshore South Australia. Due to the difficulties associated with regulatory approvals to conduct operations, Karoon submitted a formal request with the regulatory authorities to surrender exploration permit EPP46 during the December quarter 2019."*

Given the above, it is therefore unlikely that operation of the Project area will impact future exploration activities by Karoon, particularly if they have surrendered their tenement. Southern Launch will periodically investigate the status of EPP46 to determine if the tenements have been surrendered, or there has been a change in operational status or ownership.

14.4.6 Guideline 16.6

16.6.	*Outline any mitigation measures to alleviate or avoid impacts on land owners and land uses.*

14.4.6.1 Management Procedures and Strategies

The proponent has developed separate strategies to manage the potential environmental impacts during the construction, operational and de-commissioning phases of the Project. The strategies will be documented in the Construction Environmental Management Plan (CEMP) and Operational Environment Management Plan (OEMP). Draft versions of these management plans have been provided within **Appendix AD** and **Appendix AE**, respectively.

The overall goal of the environmental management framework is to avoid, mitigate, manage and/or control any potential adverse impacts of the construction, operation and de-commissioning of the complex on the biological, physical, social or economic environment. The Management Plans would reflect the commitments of Southern Launch to environmental management and contain the following information:

- Summary of the potential environmental impacts of the proposal.
- Relevant legislative requirements and legal obligations and governing agencies.

- The environmental values requiring protection.
- the environmental objectives and goals to be achieved through implementation the EMP's.
- The measures required to manage and/or mitigate potential environmental impacts.
- The assessment criteria required to assess the effectiveness of the management measures.
- Monitoring programs to ensure continued compliance with the management measures.
- A reporting process to keep the public and government agencies informed on the performance of the management measures.
- A process for review and refinement of the environmental management measures based on performance and/or change in circumstances/scope of the Project.

The draft Management Plans will be fully detailed and finalised following assessment and approval of the EIS having regard to the assessment outcome, public submissions, agency comments and/or requirements, and any conditions of approval, and reflect the final design and scope of the Project as approved.

A second tier of specified management plans will address procedures for specific elements and events. These will include:

- Native Vegetation Management Plan.
- Flora and Fauna Management Plan.
- Offset Implementation Plan.
- Planting Guide.
- Coastal Acid Sulphate Soil (CASS) Management Contingency Plan.
- Contamination Management Contingency Plan.
- Stormwater Management Plan.
- Heritage Management Plan.
- Soil Erosion and Drainage Management Plan (SEDMP).
- Spill Response Plan.
- Emergency Response Management Plan.

As part of the Complaints Management Procedure/Community Engagement Plan, a program of assessment, monitoring and reporting will be utilised to respond proactively to issues or complaints raised by landowners, stakeholders, and the community generally. All complaints will be recorded and a compliance check with relevant procedures, licences and permits will be undertaken to determine whether corrective action is required. On-going monitoring will maintain compliance.

14.4.6.2 Mitigation Measures for Specific Amenity Impacts

Noise and vibration impact and associated mitigation methods are addressed in detail in **Section 8.0**. In summary, noise mitigation will include:

- source point noise mitigation methods including water deluge system and blast walls;
- administrative measures proposed by Southern Launch will include a plan to notify residents of upcoming launch activities and to restrict human presence within required set back distances prior to a launch; and
- a noise monitoring and reporting program would also be developed to verify noise impacts of launch activity on nearby residents.

Visual impacts and associated mitigation methods are addressed in detail in **Section 16**. In summary, the methodology used to offset the visual impacts of the Project on the site and locality will include:

- the use of low-reflective material applied colour schemes that mimic the existing landscape;
- the revegetation of the sites will further assist in limiting the visual impacts;
- separated locations will assist in minimising and fragmenting the visual impact on the locality; and
- given the contained visibility of the sites the potential impacts will be mitigated by the surrounding topography to the east and west.

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15 TRANSPORT & ACCESS

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15.0 TRANSPORT AND ACCESS

15.1 Summary

A Transport and Access Impact Assessment (TAIA) has been undertaken by traffic engineers Wallbridge Gilbert Aztec (**Appendix AA**) and forms the basis of the assessment contained in this section of the EIS. The assessment evaluates the current and proposed access arrangements for the site as follows:

- Traffic impacts on the arterial and local road networks to an extent which encompasses Port Lincoln.
- The traffic and access impact for the construction period as well as any ongoing operations and maintenance.
- Details of the transport vehicle sizes and movements outside of normal gazetted heavy vehicles.
- The minimisation and/or mitigation of traffic and transport impacts.

In summary, the analysis concluded:

- The external road network will cater for the 19 metre Semi Trailer design vehicle – the largest vehicle required to access the site. As this is a General Access Vehicle, permits are not required to negotiate the vehicle through the adjoining road network. (Note: special exemption permits will be required to be applied for if over-weight or over-size vehicles are required).
- Some geometric realignment and road upgrades to the internal access network will be required to enable the safe passage of all vehicles to the proposed launch sites. Realignment of some of the internal intersections may be required to achieve safe sight distances.
- A total of 12 heavy vehicles per day and additional worker (light vehicle) traffic is projected to access the site on a daily basis (weekdays only) to construct the new tracks and associated launch site infrastructure over the construction phase.
- Once the launch pad is operational, total traffic (excluding tourist traffic) is expected to be approximately 56 vehicles per day with 8 per cent of that volume being commercial vehicles.
- Some additional maintenance, such as more frequent grading, will likely be required on Fishery Bay Road to cater for the additional proposed traffic volumes.

15.2 Methodology

The Transport and Access Impact Assessment has been undertaken incorporating the following investigations and analysis:

- Desktop analysis of transport network.
- Physical inspection and analysis of existing transport network including road engineering and geometry, weight limits, pavement condition, traffic control measures and traffic characteristics.
- Physical inspection of the Project Site access network including, horizontal alignment (location of curves and radius), vertical alignment (location of crests), condition and type of track subgrade, approximate track width, and basic drainage considerations.
- Analysis of project components and calculation of expected traffic generation and anticipated vehicle types, access requirements, manoeuvring and car parking requirements (for both construction and operational phases).
- Analysis of the external and internal road network to accommodate the projected transport and access requirements of the Project having regard to Australian Standards and Austroads Guide to Road Design.

15.3 Relevant EIS Guidelines

Assessment Requirement 14: *The proposal requires access for the transportation of infrastructure and construction material to the site and on-going access for materials transport, workforce attendance and public viewing purposes.*

14.1 *Undertake a Transport Assessment that involves end-to-end supply chain (input and output) to determine transport impacts (including traffic impacts on the local and arterial road network) and measures to manage and / or mitigate the impacts during the construction and operational phases. The impacts on the arterial and local road networks are to be considered to an extent which encompasses Port Lincoln.*

14.2 *Describe the existing transport and access arrangements to and around the site, including access from the arterial and local road network, private roads, and gated areas. Detail the road surface treatments and minimum vehicle types for each road and track (e.g., 4WD).*

14.3 *Describe and identify on plans, all primary and alternate access roads (including arterial and local roads), tracks and parking proposed for the construction and operational phases.*

14.4 Identify all vehicle types required to utilise the existing and any proposed access routes, specifically the heavy vehicles anticipated. Identify any road surface upgrades required as a result of the development and any heavy vehicle movements (including over-size/over-mass) that require approval through the National Heavy Vehicle Regulator.

14.5 Identify the anticipated construction and operational vehicle movements per day, making provision for any increases in either phase of development. Include the likely transportation of large- scale materials or componentry and method of transport (e.g., heavy vehicles, airfreight, and shipping).

14.6 Document the anticipated publicly accessible areas, including roads to be utilised, parking and turnaround facilities.

14.7 Describe the right of way access easements required to facilitate public access to the site for public viewing purposes.

14.8 Identify any potential effects of construction traffic including noise and dust and associated mitigation measures.

14.9 Describe the location, extent, number, and purpose (e.g., commercial, or otherwise) of helicopter pads. Identify the potential impacts of helicopter operations with regard to the intended flight paths, downdraft below cruising height, wildlife (e.g., bird and bat strike) and noise implications.

14.10 Describe the risk involved in transporting materials to the site, including any specific safety and security requirements to be implemented when travelling on roads, including the dangerous goods code requirements.

15.4 Analysis

15.4.1 Guideline 14.2

14.2 Describe the existing transport and access arrangements to and around the site, including access from the arterial and local road network, private roads, and gated areas. Detail the road surface treatments and minimum vehicle types for each road and track (e.g., 4WD).

15.4.1.1 External Site Access Network

Access to the site is available via the existing arterial and local road network. From Port Lincoln. Access to the site follows Proper Bay Road, Fishery Bay Road to Right Whale Road before entering the site and private access known as Whalers Way Road (**Figure 15.1**).

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FIGURE 15.1

WHALERS WAY ROAD
SOURCE: GOOGLE

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The following sets out in more detail the nature and characteristics of this route:

- Mortlock Terrace/Yandra Terrace onto Western Approach Road (sealed arterial road DIT maintained – 2,200 vehicles per day 21.5 per cent commercial traffic). Approximately 3.0-kilometre length.
- Pine Freezers Road (sealed connector road, City of Port Lincoln maintained, traffic volume unknown). Pine Freezers Road has a rail crossing midway along its length. The rail crossing is at right angles to the road and presents no issues for 19-metre semi-trailer access. Approximately 800 metre length.
- Investigator Road (sealed connector road, City of Port Lincoln maintained, traffic volume unknown). Approximately 2.0-kilometre length.
- Proper Bay Road (sealed connector / local road, DC Lower Eyre Peninsula maintained, traffic volume unknown). Approximately 13-kilometre length.
- Fishery Bay Road (unsealed local road, DC Lower Eyre Peninsula maintained, traffic volume unknown). Approximately 12-kilometre length.

The traffic volumes on the Council road networks are unknown, but generally reduce significantly the further south the roads are located. It can be assumed that Fishery Bay Road, being unsealed is likely to have traffic volumes of less than 150 vehicles per day, therefore the additional traffic introduced by the launch facility operations will have the most impact on this section of total network.

Access requirements resulting from the Project will impact on both the external road network and the internal track network and site environment as follows:

- Initial construction of the facility.
- Employee requirements between launch operations (e.g., maintenance, administration, security).
- Access associated with launch operations including launch vehicle and payload delivery, associated workforce, and visitors.
- Emergency vehicle access.

15.4.1.2 Internal Site Access Network

Reflecting the predominant use of the site for recreational purposes, a series of bush tracks currently provide access to various coastal, camping and picnic areas spread throughout, but mainly around the coastal perimeter of, the site.

The existing tracks are of varying quality and accessibility. Some of the main tracks would be accessible to two-wheel-drive vehicles during good weather, however, the majority of the lower order tracks are only accessible to four-wheel-drive vehicles, with some only being accessible in good weather conditions.

The existing tracks have generally been formed over the longer-term use of the site for recreational access. In some cases, the existing bush tracks have been formed and graded. The tracks are not sealed and vary in condition of subgrade between hard limestone caprock through to soft sand, resulting in highly varied road and ride conditions. Consequently, the existing tracks commonly feature corrugations and erosion.

The geometric alignment, dimensions, subgrade, drainage and general condition and of the existing tracks has been recorded for analysis and rating purposes. A detailed record of the rating of the existing tracks, and the methodology used is documented in Section 5.2 of **Appendix AA**.

This analysis forms the base data for determining the extent of upgrade required to existing tracks to accommodate the nature of vehicles required to service the construction and operation of the complex.

15.4.1.3 Public Access within the Site

Notwithstanding the private ownership of the site, public access within the site for recreational purposes is currently possible through the purchase of a permit.

Visitor traffic volumes for the site have never been recorded, however, based on site observations it can be assumed that tourist volumes are relatively low, with seasonal peaks expected to coincide with warmer seasons and holiday periods. The types of vehicles are generally 4WD or SUV type passenger vehicles and volumes greater than 30 vehicles per day in peak seasonal tourist times are estimated.

15.4.2 Guidelines 14.1, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 14.10

14.1	*Undertake a Transport Assessment that involves end-to-end supply chain (input and output) to determine transport impacts (including traffic impacts on the local and arterial road network) and measures to manage and / or mitigate the impacts during the construction and operational phases. The impacts on the arterial and local road networks are to be considered to an extent which encompasses Port Lincoln.*

14.3	*Describe and identify on plans, all primary and alternate access roads (including arterial and local roads), tracks and parking proposed for the construction and operational phases.*

14.4	*Identify all vehicle types required to utilise the existing and any proposed access routes, specifically the heavy vehicles anticipated. Identify any road surface upgrades required as a result of the development and any heavy vehicle movements (including over-size/over-mass) that require approval through the National Heavy Vehicle Regulator.*
14.5	*Identify the anticipated construction and operational vehicle movements per day, making provision for any increases in either phase of development. Include the likely transportation of large- scale materials or componentry and method of transport (e.g., heavy vehicles, airfreight, and shipping).*
14.6	*Document the anticipated publicly accessible areas, including roads to be utilised, parking and turnaround facilities.*
14.7	*Describe the right of way access easements required to facilitate public access to the site for public viewing purposes.*
14.8	*Identify any potential effects of construction traffic including noise and dust and associated mitigation measures.*
14.10	*Describe the risk involved in transporting materials to the site, including any specific safety and security requirements to be implemented when travelling on roads, including the dangerous goods code requirements.*

15.4.2.1 Construction Access

Construction of the various site infrastructure will require a range of vehicle types that typically service the building, civil, mechanical, and hydraulic industries as well as the construction work force.

The largest civil components of the site will be the access roads, carparks, launch pads (and flame trench), fuel bunds and general site foundation works, which are constructed from large volumes of rubble and concrete along with other building materials.

Options for concrete production required for construction have been considered, however, it is assumed the most likely option will be to install a temporary concrete batching plant on site, thus avoiding the need for a period of concrete transport to the site from Port Lincoln.

Depending on the required volumes and outputs of both the concrete and rubble, the scale of the batching / mobile crushing plant in its various componentry may arrive in over-dimensional (OD) load configurations. These loads would only need to be delivered to the site once and removed from the site after completion of the construction activity, typically under an escort and when traffic volume is low, however, if OD loads are to access the site, they need to be assessed on the individual needs of the route and considered in greater detail in a Construction Traffic Management Plan and in accordance with regulatory requirements.

Significant quantities of steel, building materials, pipework, and other building ancillary components will likely be sourced from suppliers within Port Lincoln where possible, otherwise freighted in via ship or road, and then freighted by road into the site. Generally, these deliveries will fit onto 19-metre semi-trailers. Once again, as detailed design progresses the actual quantities will be determined and can be better catered for in the Construction Traffic Management Plan.

Rough rubble and concrete volumes, and approximate transport vehicles to distribute these materials have been estimated and tabulated in **Appendix AA**. Approximate truck volumes for the building construction component are estimated.

Approximate calculations indicate a total of 1,400 heavy vehicles (comprised of tipper trucks with dog box and 19-metre semi-trailer loads) will require access to the site during construction operations (building of access tracks and launch pad infrastructure). Assuming a 120-day construction duration, this equates to 12 heavy vehicles per day using the access track.

Table 15.1: Approximate construction equipment (trucks)

Element	Dimension	Approximate Volume (m^3)	Approximate number of Trucks required to transport from Plant to Site
Internal Access tracks (Rubble)	9680m X 8.6m	12,500 m^3 (assume 150mm base thickness)	480 Trucks (assumes 30m^3 per Tipper/Dog and 15% additional volume for loose cubic meters)
Access tracks within Site (Rubble)	2000m2	500 m^3 (assume 250mm base thickness)	20 Trucks (assumes 30m^3 per Tipper/Dog and 15% additional volume for loose cubic meters)
Construction Miscellaneous	Assumption	NA	Allow 200 Semi Trailer Sized trucks for mobilisation of plant (eg graders, water carts, rollers), mobile plant (concrete batching plant, mobile crushing plant) and building materials deliveries. This includes cement deliveries for a batching plant, but assumes sand and aggregate can be sourced from the borrow pit. Water is assumed to be available on site.
		TOTAL	**700 Heavy Vehicles (2 combinations)** (500 X Tipper and Dog) (200 X 19m Semi Trailers)
		TOTAL TRIPS	Assume each truck makes a return trip via the local access track i.e. two trips per load TOTAL TRIPS = **1400 Heavy Vehicle Trips**
		ASSUMED VEHICLES PER DAY	**12 Heavy Vehicles per day.** (Assume 6-month construction timeframe and 5 day working weeks IE 120 working days)

15.4.2.2 Operations Access

The proposal comprises two (2) separate launch facilities (Sites A and B) together with associated infrastructure facilities (Site D) and range control facilities (Site E). A detailed description of the proposed site facilities is outlined in **Section 5**.

The following vehicle movement requirements are anticipated on site:

Launch Site A

The launch facility at Site A is intended to cater for larger conventional launch vehicles (rockets) of greater than 30 tonnes up to approximately 100 tonnes.

Site A is intended to form Stage 2 of the Project, at is anticipated to be constructed in 2023 or later.

Access Tracks for commercial vehicles are to be designed to cater for 19-metre semi-trailer vehicles. There will be very low vehicle movements in respect of heavy vehicle movements commercial vehicles per day peak.

Vehicle movement generators for the launch site (A) include:

- Launch Vehicle Fuel delivery (three (3) per week).
- Oxidiser delivery (three (3) per week).
- Generator Fuel delivery (one (1) per week).
- Septic Tank Pump Out (one (1) per week).
- Launch Vehicle transport to site (one (1) per week).
- Crane movements (three (3) per week).

Two (2) vehicle parking spaces for delivery vehicles, one (1) adjacent to the fuel bund and one (1) adjacent to the oxidiser bund, will be of concrete construction.

Car parking is required within the launch pad site and should cater for between 12 and 20 vehicles near the assembly building. The staff parking area is to be of asphalt construction to meet the relevant standards in respect of parking dimensions and number of disabled carparks.

Launch Site B

The launch facility at Site B is intended to cater for larger conventional launch vehicles (rockets) from micro sized (less than 10 tonnes) up to approximately 60 tonnes.

Site B is intended to form Stage 1 of the Project and is anticipated to be constructed as soon as the Project receives approval.

Access Tracks for commercial vehicles are to be designed to cater for 19-metre semi-trailer vehicles. There will be very low vehicle movements in respect of heavy vehicle movements (two (2) commercial vehicles per day peak).

Vehicle movement generators for the launch site (B) include:

- Launch Vehicle Fuel delivery (three (3) per week).
- Oxidiser delivery (three (3) per week).
- Generator Fuel delivery (one (1) per week).
- Septic Tank Pump Out (one (1) per week).
- Launch Vehicle transport to site (one (1) per week).
- Crane movements (three (3) per week).

Two (2) vehicle parking spaces for delivery vehicles, one (1) adjacent to the fuel bund and one (1) adjacent to the oxidiser bund, will be of concrete construction.

Car parking is required within the launch pad site and should cater for between 12 and 20 vehicles near the assembly building. The staff parking area is to be of asphalt construction to meet the relevant standards in respect of parking dimensions and number of disabled carparks.

Infrastructure Site D

Site D will initially consist of a quarry and workspace to produce engineered pavement materials. Subsequently the site will accommodate a workshop and rocket storage building and will be accessed by the same kinds of vehicles accessing the launch sites described above.

Range Control Site E

Site E will accommodate the range control building which will be located close to the entry to the site from Right Whale Road The facility will provide integrated office accommodation, toilet facilities and kitchen facilities for up to 40 staff and 20 VIPs/visitors.

It will also have a visitor information centre and the main operations area for security and emergency services.

A bitumen carpark with spaces for staff and visitors, including disabled spaces, and dedicated car parking for emergency services, will be required. These facilities will be designed and constructed in accordance with relevant standards.

15.4.2.3 Trip Generation

A variety of customers are expected to utilise the site once operational. The number of launches is anticipated to grow over time, with approximately six (6) launches anticipated in the first year of operations, increasing to a maximum of 36 launches in year five of operations.

Customers of the facility will transport their equipment and launch vehicle stages to the site before undertaking final assembly in preparation for the launch. Once the launch is complete, the customer will remove their equipment and vacate the launch site ready for occupation by the next customer.

Typically, a launch cycle will run in the order of three (3) to five (5) weeks from occupation to vacation of a launch site (refer **Section 6.3**), however, the exact timeframe will vary based on the nature of the launch vehicle and the specific requirements of an individual launch mission.

The intensity of use of the site will vary throughout the year. When there is no material activity on-site and only routine security present it is expected there will be only one (1) or two (2) people on site.

When multiple launch sites are occupied, the level of activity will be more significant with larger numbers of staff on site. It is expected numbers will be typically 10 to 20 people per day (mix of customers and Southern Launch team members) and approaching up to 50 people per day during the launch cycle.

The facility is expected to generate the following types of vehicles and volumes during typical launch operations (it is assumed that these vehicles generate two (2) trips per vehicle):

- 20 passenger cars/4WDs entering and leaving the site (i.e., 40 vehicle trips per day).
- Four (4) maintenance staff cars / 4WDs / small rigid trucks entering and leaving the site (i.e., eight vehicle trips per day).
- The equivalent of one (1) semi-trailer and three (3) small rigid trucks entering and leaving the sites (i.e., eight freight vehicle trips per day).

15.4.2.4 Anticipated Vehicle Types

During operations a number of vehicles will be utilised to deliver, operate and maintain the various site infrastructure, which consists of many interrelated systems such as civil (building), mechanical (air conditioning, extraction and exhaust) and hydraulic (plumbing and drainage, septic, compressed air etc).

The rockets themselves are largely constructed offsite, containerised, and then delivered to site for final assembly.

Derived from the above analysis, the following vehicles are expected to be used during operations:

- 19-metre semi-trailer for rockets/launch vehicle and other component deliveries.
- Small rigid vehicle (SRV) for smaller package deliveries and septic removal.

- Forklifts to unload and move containers at site activity locations.
- 19-metre semi-trailer (sealed tanker) liquid fuel deliveries (oxidiser, launch vehicle fuel, generator fuel etc).
- Maintenance Vehicles i.e., for mechanical and access track maintenance/repairs.
- Cranes.
- Passenger vehicles and 4WD vehicles (discussed above).

15.4.3 Guidelines 14.1, 14.6, 14.7, 14.8

14.1	*Undertake a Transport Assessment that involves end-to-end supply chain (input and output) to determine transport impacts (including traffic impacts on the local and arterial road network) and measures to manage and / or mitigate the impacts during the construction and operational phases. The impacts on the arterial and local road networks are to be considered to an extent which encompasses Port Lincoln.*
14.6	*Document the anticipated publicly accessible areas, including roads to be utilised, parking and turnaround facilities.*
14.7	*Describe the right of way access easements required to facilitate public access to the site for public viewing purposes.*
14.8	*Identify any potential effects of construction traffic including noise and dust and associated mitigation measures.*

15.4.3.1 Impacts on the surrounding Arterial and Local Road Network

Impact of traffic generated by the Project is assessed based on the trip generation and vehicle types discussed above.

The road network is available to General Mass Limit (GML) and Higher Mass Limit (HML) B-double freight from Port Lincoln CBD through to Investigator Road.

These roads are currently heavily used by various freight operators and the impacts on this section of the road network from the proposed Southern Launch operations is considered to be negligible considering the magnitude of heavy vehicle traffic in this commercially zoned area.

Peak launch operations will generate approximately 50 vehicle trips per day of which around 8.0 per cent are commercial vehicles. Outside of specific launch events, typical trip generation would be lower.

An additional 50 vehicles per day using the sealed section of Proper Bay Road is unlikely to have any noticeable effects on pavement life or degradation. The additional traffic generation on Fishery Bay Road may require slightly more frequent grading operations on the affected section of road to maintain the existing shape and ride/roughness (condition) of the road e.g., corrugations may develop more frequently.

The main intersections along the route are viable for up to B-Double vehicle access:

- Yandra Terrace/Pine Freezers Road – Gazetted 35.0 metre B-triple vehicles. The intersection is formalised with turn lanes, lighting, and kerbing. Pine Freezers Road is required to give way to Yandra Terrace. The junction has good sight lines on all approaches.

- Pine Freezers Road/Investigator Road (Proper Bay Road) – this junction has gazetted (approved) B-double access. This junction has pavement bars/line marking for traffic controls and has basic lighting. Pine Freezers Road is required to give way to Investigator Road. The junction has good sight lines on all approaches.

- Proper Bay Road / Fishery Bay Road – this junction has been constructed full width with a sealed throat area for 100 metres down Fishery Bay Road and has accommodated over dimensional permit vehicles for the Cathedral Rocks Wind Farm components. The junction has line marking / pavement bars and is controlled by a give way treatment with Proper Bay Road having priority. A 19-metre semi-trailer vehicle will be able to manoeuvre through the junction although it may run over the pavement bars. The junction has good sight lines on all approaches.

As larger vehicles progress their way beyond Investigator Road and onto Proper Bay Road the maximum permittable freight vehicle size is a 19-metre GML semi-trailer. This restriction is continued onto Fisheries Bay Road and onto the Whalers Way site. Any vehicle larger than a 19-metre semi-trailer would require a permit to access either Proper Bay Road or Whalers Way Roads.

Should there be a requirement for a vehicle that exceeds the statutory masses, an exemption/permit will be required from the National Heavy Vehicle Regulator.

15.4.3.2 Impacts on Site

Roads and tracks within the site will be constructed/upgraded and maintained at a standard which are suitable for the traffic volumes, the vehicle types, and the speed environment that is expected. Roads and tracks will generally be of gravel construction but may be upgraded to asphalt as opportunities present themselves. These roads will be designed and constructed with a design life in excess of 25 years.

Circulation and movement

Construction traffic will require access tracks of sufficient quality to enable efficient passage to the desired launch pad construction site. For this reason, it will be necessary to construct the access tracks prior to construction of the main launch pad building infrastructure.

The main circulation flows and accessibility requirements within the site include:

- Vehicular access between activity nodes within the site during regular operations.
- Access for emergency and others in times of need.
- The "flow" of the operational process throughout the site.
- Safe functional access within and around the activity areas and structures.
- Accessibility to buildings for people with disabilities.
- Security vehicle and surveillance requirements.

Approximately 12 heavy vehicles per day will be expected to require access to the local road network during construction operations, not including supplementary worker vehicles (such as 4WDs) and construction equipment (rollers, graders, water carts etc).

Construction activities are likely to generate dust and consideration to minimising dust should be considered by the Construction Traffic Management Plan. Traffic management will also be needed during construction to ensure the awareness of the worksite, safe passage of vehicles through any work sites (to minimise work site incidents), or along the unformed access tracks (to minimise single vehicle (e.g., off road) or multiple vehicle (e.g., head on) crashes). Traffic Management for Works on Roads is defined in AS1742.3.

Geometric Requirements

To facilitate the operational aspects of the launch site and its supporting processes the following geometric requirements are proposed for the main access alignment:

- Access roads will be upgraded to meet the relevant requirements of the Austroads Guide to Road Design Part 3 *Geometric Design* (AGRD3) and ARRB Unsealed Roads Manual.
- It is assumed that the traffic volumes on the internal access network will be <150 vehicles per day. In this instance a sealed road is not considered to be a design requirement.
- The existing speed limit of the internal access network is 40 kilometres per hour. If this speed limit is to be retained, then the design speed will be 50 kilometres per hour. At the very least, the access track network will require warning signage to highlight geometric deficiencies, as required by AS1742.2 "*Traffic Control Devices for General Use*".

- A 50 kilometre per hour design speed requires a safe stopping distance (SSD) of 65 metres on an unsealed surface. Should a higher design speed be required (or if downhill section) then this will increase the SSD. Additional sight line requirements must be met at access track intersections.
- The design vehicle is a semi-trailer (19-metre length), although this is considered to be a lower volume movement.
- Clearing of access track verges to provide a formation width of minimum 7.5 metres (relatively flat and rid of vegetation).
- Where the access track environment is "*closed*" i.e., geometric conditions that limit sight lines, the formation width should increase to a minimum of 9.0 metres to provide for improved clearance between two-way traffic.
- Allowance for drainage systems to allow surface flows to drain away from the pavement areas, such as swales (table drain), diversion drains etc (some sections may require piped drainage system in low spots if the area is unable to drain).
- Curve widening where required to allow oncoming vehicles to pass simultaneously. Furthermore, consideration to removal of vegetation on the inside of curves may be required to provide the necessary sight lines for the design speed (further guidance available AGRD3 *Figure 5.4 (in guideline)* Line of Sight on horizontal curves).
- A 19-metre semi-trailer at critical (tighter) curves can theoretically negotiate most of the curves analysed, a surface providing suitable traction and access track widening (to allow two-way passage) is generally required.
- Access track grades will need to be assessed and where grades exceed 9 per cent consideration will be required to flatten these grades (by cutting down crests and filling in sags) so that the access track network is theoretically passable for the heavy vehicles. Access track section V6 has a very steep grade (in excess of 6 per cent) which may present grade conditions at odds with the guideline. Further analysis is required to determine if this grade requires additional treatment(s) to improve traction for heavy vehicles.
- Engineering survey will likely be required where access track design is necessitated for the more complex sections of access track network (poor horizontal or vertical geometric sections).

Pavement Requirements

To facilitate the operational aspects of the launch site the following access track pavements are proposed:

- Granular unsealed pavement (will require routine maintenance (grading) to keep the surface shape).

- A pavement basecourse should be provided for the entire width of the carriageway, so the access track surface is smooth and has the structural adequacy to support the proposed traffic loading. Structural pavement design is required for a range of subgrades encountered on site (soft sand through to solid limestone cap rock depending on the access track section).

Intersections (Junctions)

There are five (5) junctions within the internal access track network that need to be considered in the context of readability of the junction layout and safety of traffic negotiating the junctions. (Two (2) of the five (5) junctions are currently not operating as intersections as "*Sinkhole Road*" is closed to traffic). The current junction layouts are not ideal and should be upgraded achieve minimum approach sight distances (ASD) and safe intersection sight distances (SISD).

Supplementary access tracks are to be provided for emergency services vehicles. It is considered that these access tracks would be informal "bush tracks" that will be formed through simply grading/bulldozing a defined pathway (subject to environmental approvals) and is intended to be accessed by 4WD CFS trucks only.

15.4.3.3 Public Access Impacts

Public access throughout the site will be alternatively managed once the Project commences.

Once the facility becomes operational, tourist and visitor access to the site will be provided in accordance with the OEMP and security arrangements and utilising the existing site access and facilities as established.

The predicted volume of escorted tourists to the site associated with launch events is up to ten (10) 4WD/SUV type vehicles and one (1) heavy vehicle (bus) per day (22 VPD 9% CV). These tourist and recreational movements will not coincide with the peak operational volumes.

15.4.5 Guideline 14.10

14.10	*Describe the risk involved in transporting materials to the site, including any specific safety and security requirements to be implemented when travelling on roads, including the dangerous goods code requirements.*

15.4.5.1 Dangerous Goods Transport

Hazardous materials will be required to be transported to the site. Safework SA provides guidance and legal/regulatory requirements in respect of Transport of Dangerous Goods. Transporting dangerous substances is an operation that can potentially impact the environment and the surrounding community. Everyone involved in transporting dangerous goods has responsibilities to prevent and reduce damage to people, property, and the environment.

In South Australia, the transport of dangerous goods is regulated through the:

- *Dangerous Substances Act 1979* (SA) and
- *Dangerous Substances (Dangerous Goods Transport) Regulations 2008* (SA).

The Australian Code for the Transport of Dangerous Goods by Road and Rail sets out the operational and technical requirements in the management of dangerous goods transportation. The Code should be read in conjunction with the Regulations, which include information on licence requirements. The Code is commissioned by the National Transport Commission (NTC) Australian Code for the Transport of Dangerous Goods by Road and Rail (Edition 7.6, 2018). Rules and recommendations cover the following:

- definition, classification, packaging, marking and labelling of substances;
- the consignment of dangerous goods for transport, including loading, stowage, load retention etc;
- the provision of transport documentation describing the goods;
- the unloading, receipt and transfer of dangerous goods; and
- the transport of dangerous goods, including the use of vehicles, containers and equipment and the provision of safety equipment.

Section 13 of the Code discusses the routes for road vehicles transporting dangerous goods. The following factors are to be considered:

- routes for road vehicles transporting dangerous goods must be pre-planned whenever possible to the extent practicable;
- routes should be selected to minimise the risk of personal injury or harm to the environment or property during the journey;
- routes should wherever practicable avoid heavily populated or environmentally sensitive areas, congested crossings, tunnels, narrow streets, alleys, or sites where there may be, a concentration of people; and
- a road vehicle transporting dangerous goods must observe any requirements or restrictions on the selection of routes or times of travel which have been determined by the Competent Authority.

The transportation of dangerous goods is specific upon the goods being moved. Specific licensing and approvals will need to be obtained by the carrier of the dangerous goods. It should be noted that the "*Transportation of Dangerous Goods*" does not cover the transport of all classes of explosives or radioactive materials.

The safe passage of "dangerous goods" deliveries to the launch site (depending on the material being transported) may be deemed to be a high-risk activity. To mitigate these risks transport

will be heavily reliant on a safe and accessible access track network. Within the internal site network, the application of road design guidelines and appropriate road design, as described in this report and to be developed upon during subsequent road engineering and design, will assist the facilitation of a safe access track network.

Appropriate procedures will be required to be embedded in the site CEMP and OEMP.

15.4.6 Guideline 14.9

14.9	*Describe the location, extent, number, and purpose (e.g., commercial, or otherwise) of helicopter pads. Identify the potential impacts of helicopter operations with regard to the intended flight paths, downdraft below cruising height, wildlife (e.g., bird and bat strike) and noise implications.*

15.4.6.1 Helicopter Operations

The launch sites (A and B) will incorporate a Helicopter Landing Site (HLS) for emergency operations.

The HLS shall be designed to suit the requirements of "*CAAP 92-2(2)'Guidelines for the establishment and operation of onshore Helicopter Landing Sites*". The major considerations for the design and locating of the HLS is the approach and departure flight path.

It is the responsibility of the designer of the launch pad layout to ensure that the requirements of "*CAAP 92-2(2)'Guidelines for the establishment and operation of onshore Helicopter Landing Sites*", and any environmental conditions are met.

As helicopter movements to and from the site are anticipated to occur only in respect of emergencies and not as a regular operational element of the proposed operation, the impacts from such movements are considered insignificant, and have not been assessed further.

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16 VISUAL & AMENITY IMPACTS

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16.0 VISUAL AND AMENITY IMPACTS

16.1 Summary

A Landscape and Visual Impact Assessment, 5 February 2021, has been undertaken by WAX Design to assess the potential visual impact of the proposed Whalers Way orbital launch complex (**Appendix Z**). The report evaluates the existing landscape character, undertakes a visual impact assessment of the site of the proposed launch facilities and provides discussion around the degree of visual change that is likely to result from the introduction of the Project within the landscape of the Lower Eyre Peninsula.

The section herein considers the findings of the Landscape and Visual Impact Assessment (**Appendix Z**) and addresses the key related EIS Guidelines, these being Assessment Requirement 7 and Guidelines 7.1 to 7.7.

16.2 Methodology

The Landscape and Visual Impact Assessment (LVIA) comprises of two (2) separate but inter-related assessments, a landscape character assessment and a visual impact assessment. A detailed description of the landscape and visual impact assessment methodology is contained in Section 2 of **Appendix Z**.

The LVIA methodology aims to provide an objective, reliable analysis of the potential visual impact when considered against the existing landscape character. The process for the visual assessment is based on the recommendations of John Ginivan and Planning SA (2002), described as follows:

4. Review the Project:
    - Define its size, scale, clustering, and location. Consider significance of local, sub-regional and regional context.
5. Preliminary Landscape Assessment:
    - Define the potential viewshed and describe the landscape character and scenic quality. Assess landscape character.
6. Detailed Visual Effect Assessment:
    - Assess the degree of visual modification likely to be caused.

There is no formalised standard visual assessment methodology at local, State or Commonwealth government levels. Various guidelines and frameworks have been development however they do not provide a clear consensus on approach.

A 'best practice' approach has been adopted for this assessment, utilising the following documents and previous experience to define the approach and methodology:

- Guidance Note for Landscape and Visual Assessment (2018);
- Guidelines for Landscape and Visual Impact Assessment (Third Edition) (2013), Landscape Institute;
- Visual Landscape Planning in Western Australia. (2007). A manual for evaluation, assessment, siting and design, Western Australian Planning Commission;
- Swanwick, C. (2013). Guidelines for Landscape and Visual Impact Assessment. 3rd ed. United Kingdom: Landscape Institute and Institute of Environmental Management and Assessment;
- Lothian, A. (2000). Landscape Quality Assessment of South Australia. PhD Thesis, Adelaide University.

The approach used for the LVIA is based on two (2) assessment stages with reference to the Guidelines for Landscape and Visual Impact Assessment (Third Edition) (2013).

- Landscape character assessment is concerned with identifying and assessing the importance of landscape characteristics and the existing landscape quality.
- The Visual Assessment aims to qualify the extent to which the Project is visible as well as defining the degree of visual change and the associated visual impacts.

The following summarises the stepped approach of the methodology.

16.2.1 Desktop Studies

The Landscape Character Assessment for the Project includes reviews of the Project documentation, the Project's location, and infrastructure requirements. An analysis of GIS data has been undertaken along with on-site photography and aerial photographs as well as a review of the supporting literature was completed to establish a broad comprehension of the scope of the Project and the existing landscape character.

16.2.2 Landscape Character Assessment

The Landscape Character Assessment considers the existing character of the landscape, and the localities of the launch facility sites. For these purposes, the site locality is defined by the areas around the Project from which the proposed development and associated infrastructure are likely to be visible. The assessment identified and described the landscape character as well as any notable landscape features.

The assessment includes identification and description of landscape character as well as any notable landscape features. Mapping and photographic surveys are undertaken in addition to written commentary to describe the locality and existing landscape character of the site locality.

The Landscape Character Assessment was undertaken on 26 March 2020 to enable a detailed understanding of the existing landscape character. The weather conditions during the site visit were good with clear skies and no atmospheric conditions to affect the visual assessment.

16.2.3 Zone of Theoretical Visual Influence

Zone of Theoretical Visual Influence (ZTVI) maps are produced to gain an appreciation of where the Project will be visible. The maps qualify the extent to which the Project is likely to be seen using heights of 10 metres to represent the maximum building height on the site, 23 metres to represent the water towers and an infrastructure height of 30 metres to represent the launch gantry and pad equipment. The launch gantry and associated infrastructure represents a temporary visual effect and will only occur during launch operations.

The analysis uses a digital terrain model, and computer-generated models of site facilities to illustrate how the Project would be visible from locations around the proposed Project. It should be noted that the ZTVI does not take into account the impact of local vegetation or localised landforms, and it is based on a 1.0 metre contour data set. This means that the theoretical visual impact of the Project is calculated within a landscape devoid of any vegetation or built form screening, as such represents a 'worst case' scenario.

Assessment of each of the launch sites has been undertaken in order to understand the visual effect associated with each site and the potential mitigation that is offered by the specific location of each land site. These maps demonstrate the variations that will occur and the modification of the visual impact that occurs as a result of the proposed developments in the landscape and the screening provided by the existing landscape features.

Due to the small-scale development of Site E, specific ZTVI mapping has not been undertaken. Instead, a description of the potential visual impacts has been prepared.

16.2.4 Landscape Visual Impact Assessment

The visual impact assessment considers the possible effect that may result from the development in the landscape. The potential visual impact utilised data and information obtained through on-site assessments, GIS analysis and desktop assessments with reference to the Zone of Theoretical Visual Influence (ZTVI) maps.

The assessment considers:

- Topography (the complexity of the land that exists as part of the underlying landscape character);

- Vegetation Cover (the extent to which vegetation is present and the potential to screen and filter views);
- Existing Infrastructure (the impact of development on landscape and visual character); and
- Cultural Sensitivity (existing cultural overlays, planning designations and any identified listing of heritage items and or local sensitivities to the landscape such as scenic drives and viewpoints).

The visual impact assessment considers the sensitivity of the existing landscape character and the degree of visual change that is likely to occur as a result of the development of Project. The assessment considered baseline visual character of each site identified within the Landscape Character Assessment, and, with consideration of the identified ZTVI area for each site, sought to qualify the visual impact likely to be caused by the infrastructure associated with each site.

16.2.5 Results and Conclusion

The degree of effect on the visual amenity of the locality was determined based on the classifications as recommended by the Guidelines for Landscape and Visual Impact Assessment (2nd Edition) (with reference the base criteria of Terance O'Rourke plc.).

The following **Table 16.1** provides a summary of the classifications.

Table 16.1: Classification of Visual Impacts.

DESCRIPTIVE OF VISUAL IMPACT	DESCRIPTORS - APPEARANCE IN THE CENTRAL VISION FIELD	COMMENTS
Severe	Standing out, striking, sharp and unmistakable.	Severe change in the view involving the obstruction of existing views or alteration to underlying landscape visual character through the introduction of new elements. Change may be different in scale and character from the surroundings and the wider setting or a severe change in the context of the existing landscape character. Resulting in a perceived adverse visual effect and an increase in a proportional change to the underlying landscape visual character.
Substantial	Noticeable, distinct, catching the eye or attention, clearly visible, well defined and easily seen.	A substantial change in the view: which may involve partial obstruction of existing view or alteration of underlying landscape visual character and composition through the introduction of new elements. The composition of the view will alter the sensitivity of the underlying landscape character. The visual character may be changed through the introduction of features.

DESCRIPTIVE OF VISUAL IMPACT	DESCRIPTORS - APPEARANCE IN THE CENTRAL VISION FIELD	COMMENTS
Moderate	Visible, evident, obvious.	A moderate change in the view: visual change will be distinguishable from the surroundings while the composition and underlying landscape visual character will be retained. The existing landscape has limited sensitivity change.
Slight	Not obvious, indistinct, not clear, obscure, blurred, indefinite.	A very slight change in the view: change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.
None	Not visible	No part of the development is discernible

Based on an assessment of the existing landscape character, the ZVTI and a review of the relevant planning policies, an opinion of the suitability of the Project is developed. The conclusion considers the sensitivity of the landscape to change, the visibility of the development and the potential visual impact.

16.3 Relevant EIS Guidelines

Assessment Requirement 7: *The impact of permanent structures and visually prominent operations on a highly visible peninsula with substantial landscape value. There will be significant changes from the existing natural landform and conservation use, currently utilised for ecotourism purposes. Ongoing coastal tourism access is proposed along the eastern coastal boundary. Cape Wills Radio Station in the lower south-east is excluded from the lease area.*

7.1 *Describe how the visual landscape and amenity will be altered by the development, for residents and visitors, for both near and distant views.*

7.2 *Describe and illustrate the development when viewed from the publicly accessible coastal reserve (Crown Land Allotment 102 – CR5993/375) or from the adjoining waters, on launch and non-launch days.*

7.3 *Outline the methodology adopted for classifying landscapes and assessing visual and landscape impacts.*

7.4 *Describe the impacts (amenity and economic) on the region's ecotourism sector and the existing caravan park in the north-east portion of the site.*

7.5 *Describe alternative measures for minimising potential loss of visual amenity.*

7.6 *Identify lookout / viewing locations and anticipated delivery timing of these facilities.*

7.7 *Identify any potential impacts on Cape Wills Radio Station.*

16.4 Analysis

16.4.1 Guidelines 7.1 & 7.5

7.1 Describe how the visual landscape and amenity will be altered by the development, for residents and visitors, for both near and distant views.

7.5 Describe alternative measures for minimising potential loss of visual amenity.

The landscape of the Eyre Peninsula, including the Whalers Way area, received a moderate to high ranking in terms of the scenic quality. In the case of the allotment containing the site, the existing landscape quality has a moderate to high scenic value due to the coastal location. Consequently, development of the proposed sites within this scenic landscape character may potentially impact on the visual amenity of the area. The probable visual impact of each project site is considered in the following sections.

In order to quantify where the various sites will be visible from a series of Zone of Theoretical Visual Influence (ZTVI) maps have been prepared. The maps assess the visual influence area of Sites A, B and D including both temporary and permanent infrastructure.

The ZTVI maps are depicted in the following **Figure 16.1** to **16.3**.

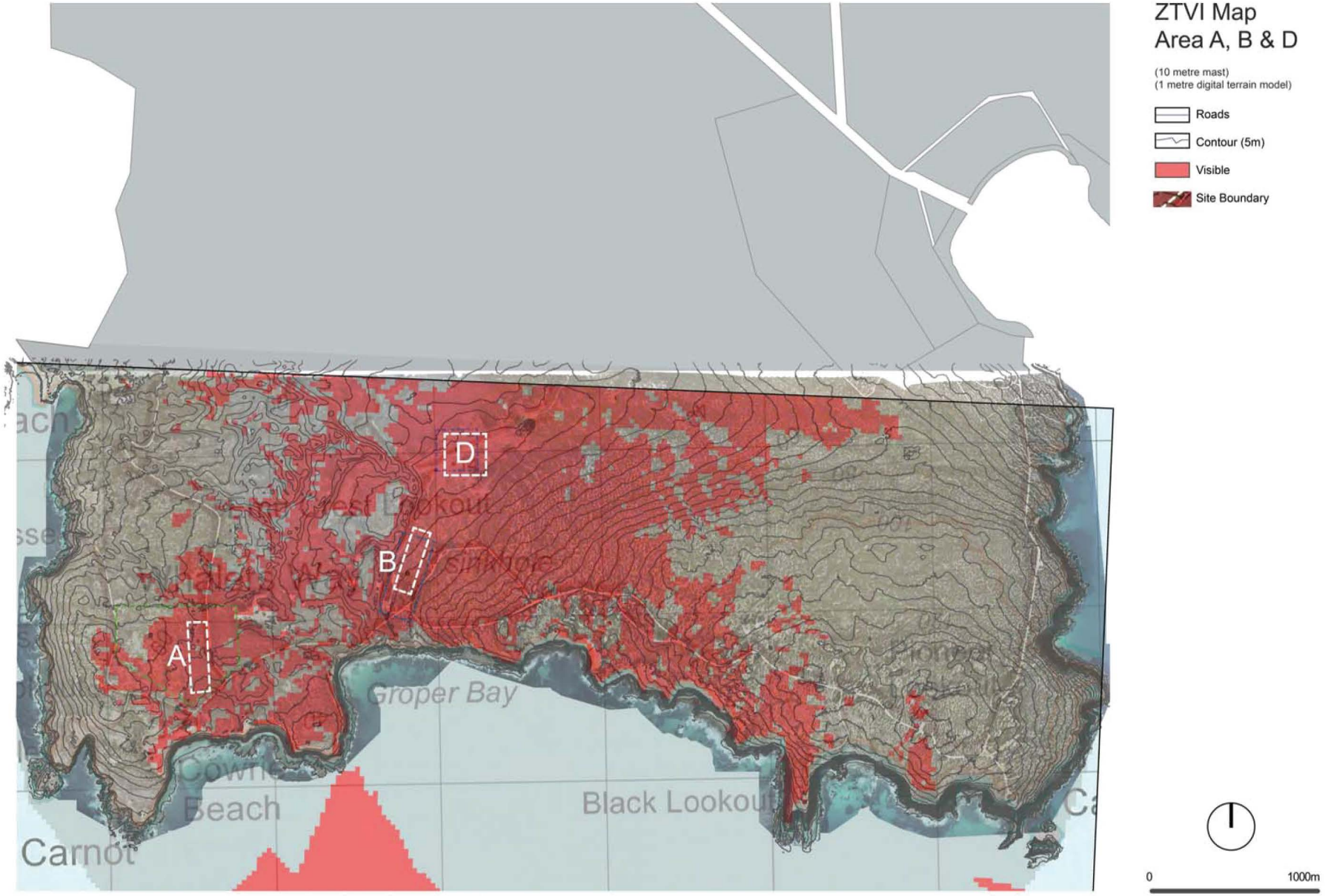

FIGURE 16.1

ZVTI MAP AREA A, B, & D FOR 10 METRE HIGH STRUCTURES

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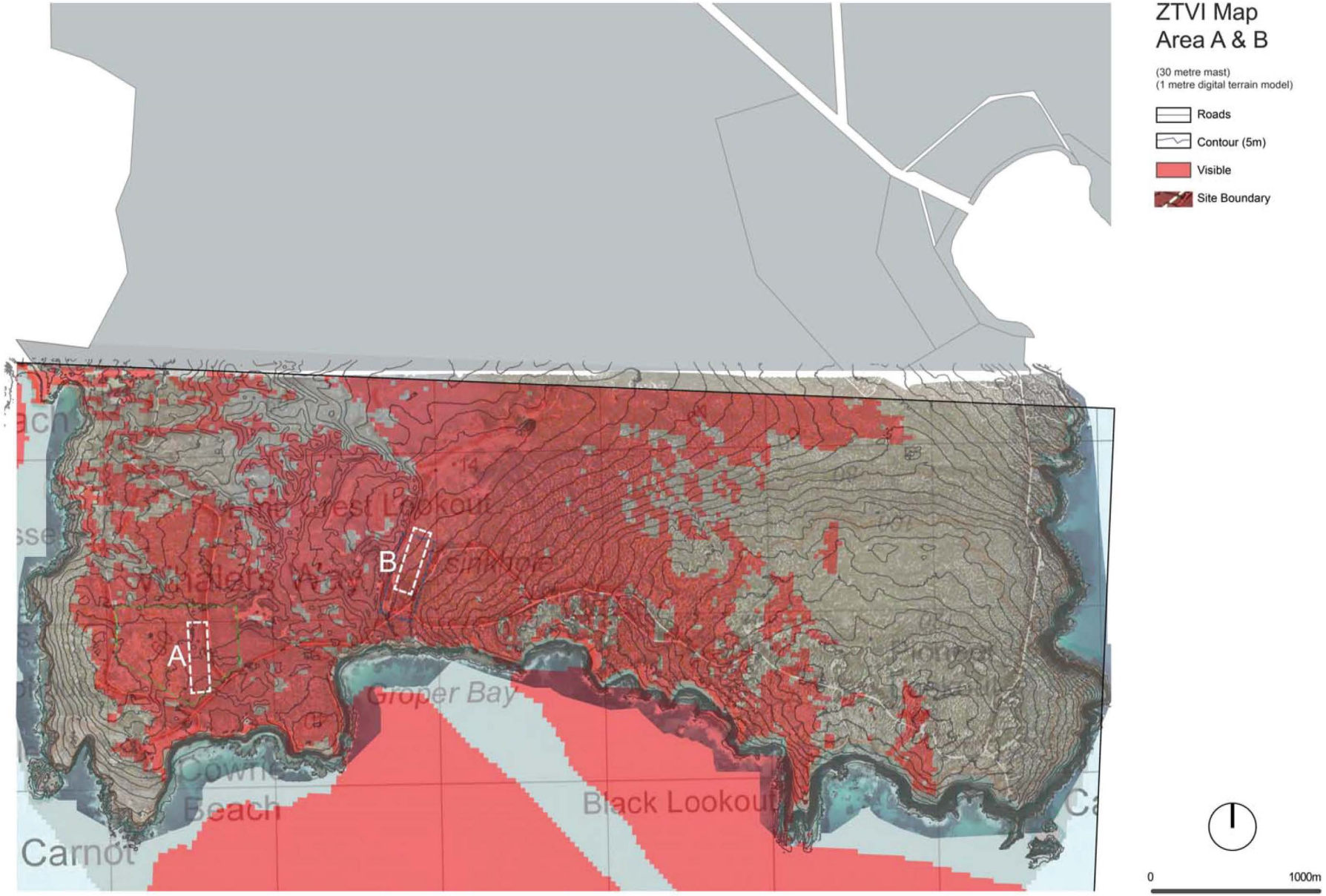

FIGURE 16.2

ZVTI MAP AREA A, B, & D FOR 30 METRE HIGH STRUCTURES

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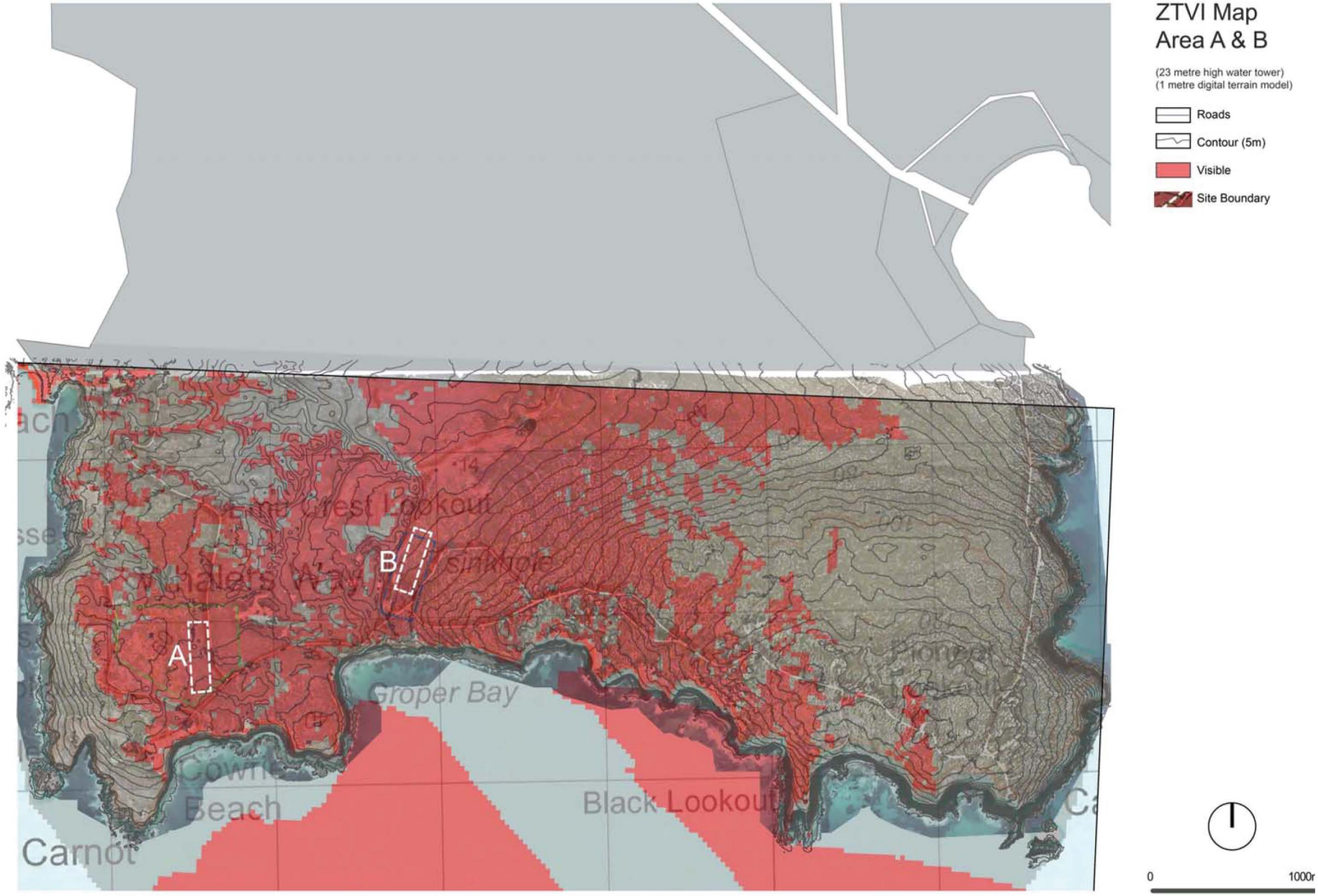

FIGURE 16.2

ZVTI MAP AREA A, B, & D FOR 23 METRE HIGH STRUCTURES

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16.4.1.1 Launch Sites A and B

Site A is located to the western edge of the peninsula. The largest of the three (3) proposed sites that will be used as part of the entire Project. Site A is positioned on an elevated plateau that is orientated and slopes gently to the north. The western edge of Site A is contained by a local ridgeline that is elevated to the southeast creating a visual screen to the broader locality around Site A. The ridgeline limits the visibility of the site, particularly to the west and south and rises to an elevation of 71 metres.

Site B is located within the coastal basin that forms the central landscape character of the locality. At the southern end of Site B, the coastal basin narrows with local ridgelines forming a small valley that connects the coastal basin with the coastal cliffs. The low-lying valley and adjacent ridgelines create an enclosed visual character with narrow views to the south. Views south to the coastline are screened by small ridgelines that provide a degree of visual separation to the scenic coastal edge beyond. To the north, views to the surrounding landscape are mostly absent with occasional glimpsed views to distant ridgelines. The location of Site B, the surrounding ridgelines and low-lying topography of the coastal basin limit the visual impact that may result from the development of this site.

Photograph 16.1: Panoramic view from Site A looking north.

Photograph 16.2: Panoramic view from Site B looking north.

Permanent Launch Site Infrastructure

The permanent infrastructure at the launch sites consists of buildings with a maximum height of 10.0 metres and elevated water tanks with a maximum height of 23 metres. Additionally, Sites A and B both contain a 40-metre-high lightning tower; however, this is a slender piece of infrastructure and is unlikely to cause a visual effect in the locality. Consequently, this piece of infrastructure has not been included in the ZTVI assessment. Sites A and B also include temporary infrastructure associated with launch that will include launch gantries which reach a height of 30-metre but are only present during launch operations.

The proposed elevated water tanks will be the most prominent permanent infrastructure at Site A and B. These tanks will sit atop a 20-metre-tall lattice tower, while the tanks have dimensions of 3.0 metres in height and 9.3 metres in diameter. The lattice tower provides a degree of transparency and will be hard to discern from the sky from outside the subject land. However, the water tanks will be viewed as a solid object against the sky. To ensure the visibility and visual impact of the tanks is limited, the water tanks will incorporate a suitable paint finish to visually integrate the structure.

Given the scale of the proposed developments, the existing landscape character, and the distance over which the visual effects are likely to occur, the visual impact of permanent infrastructure has been described as slight.

Temporary Launch Infrastructure (Launch Towers)

This visual effect represents a temporary impact that will occur for a day or two (2) during a launch, up to three (3) times a month. This also encompasses the impact associated with the 20-metre-tall flare stacks which are utilised on launch days to burn off excess fuel and the 30-metre-tall launch gantry.

The topography and vegetation cover to the east and west of the sites ensure that visual impacts on the sensitive landscape character of Red Banks, Sleaford Bay and Cape Wiles are screened. This screening also extends to the Pioneer Lookout, which is recognised as a site of cultural value.

The visual impacts to the north will occur in a modified agricultural landscape character. Given the extent of existing infrastructure in the landscape and low levels of landscape amenity, the potential visual impacts associated with the launch tower on launch days will be limited and viewed over several kilometres.

The visibility of Site A on launch days extends south over the coastal waters and east along the coastline to Black Lookout. At this point, the north-south ridgeline of the eastern escarpment forms a defined visual envelope.

The location of Site B within the central coastal basin will have an increased visual containment. During launches, the visual impact is contained in the centre of the peninsula. The undulating coastal plateau and the northern escarpment contain the visibility of the site to the east and west.

16.4.1.2 Site D and E

Site D Visual Impact

Site D is located at the northern edge of the coastal basin. The site is enclosed by the surrounding vegetated ridgelines to the north, south, east, and west. These ridgelines rise 5.0 to 6.0 metres above the floor of the basin. The presence of coastal scrub and pockets of trees increase the screening provided by the ridgelines and enhance the visual amenity across the floor of the basin.

Site D will contain a workshop which will have a maximum height of 10 metres. While the development of Site D includes dam walls up to 5.0 metres, the surrounding ridgelines form distinct visual envelopes and views to the proposed site from surrounding areas do not extend beyond a few hundred metres. Views to the coastline or further inland are screened, reinforcing the defined visual enclosure to Site D.

Due to the enclosed topography of Site D, there is no significant visual impact outside of the immediate location expected.

Site E Visual Impact

Site E is located to the base of the eastern coastal escarpment that faces Sleaford Bay. The vegetation cover, orientation and the underlying topography are defined by the low-lying coastal scrub and variations in the local landforms. The rising elevation of the coastal edge provides a distinct backdrop to the site. To the east are panoramic views across Sleaford Bay to Jussieu Peninsula and the vegetated coastal character of Lincoln National Park.

Site E will contain the range operations centre of approximately 300 square metres. It is anticipated that this building will low scale and designed in a manner which incorporates materials and building heights which blend into the surrounding landscape, utilising indigenous vegetation for screening from public vantage points, particularly from lookout and viewpoints along the eastern edge of Sleaford Bay.

Site E will contain several low-rise buildings and represents a small-scale development in the landscape.

16.4.2 Guideline 7.2

7.2 Describe and illustrate the development when viewed from the publicly accessible coastal reserve (Crown Land Allotment 102 – CR5993/375) or from the adjoining waters, on launch and non-launch days.

16.4.2.1 Visual Impact from Coastal Reserve

The Coastal Reserve spans the length of the Whalers Way coastline. Given the proximity of the launch sites to the coast and the topography of the land, permanent infrastructure will be visible from much of the central portion of the Whalers Way coastline, with visibility increasing in closer proximity to the sites.

Photograph 16.3: View of typical landscape character of the coastal cliffs (WAX, 2021)

While the visible structures will alter the visual landscape when viewed from portions of the coastal reserve, it is not expected that the impact would severely or substantial degrade the visual quality of the landscape. As discussed, the scale, degree of transparency, and slender nature of the permanent infrastructure means that the visual impact will be slight. It is noted that structures of this nature are not uncommon to a coastal and rural locality such as this.

With respect to temporary launch infrastructure, it is noted that the vast majority of the time that this infrastructure is erect, access to the coastal reserve will be prohibited and as such there will be limited opportunity for interpretation of any visual change within the coastal reserve.

16.4.2.2 Visual Impact from Seaward Areas

Visual impacts from the water looking back at the proposed development sites typically occur at distances over a kilometre offshore. The height of the coastal cliffs creates a defined viewshed that screens the coastal edge from any potential visual impacts.

Glimpsed views of the buildings and structures will be seen from coastal water at a distance of several hundred metres. The visual impact of the development will be set in the landscape partially screened by local ridgelines and vegetation. During launch days, the visual impact will increase slightly and focus on the launch tower with the potential visual impact described as slight increasing to moderate.

Visual impacts occur to the south over the coastal waters of the peninsula. While the coastal water to the south will be impacted and the launch towers will be glimpsed from several hundred metres offshore, the temporary nature of the tower and frequency of people viewing the tower from the water will be limited. This combination is likely to result in very slight visual impacts. Furthermore, the coastal waters surrounding Whalers Way will be subject to an exclusion zone during launch operations, preventing the opportunity for the interpretation of launch infrastructure from coastal waters during these times.

16.4.3 Guideline 7.3

7.3 Outline the methodology adopted for classifying landscapes and assessing visual and landscape impacts.

A detailed description of the landscape and visual impact assessment methodology is contained in **Section 16.4.2** of this report and Section 2 of **Appendix Z**.

16.4.4 Guideline 7.4

7.4 Describe the impacts (amenity and economic) on the region's ecotourism sector and the existing caravan park in the north-east portion of the site.

As discussed, while the coastal landscape of the subject land is sensitive to visual and landscape change, the scale and separated locations of the development sites help to limit and fragment the potential effect. Given the contained visibility of the sites, the potential impacts are mitigated by the surrounding topography to the east and west.

On balance, the slight to moderate visual impacts and contained visibility, as well as the potential to deliver a range of mitigation measures, will ensure that the degree of visual effect of the proposed built form on the existing landscape of the subject land will be minimised.

It is not expected that the minimal visual presence of these separated sites will cause significant enough disruption to the prevailing landscape of the region so as to jeopardise its value and function as a tourism attraction. As noted elsewhere within the EIS, the facility is likely to represent a tourism attraction in many respects contributing to the regions tourism sector.

16.4.5 Guideline 7.6

7.6	*Identify lookout / viewing locations and anticipated delivery timing of these facilities.*

No public vantage points or viewing platforms are proposed at this time. Due to legislative requirements for exclusion zones around the launch sites during a launch operation, these types of facilities would need to be located at such a distance from the site that their function would likely become obsolete.

Additionally, the topography of the land means that the visibility of the launch sites is constrained. Some guests may be invited to observe the launch from the Range Control Facility (Site E), however even the vantage of the launch sites from this facility is limited by the prevailing topography.

16.4.6 Guideline 7.7

7.7	*Identify any potential impacts on Cape Wills Radio Station.*

There will be no impact on the function of the Cape Willis Radio Station. This facility will continue to operate in the same manner it presently does. Access to the facility is irregular and will be maintained.

17 EFFECTS ON CULTURAL HERITAGE VALUES

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17.0 EFFECT ON CULTURAL HERITAGE VALUES

17.1 Summary

Investigations of the site and locality has been conducted in order to ascertain what culturally significant sites for both Aboriginal and non-Aboriginal heritage are present within the Subject Site, Project Footprint or located in proximity to this area.

Both Aboriginal and non-Aboriginal heritage have been identified. Certain revisions to the proposal have been made subsequent to these investigations to ensure impacts are avoided. Ongoing procedures will be implemented to ensure an appropriate management regime is in place in the event any heritage is encountered during the construction and operation of the proposed project.

The EIS assessment guidelines recognise that the development has the potential to impact on items of Aboriginal and non-Aboriginal heritage. This section considers and responds to EIS Guidelines 12.1 to 12.5 and Assessment Requirement 12.

17.2 Methodology

The methodology adopted in assessing the effect on cultural heritage includes the following:

- Desktop review State Government mapping of Contributory, Local, and State Heritage items.
- Review of Eyre Peninsula heritage survey - District Council of Lincoln (Danvers Architects, 1987).
- Search of request of Aboriginal Heritage Register.
- Engagement with representatives of the Nauo people.

17.2.1 Cultural Heritage Assessment

In respect to Aboriginal cultural heritage a Cultural Heritage Assessment (**Appendix Y**) was undertaken. This Section considers the findings of the Cultural Heritage Assessment, led by Anthropologist Scott Cane. The methodology adopted for this investigation was to undertake a detailed field survey with Nauo representatives, in order to:

- characterise the regional cultural sensitivity;
- characterise the local cultural sensitivity; and
- examine each project site by driving and walking through these areas with the survey team.

The detailed assessment and findings of this investigation are documented in the report contained in **Appendix Y** to this EIS.

17.3 Relevant EIS Guidelines

Assessment Requirement 12: *The proposed development has the potential to impact on sites / locations of Aboriginal or non-aboriginal heritage through disturbance during construction and operation.*

12.1. Quantify any Aboriginal sites of archaeological or anthropological significance, including but not limited to those listed in the SA Register of Aboriginal Sites and Objects.

12.2. Identify any effects on Aboriginal sites of archaeological or anthropological significance. Indicate any consultation with local Aboriginal organisations that have an in interest in the area, specifically addressing Native Title Claim Nauo No. 2.

12.3. Quantify any non-aboriginal settlement heritage places or elements on or adjoining the subject site, including but not limited to those listed in the SA Heritage Places Database (state and local heritage value).

12.4. Identify any impacts on non-aboriginal settlement heritage places or elements on or adjoining the subject site.

12.5. Outline measures adopted to avoid or minimise impacts on Aboriginal and non-aboriginal sites of archaeological or anthropological significance.

17.4 Analysis

17.4.1 Guideline 12.1

12.1. Quantify any Aboriginal sites of archaeological or anthropological significance, including but not limited to those listed in the SA Register of Aboriginal Sites and Objects.

The project is located within the traditional lands of the Nauo people. A Cultural Heritage Investigation was undertaken to inform this project, this investigation was in-turn informed by a field survey of Whalers Way and the specific Project Footprint locations within that area (refer to methodology above for more detail).

The field survey was conducted by four (4) Nauo representatives. An anthropologist also participated and was assisted by two (2) representatives of Southern Launch.

The key outcomes of the survey were as follows:

- Two (2) areas of mythological significance were located within the southern portion of Whalers Way area but not within the identified Project Footprint, both relating to a large mythic complex known informally as 'Seven Sisters', identified in the following **Figure 17.1** as Site 1 and 2.
- Two (2) areas of archaeological significance were located within the subject area, consisting of Site 3 and 4. Two (2) areas of deflated dunes containing varied artefacts exposed in deflated dunes, likely used by different groups through time in the cultural practice of harvesting 'Nondo' beans.
- None of the above identified sites of cultural significance occur within or in proximity to the proposed launch or related infrastructure sites.

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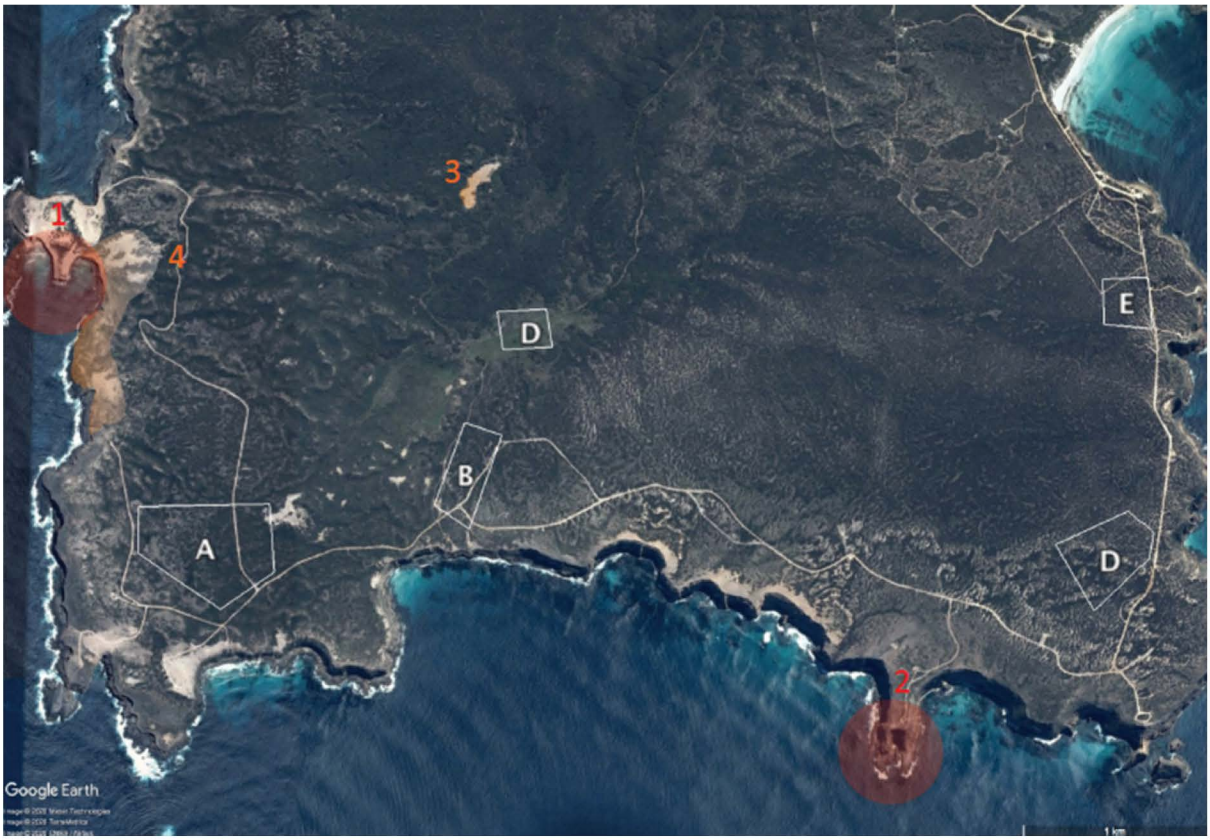

FIGURE 17.1

CULTURAL HERITAGE SURVEY IDENTIFIED PLACES

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The survey team also investigated the nominated launch sites and infrastructure sites to assess whether there were any culturally significant sites or objects present within or in proximity to these areas. These specific sites are identified within **Figure 17.1** as Area A, B, D and E, noting that south-eastern Area D is no longer included within the proposal.

Within Area A three (3) artefacts were identified within a deflated dune in the north-eastern corner of the identified boundary area. These artefacts include two (2) flaked pieces of quartzite and a hydrated core of chalcedony. No artefacts or sites were identified within Area B; however, one (1) artefact, a ground and percussion damage granite cobble, was identified within dune swales to the west of Area B. No artefacts or other signs of Aboriginal occupation were found in the remaining areas. The investigation concludes that the frequency of artefacts is so low as to have little cultural value, "*certainly insufficient in the view of the field participants to create an impediment to the proposed development*" (Cane, 2020, pg.17).

17.4.2 Guideline 12.2

12.2.	*Identify any effects on Aboriginal sites of archaeological or anthropological significance. Indicate any consultation with local Aboriginal organisations that have an in interest in the area, specifically addressing Native Title Claim Nauo No. 2.*

As discussed above, the Cultural Heritage Investigation was conducted with representatives of the Nauo Native Title Claimant Group. This investigation concluded that, subject to minor alteration to the boundary for Site A, the proposal is not expected to impact on Aboriginal sites of archaeological or anthropological significance.

The construction and operation of the project will be conducted in accordance with the CEMP and OEMP, which outline the methodology to be employed in the event a culturally significant artefact or site is identified or disturbed during construction or operation.

As a freehold allotment, no native title claim under *Native Title Claim Nauo No. 2* applies to the subject allotment. *Native Title Claim Nauo No. 2* applies and will continue to apply to coastal land and waters surrounding the subject allotment.

17.4.3 Guideline 12.3

12.3.	*Quantify any non-aboriginal settlement heritage places or elements on or adjoining the subject site, including but not limited to those listed in the SA Heritage Places Database (state and local heritage value).*

There are no non-Aboriginal heritage places or elements within the Project Site or Project Footprint. A State Heritage Place, the Former Fishery Bay Whaling Station, is located in proximity to the northern boundary of the Project Site.

A review of the Eyre Peninsula Heritage Survey - District Council of Lincoln (Danvers Architects, 1987) states the following in respect to the site:

> *"The whaling station which operated from the shore, was established by the South Australian Company in 1837 and was in use until it was abandoned in 1841 after a series of bad seasons".*

The significance of the site is that it represents "*The most extensive remains of whaling in South Australia*".

17.4.4 Guideline 12.4

12.4.	*Identify any impacts on non-aboriginal settlement heritage places or elements on or adjoining the subject site.*

The proposed development will result in no impact on this State Heritage item. The Project Footprint and Project Site are suitably separated from the Former Whaling Station to avoid any impacts on its setting or historic character. The proposal will not inhibit access to the place, therefore resulting in no material impact on interpretation of the Heritage place.

17.4.5 Guideline 12.5

12.5.	*Outline measures adopted to avoid or minimise impacts on Aboriginal and non-aboriginal sites of archaeological or anthropological significance.*

In response to the findings and recommendations of the Cultural Heritage Investigation, the proponent has amended the boundary of Launch Site A to exclude a natural soakage area along the western boundary and a portion of low dunes in the north-east corner where artefacts of indigenous cultural value were identified (see **Figure 17.2**).

FIGURE 17.2

LAUNCH SAFETY ZONES

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The proponent is also engaged in discussion in respect to establishing the area as a "*Environmental and Cultural Sanctuary*" to assist with cultural heritage management and cultural tourism in respect sites and artefacts of Aboriginal heritage significance.

As mentioned above, if unexpected sites or artefacts are encountered during the construction and operation of the project appropriate management response will be employed. In the event any Aboriginal Heritage objects or sites are encountered during works a stop work order will be issued, all works will cease in the vicinity until an assessment by a suitably qualified individual can be conducted and further recommendation obtained.

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18 EFFECT ON COMMUNITIES (LOCALITY)

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18.0 EFFECT ON COMMUNITIES (LOCALITY)

18.1 Summary

The proposed WWOLC will result in a number of direct and tangential impacts on the local Eyre Peninsula community as well as South Australia at larger level. The Project will present both opportunities and potential challenges to these communities.

This is recognised in the EIS Guidelines, which seek to understand the potential effects that will result from the establishment and ongoing launch complex operations. This section responds to the relevant EIS Guidelines, including Assessment Requirement 9 and Guidelines 9.1 to 9.7.

18.2 Methodology

An analysis of the expected community effects and the likely impacts of the proposed land use within the immediate and wider locality was identified through a mix of desktop and on-site analysis, comprising of:

- Desktop review and on-site investigation of the immediate and wider locality, including analysis of key economic, tourism, education, and health related infrastructure.
- Review of the City of Port Lincoln and District Council of Lower Eyre Peninsula strategic documents, including:
  - District Council of Lower Eyre Peninsula Strategic Plan 2020 – 2030;
  - Port Lincoln Strategic Directions Plan 2021 - 2030;
  - Port Lincoln & Southern Eyre Peninsula Tourism Strategy 2018 – 2028; and
  - Southern Eyre Peninsula Regional Public Health Plan.
- Review of supporting assessment reports and documents related to community effects, including:
  - Economic Analysis (**Appendix N**);
  - Cultural Heritage Assessment (**Appendix Y**); and
  - Stakeholder Consultation and Engagement Plan.

18.3 Relevant EIS Guidelines

Assessment Requirement 9: *The proposed development has the potential to affect the local community through the establishment and ongoing launch complex operations.*

9.1. Describe and illustrate the proximity of the proposed development to local communities and individual dwellings.

9.2. Describe the impacts which may impact on nearby communities and residents (e.g., businesses, employment, visual amenity, ecotourism).

9.3. Outline potential impacts on the use of the land by Aboriginal people, or on cultural values held by Aboriginal people that relate to the areas affected by the project (land and water).

9.4. Detail the impacts of the increased workforce on the communities and evaluate the necessary accommodation, and other local infrastructure such as schooling and health facilities, for peak periods of construction and operation.

9.5. Describe any community consultation processes conducted by the proponent, specifically detailing the support and / or any concerns raised about the proposed development.

9.6. Identify any potential effects on education and skills, or opportunities to retrain and upskill workers, in the State and local area.

9.7. Identify any impacts on recreational use of coastal land on and around the site, including recreational fishing and access to coastal crown land.

18.4 Analysis

18.4.1 Guideline 9.1

9.1. Describe and illustrate the proximity of the proposed development to local communities and individual dwellings.

Project area boundary is approximately 25 kilometres south-west of Port Lincoln, the nearest local community.

There are no dwellings immediately adjacent to the proposed Project Footprint. There are two (2) residential dwellings located to the north-east of the Project Site, adjacent Fishery Beach. The distance of the closest sensitive receptors (dwellings) from respective project sites (measured from the closest dwelling) are:

- Launch Site A – 4.5 kilometres;
- Launch Site B – 3.5 kilometres;
- Infrastructure Site D – 2.8 kilometres; and
- Range Control Site E – 1.0 kilometres.

18.4.2 Guidelines 9.2, 9.4, 9.6

9.2. Describe the impacts which may impact on nearby communities and residents (e.g., businesses, employment, visual amenity, ecotourism).

9.4.	*Detail the impacts of the increased workforce on the communities and evaluate the necessary accommodation, and other local infrastructure such as schooling and health facilities, for peak periods of construction and operation.*

9.6.	*Identify any potential effects on education and skills, or opportunities to retrain and upskill workers, in the State and local area.*

The Project will present a range of challenges and opportunities to nearby communities within the Eyre Peninsula region and South Australia more generally. The key communities that are relevant to this assessment include:

- South Australia;
- The Eyre Peninsula Region;
- The City of Port Lincoln; and
- Local residents, business, organisations and service providers.

Port Lincoln is the closest community to the Project and likely the community that will experience the most tangible impacts as a result of the Project. Well known for its large and important fishing industry and deep-sea port, Port Lincoln is also an attractive tourism destination with numerous coastal and marine experiences within easy reach of the city. Port Lincoln is the largest urban centre on the Eyre Peninsula, with a population of 14,000 (ABS 2016). Accordingly, it is host to a diverse range of business, government, and community services.

18.4.2.1 Economic Effects

The proposed project will represent a significant and unique anchor land use that will present a number of direct and indirect impacts on this community. One (1) of the key impacts to be considered is the anticipated economic effects. These have been discussed in detail in **Section 13.0** and within the Economic Impact Analysis, prepared by SA Centre for Economic Studies (Refer to **Appendix N**). Some of the key findings relate to the anticipated contribution to Gross State Product (GSP) and the likely increase in employment:

- In the first year of operation the Project is expected to generate an GSP contribution of $0.9 million and generate and to increase to employment by 20.1 Full Time Equivalent (FTE) positions.
- Within the subsequent 10 years GSP contribution of $35.4 million is expected. The average gross impact on employment over the ten-year analysis period is expected to be 59.7 FTE positions.

The space industry contributes to the development of other priority sectors for South Australia including defence, agriculture, mining, and tourism, as well as services for the community such as health and education.

The WWOLC will create a 'centre of gravity' attracting both local and international rocket and satellite manufacturers to South Australia. This will create more technology related jobs in Australia.

The Economic Impact Analysis hypothesises that there is the potential for significant increase to the GSP contribution and benefit to employment levels should the facility attract new industry to South Australia (and potentially the Eyre Peninsula Region), with launch vehicle operators establishing 'final assembly and testing' facilities, or even full launch vehicle manufacturing within the State.

Rocket manufacturers will rely on Australian sourced components and services from Adelaide, Port Lincoln, and the wider Australian supply chain. Over time, it is expected that some companies may relocate some manufacturing into the State thereby generating new jobs for local Australians.

The economic and employment contributions have been modelled for the entire State. A more concentrated economic analysis of the direct economic effects on the Eyre Peninsula region or the City of Port Lincoln has not been conducted.

18.4.2.2 Effects of Space Tourism and Business Visitation

In the lead up to launch events, it is expected that a number of people associated with that particular launch will travel to the region. Many of the launch operators will be travelling from interstate and international places of origin. The anticipated route of travel will be by flight from Adelaide Airport or direct from Interstate to Port Lincoln Airport. Port Lincoln is the most practical location for these business visitors to reside during this time, relying on local accommodation, leisure, and food and beverage services.

It is also expected that a facility of this nature will introduce a new arm of tourism to the region. Space related infrastructure and events can become significant tourist attractions for enthusiasts, families, student, or tourist groups. Space related infrastructure such as the Observatory 'dish' in the regional town of Parkes NSW attracts in the order of 100,000 visitors per year (CSIRO, n.d.). The Kennedy Space Centre in Florida USA hosted 1.7 million visitors to its Visitor Complex in 2016, where it hosts large, ticketed launch viewing events (Florida Today, 2017).

In some cases, the proposed facility will allow escorted public access into the complex to observe launches from the range control facility at Site E (which will provide facilities for up to 20 VIPs/visitors) and in some circumstances inspect the facilities outside of launch or testing events. Additionally, is expected that some tourists may choose to visit the region to observe launches from areas outside of the complex.

It is anticipated that the Port Lincoln community has existing capacity to respond to the likely increased activity and demand generated by additional visitation to the area as a consequence of the Project. The Port Lincoln and Southern Eyre Peninsula Tourism Strategy 2018 – 2028, indicates that the region accommodates approximately 415,000 overnight visitors each year and has approximately 1,500 in active employment in this sector noting that these figures are derived from data available in 2018 and may have changed as a result of COVID-19. As of June 2016, the Southern Eyre Peninsula had 987 hotel rooms available. It is expected that the local tourism market will be able to accommodate and respond to the increased activity as the operations on the site develop, especially given the growth in residence-based accommodation options in regional areas through growing use of platforms such as Airbnb and Stayz. It is expected that the tourism market will respond and grow as necessary as the operations continue.

18.4.2.3 Impact on Educational Infrastructure Capacity

Port Lincoln provides a full range of educational offering from Kindergarten to Year 12, including both private and public institutions. Within the area there are three (3) high schools, five (5) primary schools, five (5) kindergartens, and one (1) special education provider. Tertiary education opportunities within Port Lincoln area are limited, being largely comprised of the Port Lincoln TAFE SA campus. University of South Australia (UniSA), the University of Adelaide, and Flinders University do have facilities within Port Lincoln, mostly dedicated for use by specific courses (e.g., the Lincoln Marine Science Centre); however, these are not University campuses per se. It is noted that the UniSA Whyalla Campus, the largest regional University campus in South Australia, is located approximately three (3) hours' drive north.

Should the increased visitation and workforce generated by the proposal result in increased demand for education services within the region, it is predicted that there is adequate capacity within the existing educational infrastructure available within the region to accommodate this.

The proponent has indicated that they are committed to engaging with local schools to develop and contribute to STEM education. Every company that launches from Whalers Way will be asked to do a number of public outreach activities at local communities and schools. This will provide local students the opportunity to experience things happening in this space and expose them to this emerging industry within South Australia. Opportunities for collaboration and partnering with tertiary education providers are one (1) possibility.

Southern Launch is currently in negotiations with University of Adelaide and UniSA with a view to sponsoring one (1) or two (2) PhD candidates to undertake their thesis on the Project Site in respect of impacts on flora/fauna. This study/s will take approximately four (4) years. This will result in a strong understanding of the impacts of operations on local flora/fauna.

18.4.2.4 *Impact on Health Infrastructure Capacity*

Port Lincoln Country General Hospital is the closest medical facility to the Project Site. This hospital is the major health and medical facility for the lower Eyre region and has a catchment area that extends throughout the Eyre Peninsula to the Western Australian border including the townships Tumby Bay, Coffin Bay, Elliston, Wudinna, Cummins, Lock, Streaky Bay, Ceduna, and Yalata.

Located some 646 kilometres from Adelaide, the facility is somewhat isolated from medical and health services located there, however the Australian Red Cross operates a community passenger transport network on the Eyre Peninsula for people who have no access to other means of transport for medical appointments. Regular flights and bus services are available.

The proposed project is suitably located to utilise available health infrastructure when needed but is not anticipated to place unreasonable demand on the health infrastructure services available within the region.

18.4.2.5 *Social Wellbeing and Security Impact*

All launch events will be coordinated with the State and local branch of the South Australian Police to ensure safe public viewing and security. The national terrorist threat level will be assessed on a launch-by-launch basis by the Police and appropriate measures put in place as required to ensure safety to the local population, viewers, and the Launch Complex.

18.4.3 Guideline 9.3

9.3. Outline potential impacts on the use of the land by Aboriginal people, or on cultural values held by Aboriginal people that relate to the areas affected by the project (land and water).

The site area is located within the traditional lands of Nauo speaking people. Site investigations and assessment were undertaken by representatives of the Nauo Native Title Claimant Group to inspect the site for sites or items of aboriginal heritage significance. This investigation and its findings are documented within the Cultural Heritage assessment prepared by Archaeologist and Anthropologist, Scott Cane (Refer to **Appendix Y**).

Some artefacts and areas of Cultural Heritage significance were identified. A small adjustment to the siting and boundary location of Launch Site A was undertaken to ensure safe separation from potential culturally significant area was maintained. The investigation did not identify any artefacts or locations that precluded the development of the WWOLC.

The *Aboriginal Heritage Act 1988* (SA) provides for the protection and preservation of Aboriginal heritage in South Australia. Preliminary investigations have been undertaken to determine compliance with the Act and minimise the risk of damaging or disturbing cultural sites. The proponent has consulted with local Indigenous groups to ensure compliance with the Act during construction and operation.

Should any Aboriginal objects be encountered during works associated with this proposal, works will cease in the vicinity until the find can be assessed by a suitably qualified individual and further recommendation sought.

18.4.4 Guideline 9.5

9.5. Describe any community consultation processes conducted by the proponent, specifically detailing the support and / or any concerns raised about the proposed development.

18.4.4.1 Preliminary Consultation and Engagement

Southern Launch has undertaken a range of consultation and engagement processes during the Project. This has involved public and stakeholder sessions following the identification of the site and a broad range of targeted engagement with various stakeholders. Consultation started in late-2018 and various engagement processes have continued since this time.

The engagement to date has included:

- State Government via the Southern Launch Taskforce.
- State Government directly with key assessment agencies, including (but not limited to):
  - Attorney General's Department – Planning and Land Use Services;
  - Environment Protection Authority;
  - Department for Environment and Water;
  - Defence SA;
  - South Australian Department of Primary Industries and Regions;
  - South Australian Department of Trade and Investment;
  - South Australian Police Force;
  - South Australian Ambulance Service; and
  - South Australian Country Fire Service.
- Commonwealth Government, including (but not limited to):
  - Australian Space Agency;
  - Civil Aviation Safety Authority;
  - Australian Maritime Safety Authority; and
  - Department for Agriculture Water and the Environment.
- District Council of Lower Eyre Peninsula.
- City of Port Lincoln.
- Eyre Peninsula Local Government Association.
- Regional Development Australia – Whyalla and Eyre Peninsula.

- Community information sessions in Port Lincoln and Adelaide.
- Local Industry and Business groups.
- Seeking contact with all landowners within 10-15 kilometres of the subject site.

As engagement processes to date have been non-statutory, and to protect privacy at the request of a number of stakeholders and community members who have engaged with Southern Launch, a verbatim list of contacts has not been included in the EIS.

A limitation in engagement undertaken over the past 15 months has occurred due to the restrictions associated with COVID-19. Additionally, as the design of the Project has been evolving during the preparation of the large number of technical studies which support the EIS, Southern Launch has been cautious in placing too much definitive information in the public realm, conscious that subsequent changes to the proposed design and operations would only serve to confuse the community.

Notwithstanding these limitations, Southern Launch has continued to engage extensively with government, stakeholders, and the community, providing responses to any requests for further information.

With the finalisation of the EIS for exhibition, Southern Launch will undertake further engagement, both together with the statutory engagement process required under the *Development Act, 1993* and in addition to that process.

The further engagement will include:

- The provision of final details of the Project, including:
  - The full EIS and supporting technical information; and
  - Summary information of the proposal.
- Community information sessions in Port Lincoln, Coffin Bay and Adelaide.
- Targeted sessions with stakeholders, including:
  - EPLGA;
  - Regional Development Australia – Whyalla and Eyre Peninsula;
  - Commercial fishing industry;
  - Recreational fishing groups;
  - Peak environmental groups;
  - Local, regional and State business groups; and
  - Local landowners.
- Provision of a facility for members of the community to ask questions of Southern Launch in respect of the Project.

18.4.4.2 Formal Stakeholder Consultation and Engagement

The formal consultation program associated with the application pursuant to Section 46 of the *Development Act, 1993* is yet to commence.

- As outlined above, an engagement plan is currently under preparation by Southern Launch which will outline the process of community engagement to be undertaken to inform the public and provide the opportunity for open dialogue with the community to respond and address any concerns.
- A formal process of public consultation will be undertaken as part of the EIS assessment process, with the EIS document and all supporting material available for public review for a period of thirty business days.

18.4.5 Guideline 9.7

9.7. Identify any impacts on recreational use of coastal land on and around the site, including recreational fishing and access to coastal crown land.

Unescorted public access through the Project area to use coastal land or the Project area for recreational purposes will be controlled depending on legislative, security and safety considerations. The general public will not be able to access the launch or infrastructure facilities unescorted. It is noted that the subject land is freehold and therefore access through the site is not presently permitted without prior agreement of the landowner. Previously, use of the land by the public was available through payment of a nominal fee to the landowner. As such, the proposed development does not inhibit access to an area that was previously available for unfettered public use.

Public access and use of coastal land, features and beaches that are located outside of the Project area boundary will continue in the same manner that presently occurs. This will include access to:

- Red Banks Beach;
- White Lookout;
- The coastal reserve; and
- Fishery Bay Beach.

Access and use of surrounding coastal waters, and coastal crown reserve land will largely be undisturbed by the proposed operations, save for access during launch events. Rocket launches are controlled by the Australian Space Agency which ensures that the ocean and airspace areas directly affected by Launch Exclusion Areas are cordoned off. Any Launch Exclusion Area or Corridor will be off limits when the Australian Space Agency mandates that they be free of any non-authorised person.

The exact extent of Launch Exclusion Areas will be dependent on the particular launch, but will extend over the land, ocean and airspace. This will only happen for the minimum amount of time to ensure the least disruption to recreational and commercial fishing, shipping, and other uses.

19 PLANNING AND ENVIRONMENTAL LEGISLATION AND POLICIES

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19.0 PLANNING AND ENVIRONMENTAL LEGISLATION AND POLICIES

19.1 Summary

All planning and environmental and space related legislation relevant to the assessment and operation of the proposal has been identified and its relevance to the Project described in **Section 1.6**.

This section details the relevant aspects of that legislation and associated policy and comments on the compliance of the Project with the goals, objectives and outcomes sought by the legislation.

The analysis draws on all aspects of the Project and examines them in terms of their environmental, social, and economic affects as detailed in the respective sections of the EIS report.

In summary it is concluded the Project:

- Achieves a high degree of compliance with related land use and development controls governing the use of the land (primarily the *Development Act 1993* and *Development Regulations 2008*).
- Substantially complies with the relevant policy for development, land use and land division established under the Development Act.
- Substantially complies with the new Planning and Design Code commenced on 31 July 2020 under the new *Planning Development and Infrastructure Act 2016* which replaces the Development Plan policies referred to above – albeit not for the purposes of this assessment which commenced and must be completed under the provisions of the Development Act.
- Meets the regulating requirements for the clearance of native vegetation under the *Native Vegetation Act 1991*.
- Will be referred under the provisions of the *Environment Protection and Biodiversity Act 1999 (Cth)*.
- Accords with the requirements of the *Environment Protection Act 1993* and associated Air Quality and Water Quality policies, subject to requirements for licencing.
- Will comply with the Aboriginal Heritage Act and the *Heritage Places Act 1993*.

- *Space (Launches and Returns) Act 2018* and compliance with any relevant national and international obligations, International Conventions and Agreements to which the Commonwealth of Australia is a party, including:
    - United Nations Convention on the Law of the Sea (UNCLOS) (Law of the Sea Convention) – Defines the rights and responsibilities of nation-states usage and sovereignty related to ocean use.
    - Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other matter 1972 (London Convention) – To protect the marine environment and control all sources of marine pollution by taking practicable steps to prevent pollution of the sea by dumping of wastes and other matters.

19.2 Methodology

A desktop review of all relevant legislation has been undertaken. An identification process was undertaken by experts in relevant fields of assessment in order to identify all State and Commonwealth legislation that applies to the Project.

Compliance with legislation and policies has been analysed by the relevant experts in order to clarify the responsibilities and requirements under this legislation. These requirements and the Project response have been summarised within this section. In many cases the consultants have engaged in consultations with relevant statutory authorities and government agencies to determine compliance with the relevant policies.

19.3 Relevant EIS Guidelines

Assessment Requirement 17: *A range of planning, environmental and space related statutory requirements would need to be met for the construction and operation of the proposed development.*

17.1. Describe the launch complex and site activities in terms of the consistency with the relevant Development Plans, Planning and Design Code, the Planning Strategy and the State Planning Policies.

17.2. Describe the development in terms of its consistency with relevant State and Commonwealth legislation and initiatives.

17.3. Provide information on the operational requirements to be met with regard to the authorised space activities under the Space (Launches and Returns) Act 2018 and compliance with any relevant national and international obligations.

17.4. Identify any potential implications of the proposed launch complex for International Conventions and Agreements to which the Commonwealth of Australia is a party.

17.5. Provide information on activities which will require a licence pursuant to the Environment Protection Act 1993.

17.6. Provide information on the operational requirements to ensure compliance with the Environment Protection Act 1993 and associated Air Quality and Water Quality policies.

19.4 Analysis

19.4.1 Guidelines 17.1, 17.2, 17.5, 17.6

17.1. Describe the launch complex and site activities in terms of the consistency with the relevant Development Plans, Planning and Design Code, the Planning Strategy and the State Planning Policies.

17.2. Describe the development in terms of its consistency with relevant State and Commonwealth legislation and initiatives.

17.5. Provide information on activities which will require a licence pursuant to the Environment Protection Act 1993.

17.6. Provide information on the operational requirements to ensure compliance with the Environment Protection Act 1993 and associated Air Quality and Water Quality policies.

19.4.1.1 South Australian Planning Strategy

The South Australian Government prepared a series of planning strategies for the State which collectively formed the South Australian Planning Strategy pursuant to section 22 of the *Development Act 1993*. The Eyre and Western Region Plan, April 2012, applied to the Lower Eyre Peninsula.

The new PDI Act provides for South Australia to be divided into Planning Regions and requires a Regional Plan to be prepared for each region. The main purpose of a Planning Region is to define the area for Regional Plans over which collaborative arrangements may be established for planning and other relevant service delivery or program areas.

At present the State Planning Commission has determined that the planning strategies prepared under the Development Act will be apply until such time as new Regional Plans are prepared and adopted under the PDI Act.

The preface of the Eyre and Western Region Plan states that:

> *"The Eyre and Western Region Plan is designed to ensure that the region remains a great place to live, work and visit for many years to come. The plan is one of seven regional volumes in the South Australian Planning Strategy. Based on a presumption of strong economic growth, the plans indicate where new housing, industry and commercial activity should be best located – and not located. The plan outlines the different roles and functions of towns and addresses important issues such as the way industrial, commercial and residential areas connect and impact on each other."*

The strategy identifies infrastructure servicing the Region as follows:

> *"Extensive infrastructure includes four of the state's nine major export ports, three major regional airports (including the state's largest regional airport in terms of runway length at Whyalla) and connections to the national road and rail networks."*

This infrastructure provides a significant benefit to the proposed development providing the logistics of receiving rockets by sea prior to relatively short land transportation to the site.

The key issues for the Eyre and Western Region have been grouped into four (4) themes:

- Environment and sustainability:
  - balancing native vegetation management, the protection of vulnerable ecosystems and the maintenance of aesthetically pleasing landscapes with economic development;
  - supporting native habitat areas so they can adapt to and survive climate change;
  - planning for sustainable coastal development while protecting coastal land and waters;
  - locating development away from hazardous areas and ensuring that appropriate prevention measures are in place;
  - supporting the region's water security, including developing strategies to harvest and recycle water supplies and developing alternative water sources;
  - supporting development of renewable energy; and
  - adapting development and services to cater for the effects of changing climatic conditions.
- Economic development:
  - retaining and enhancing the region's unique natural assets and culture to support tourism;
  - supporting aquaculture growth by allocating land for service providers and processing;
  - protecting and encouraging diversification of activities on primary production land;
  - supporting existing and new mining and energy developments;
  - supporting and encouraging development of alternative energy resources;
  - attracting and retaining a skilled workforce; and
  - supporting industries in adapting to the effects of climate change.
- Population, settlements, and culture:
  - supporting development of a range of residential accommodation options to support the diversity of residential needs (for example affordable and aged housing);

- retaining and attracting young people and skilled personnel;
- identifying cultural values and encouraging a 'sense of place' in each community;
- providing adequate and accessible community services; and
- building population, employment and services in key growth centres that can also serve rural and remote residents and businesses.

- Infrastructure and service provision:

  - maximising the use and adaptability of infrastructure through consolidation, clustering, and economies of scale;
  - protecting land corridors for expansion or augmentation of infrastructure;
  - providing adequate infrastructure (for example, transport facilities, communications, energy, water security) to support development of mining, agriculture aquaculture and tourism;
  - supporting the development of social and community infrastructure; and
  - protecting services for airlines and the Royal Flying Doctor Service.

The strategy does not specifically foresee the establishment of an aerospace facility in the region, however, the concept of such a facility is consistent with the general economic development aspirations of the plan. Having regard to the investigations, analyses, mitigation, and management strategies outlined in this document, the proposal will positively contribute to the attainment of the planning strategy for the region as follows:

- Supports the economic objectives for the region refer **Section 13**):

  - through the development of a significant new industry supporting State objectives, local and regional employment, technological innovation, education, and tourism;
  - by attracting new skilled workforce to the region;
  - by providing no negative impact on existing industry and primary production in the locality and region; and
  - by supporting existing infrastructure in the region.

- Can be developed with minimal impact on the environment, flora and fauna, coastal areas and vulnerable ecosystems (refer **Sections 7, 8, 9, 10, 11** and **12**).

- Will not unduly impact the aesthetic and coastal and rural landscapes in the region (refer **Section 16**).

- Will not impact on settlements or residential amenity in the region (refer **Sections 14** and **18**).

- Will not impact on cultural values of the region (refer **Section 17**).

Potential negative impacts due to short-term sporadic interruption to commercial fishing, recreational boating and fishing, and airspace activity are specifically addressed through the management strategies outlined in this EIS (exclusion zones and prior notification procedures, refer **Sections 6.6** and **6.7**). Such arrangements are considered appropriate in providing a reasonable balance between the benefits of a new industry and the ability of existing industries to continue to be unaffected.

The impact of reducing public access to the site is unfortunately a non-negotiable aspect of the Project, both in the interests of public safety, and protection of the Project assets. However, most land in private ownership in the State does not allow or encourage public access or use. The current access arrangements are at the discretion of the landowner, and whilst highly desirable to the public, should not be an expectation or factor that precludes the future use and development of the land. Southern Launch will communicate with State and Federal authorities to ensure public access is managed in keeping with legislative requirements for the operation of a space port.

The region remains well catered for with national and conservation parks providing public access to much of the coast and natural assets of the region.

19.4.1.2 Relevant Polices of the Development Plan

The subject land is located within the District Council of Lower Eyre Peninsula and accordingly the relevant policies for assessment under the Development Act are contained with the Lower Eyre Peninsula Council Development Plan. The version of the Lower Eyre Peninsula Council Development Plan in force on the date of lodgement of the application was the version consolidated on 12 July 2018. The Development Plan has now been superseded and replaced by the new Planning and Design Code which came into effect in regional areas on 31 July 2020. If the application was being assessed as a normal development application, the plan in force at the time of lodgement of the application would be the relevant plan for the purposes of the assessment under the Development Act.

The Project site is contained with the Coastal Conservation Zone as illustrated on Zone Maps LEP/1 and LEP/18 respectively. It is not located within any specific Policy Area or Precinct of the Coastal Conservation Zone.

The policies contained in the Coastal Conservation Zone are therefore the most relevant policies against which an application must be assessed.

The Council-wide policies of the Development Plan are also relevant. They apply across the whole Council area and relate to a range of social, environmental, and economic development issues and establish the development standards that apply to all forms of development. In addition, the Plan contains an overlay policy in relation to Bushfire Risk which is relevant to the assessment of the proposal.

It is relevant to note the policies of any immediately adjoining zones in the assessment of development under the Development Act.

The Project Site adjoins the coast of South Australia which under the Development Act is situated within the area covered by the Land Not Within a Council Area (Coastal Waters) Development Plan. The site also adjoins a Caravan Park Zone on its north-eastern boundary.

To the north of the site, although not immediately adjoining, lies the Primary Production Zone which applies generally over the rural area of the Lower Eyre Peninsula.

Coastal Conservation Zone

The policies of the Coastal Conservation Zone most relevant to the Project include:

- Objectives 1 to 4.
- Desired Character.
- Principles of Development Control 1, 2, 3, 4, 6, 8, 9, 11, 14, and 16.
- Procedural matters – complying and non-complying development.

The objectives of the Coastal Conservation Zone relevant to the proposal include, inter alia:

> *"To enhance and conserve the natural features of the coast including visual amenity, landforms, fauna and flora.*
>
> *Maintain farming activities outside of areas of native vegetation, coastal dunes and wetlands of national importance.*
>
> *Development that contributes to the desired character of the zone."*

Elements of the Desired Character most relevant to the assessment of the proposal include:

> *"The role of this zone is to ensure the conservation of coastal features and scenic quality, enable appropriate public access and ensure that development is not subject to coastal hazards. Development within the zone should be subservient to the conservation of the coastal environment in order to ensure that the fragile coastal environment is protected and biodiversity maintained. The zone includes Coffin Bay National Park, Lincoln National Park, Sleaford Mere Conservation Park, Kellidie Bay Conservation Park, Memory Cove Wilderness Area. The protection of the sensitive coastal environment requires the appropriate management of public access.*
>
> *The zone continues to be a predominately natural landscape containing coastal features and habitats such as wetlands, samphire flats, beaches, sand dunes, and cliff tops. A wide variety of plant communities occur within these habitats.*
>
> *The area is abundant in native wildlife, such as the Osprey, White bellied Sea Eagle and Hooded Plover, that depend on the natural coastline for survival.*

Development borrows from, and complements the natural landscape in form and scale, and in building materials, textures, colours and tones, to ensure that the natural elements of the site/locality remain dominant to any introduced elements, and the scenic quality of the coast is protected.

Those parts of the zone at risk from coastal hazards such as flooding, erosion and acid sulfate soils are (sic) should be kept free from development. Road construction is minimal and limited to that which is required to access a car park. Access over dunes and beaches is pedestrian only, using boardwalks to protect sand dunes from erosion."

Principles of Development Control for the zone largely reflect and expand on the above Objectives and Desired Character. They focus primarily on appropriate land uses envisaged in the zone and the form and character of development with reference to the conservation and enhancement of the coastal environment and scenic beauty of the zone. Specific principles that add to or introduce specific detail over and above the Objectives and Desired Character include:

Principle 1: *1 The following forms of development are envisaged in the zone:*

- *conservation work*
- *interpretive signage and facility*
- *nature based/eco tourist accommodation.*

Principle 2: *Development listed as non-complying is generally inappropriate.*

Principle 3: *Buildings and structures should mainly be for essential purposes, such as shelters and toilet facilities associated with public recreation, navigation purposes or necessary minor public works.*

Principle 11: *Development should:*

(a) *be self-sufficient in terms of infrastructure and services, such as water, sewerage, electricity and waste disposal, unless existing infrastructure is available that can accommodate the projected demand from the development;*

(b) *minimise impacts on the natural surrounding environment by containing construction within a tightly defined site boundary;*

(c) *not obscure existing views to coastal features or be visibly prominent from key public vantage points, including public roads or car parking areas;*

(d) *avoid areas that may endanger or threaten important nesting or breeding areas or the movement/migration patterns of fauna.*

Principle 14 *Car parking and access points to development should, wherever practicable, be:*

(a) *constructed of a permeable surface;*

(b) *located on cleared land or along property boundaries to avoid the unnecessary removal of native vegetation.*

Principle 21 *Land division should only occur where either of the following applies:*

(a) *the division would create an allotment greater than 5 hectares to accommodate an existing tourist accommodation development;*

(b) *the division would not create any additional allotments either wholly or partly within the zone and would not increase the number of allotments with direct access to the coast or a reserve, including through the creation of land under rights of way or community title.*

In summary, the zone policies allow for low intensity recreation uses and to maintain farming outside of areas of native vegetation, coastal dunes, and wetlands of national importance. The relevant principles of development control focus on the conservation and enhancement of the coastal environment and scenic beauty of the zone.

The policies do not envisage the development of an aerospace facility, nor is it a defined use in any Development Plan in the State. The policies therefore provide a context and framework for development within the zone to which the proposal must have due regard. In particular the proposal should avoid or minimise to an acceptable degree any detrimental impact on the desired character of the zone, the nature and form of land uses envisaged in the zone and should not unreasonably detract from the ability for other desired development from occurring in the zone.

Council-wide Policies

The following General Section (Council-wide) provisions of the Development Plan are relevant to the consideration of the proposed development and the primary objective(s) of each noted below:

- Coastal Areas module including:
  - The protection and enhancement of the natural coastal environment, including environmentally important features of coastal areas such as mangroves, wetlands, sand dunes, cliff tops, native vegetation, wildlife habitat shore and estuarine areas.
  - Protection of the physical and economic resources of the coast from inappropriate development.

- Preservation of areas of high landscape and amenity value including stands of vegetation, shores, exposed cliffs, headlands, islands and hill tops, and areas which form an attractive background to urban and tourist areas.
- Development that maintains and/or enhances public access to coastal areas with minimal impact on the environment and amenity.
- Development only undertaken on land which is not subject to or that can be protected from coastal hazards including inundation by storm tides or combined storm tides and stormwater, coastal erosion or sand drift, and probable sea level rise.
- Development that can accommodate anticipated changes in sea level due to natural subsidence and probable climate change during the first 100 years of the development.
- Development which will not require, now or in the future, public expenditure on protection of the development or the environment.
- Management of development in coastal areas to sustain or enhance the remaining natural coastal environment.

• Crime prevention:

  - A safe, secure, crime resistant environment where land uses are integrated and designed to facilitate community surveillance.

• Design and Appearance:

  - Development of a high design standard and appearance that responds to and reinforces positive aspects of the local environment and built form.
  - Roads, open spaces, paths, buildings, and land uses laid out and linked so that they are easy to understand and navigate.

• Energy Efficiency:

  - Development designed and sited to conserve energy.
  - Development that provides for on-site power generation including photovoltaic cells and wind power.

• Hazards:

  - Maintenance of the natural environment and systems by limiting development in areas susceptible to natural hazard risk.
  - Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from, the risk of natural hazards.
  - Development located and designed to minimise the risks to safety and property from flooding.
  - Development located to minimise the threat and impact of bushfires on life and property.

  - Minimisation of harm to life, property, and the environment through appropriate location of the storage, containment, and handling of hazardous materials.

- Heritage Places:
  - The conservation of State and local heritage places.
  - Conservation of the setting of State and local heritage places.
- Interface Between Land Uses:
  - Development located and designed to minimise adverse impact and conflict between land uses.
  - Protect community health and amenity from adverse impacts of development.
  - Protect desired land uses from the encroachment of incompatible development.
- Land Division:
  - Land division that occurs in an orderly sequence allowing efficient provision of new infrastructure and facilities and making optimum use of existing underutilised infrastructure and facilities.
  - Land division that creates allotments appropriate for the intended use.
  - Land division layout that is optimal for energy efficient building orientation.
  - Land division that is integrated with site features, including landscape and environmental features, adjacent land uses, the existing transport network and the availability of infrastructure.
  - Land division restricted in rural areas to ensure the efficient use of rural land for primary production and avoidance of uneconomic infrastructure provision.
- Landscaping, fences, and walls:
  - The amenity of land and development enhanced with appropriate planting and other landscaping works, using locally indigenous plant species where possible.
  - Functional fences and walls that enhance the attractiveness of development.
- Natural Resources module including:
  - Retention, protection and restoration of the natural resources and environment.
  - Protection of the quality and quantity of South Australia's surface waters, including inland, marine, and estuarine and underground waters.
  - The ecologically sustainable use of natural resources including water resources, including marine waters, ground water, surface water and watercourses.
  - Natural hydrological systems and environmental flows reinstated and maintained and enhanced.
  - Development consistent with the principles of water sensitive design.

- Development sited and designed to:
    - o protect natural ecological systems;
    - o achieve the sustainable use of water;
    - o protect water quality, including receiving waters;
    - o reduce runoff and peak flows and prevent the risk of downstream flooding;
    - o minimise demand on reticulated water supplies;
    - o maximise the harvest and use of stormwater; and
    - o protect stormwater from pollution sources.
- Storage and use of stormwater which avoids adverse impact on public health and safety.
- Native flora, fauna and ecosystems protected, retained, conserved, and restored.
- Restoration, expansion and linking of existing native vegetation to facilitate habitat corridors for ease of movement of fauna.
- Minimal disturbance and modification of the natural landform.
- Protection of the physical, chemical, and biological quality of soil resources.
- Protection of areas prone to erosion or other land degradation processes from inappropriate development.
- Protection of the scenic qualities of natural and rural landscapes.

• Orderly and sustainable development:

- Orderly and economic development that creates a safe, convenient, and pleasant environment in which to live.
- Development that does not jeopardise the continuance of adjoining authorised land uses.
- Development that does not prejudice the achievement of the provisions of the Development Plan.
- Development abutting adjoining Council areas having regard to the policies of that Council's Development Plan.

• Siting and visibility:

- Protection of scenically attractive areas, particularly natural, rural, and coastal landscapes.

• Transportation and access:

- Development that provides safe and efficient movement for all transport modes
- ensures access for vehicles including emergency services, public infrastructure maintenance and commercial vehicles.
- provides off-street parking.
- is appropriately located so that it supports and makes best use of existing transport facilities and networks.

- Waste:
  - Development that, in order of priority, avoids the production of waste, minimises the production of waste, re-uses waste, recycles waste for re-use, treats waste and disposes of waste in an environmentally sound manner.
  - Development that includes the treatment and management of solid and liquid waste to prevent undesired impacts on the environment including, soil, plant and animal biodiversity, human health, and the amenity of the locality.

19.4.1.3 Assessment Procedures

Given the proposed use is not a defined use in the Development Plan, it is neither specifically envisaged (complying development) or not envisaged (non-complying) in the zone principles. The proposal is one that should therefore be considered on merit.

Whilst the definition or classification of a land use does not trigger any particular statutory requirements under the 'Major Projects' assessment pathway, it is relevant to note that the development would be required to be considered on its merit if it were assessed under the standard assessment pathway under the Development Act.

Under the standard assessment pathway, the proposal would be classified as a Category 3 development for the purposes of Public Notification, which would comprise a public notice and personal advice to adjoining and directly affected properties and providing 15 days for persons to lodge representations. Both the applicant and representors would have the right to address the relevant authority at a hearing prior to a decision being made on the application. The applicant and representors would be able to appeal to the Environment Resources and Development Court if aggrieved by the decision of the relevant authority.

Under the Major Projects provisions of the Act the proposal will be publicly notified, and persons will have a minimum of thirty business days in which to lodge a submission, which is more than double the time provided in the normal assessment pathway. A public hearing will be held at which persons lodging submissions may attend to make verbal representations and the applicant would be invited to respond, being a process very similar to that of the normal assessment pathway. However, under the Major Projects pathway neither the applicant nor a representor may appeal the final decision.

19.4.1.4 Development Plan Assessment

<u>Land use</u>

The absence of definition or listing as a land use in its own right does not speak for or against the suitability of the proposal. It simply means that as an unidentified use, there are no policies in the Development Plan that refer specifically to that use, nor can it be assigned the procedural status of complying or non-complying.

The principles for the Conservation Zone state that development listed as non-complying is generally inappropriate in the zone, As the proposal is not listed as non-complying it cannot be regarded in this context as being an inappropriate use in the zone.

An assessment of the merits of the proposal against the provisions of the relevant policies is therefore appropriate. This EIS considers the impact of the proposal on all of the issues raised in the Objectives, Desired Character, and Principles of Development Control above.

Visual amenity and landscape character

The overarching intent of the Zone provisions is to facilitate development that contributes to the desired character of the zone while enhancing and conserving the natural features of the coast, including visual amenity and landforms. The Desired Character Statement places a value on the protection of scenic qualities of the coastal landscape within the zone. The Desired Character Statement also acknowledges certain development may take place within the zone but must be in a way which does not dominate the natural elements of the area. This intent is also reflected in the relevant EIS assessment guidelines that apply to this project, which focus on the proposals impact on native vegetation, native fauna and ecological values of the site and locality.

The scenic landscape, visual impact, and coastal landforms policies of the plan have been extensively analysed in the Landscape Character and Probable Visual Effect Assessment – WAX (refer to **Appendix Z**).

In relation to maintaining the coastal character of the landscape, the Project will produce a defined development footprint within the existing coastal landscape. Four (4) development sites will be utilised, with three (3) located centrally and to the western portion of the subject land. The permanent structures located within each development site have a maximum height of 10 metres, with visibility contained to the coastal basin in the centre of the subject land and the northern escarpment.

There are small areas of visibility associated with the Project towards the southern coastal ridgeline and offshore. In this regard, the physical impact of the development on the coastal landscape is limited. The temporary launch towers associated with the Launch Sites A and B will have a maximum height of 30 metres. When in use, these structures will have a greater zone of visibility focusing on the surrounding near-coast waters and the north-western portion of the subject land. The frequency of use of these structures (approximately three (3) times per month) enables the protection of the coastal amenity when not in use. The temporary nature of the development helps to minimise the potential visual effects.

The separation of each of the development sites ensures that the visual effect of the proposed development is fragmented, and the underlying coastal landscape is maintained. The coastal landscape is retained while the visual character is changed to a moderate degree, decreasing to slight to the north within the defined locality of the proposed development.

The development seeks to protect the scenically attractive coastal location through the use of low building forms and associated infrastructure. Taller elements within the proposal will only be utilised during specific launch days, limiting the visual impact these will have on the surrounding area. The development site is located a substantial distance from surrounding towns and dwellings, which further helps to limit the impact on the visual character.

The ZTVI mapping indicates that some views of the development will be visible through the coastal basin when approaching from Fishery Bay Road (north). There are small portions of open waters from which development will be seen. However, it is noted this is associated with launch infrastructure and will only be present on specific days.

In summary, the proposal:

- Does not directly impact on the natural features or landscape of the coast, any conservation park or area, wetland, samphire flats, beaches, sand dunes, or cliff tops.
- Seeks to protect the scenically attractive coastal location through the use of low building forms and associated infrastructure. Taller elements within the proposal will only be utilised during specific launch days, limiting the visual impact these elements will have on the surrounding area.
- Is located a substantial distance from surrounding towns and dwellings, which further helps to limit the impact on the visual character.
- Is sited such as not to be subject to any coastal hazards.
- Will be of limited visibility from the coast and surrounding areas such as to minimise any intrusion into the scenic qualities of the area.

Natural resources and environmental effect

The provisions of the Development Plan seek to ensure that new development manages and where possible, minimises its potential impact on the natural environment, especially in locations of identified environmental and natural value, such as coastal locations.

Extensive assessment has been undertaken by suitably qualified specialists to quantify the impacts of the proposal on the natural environment. The primary assessments of relevance to this include:

- Noise and Vibration Assessment – AECOM (refer to **Appendix O**);
- Terrestrial Biodiversity Assessment – AECOM (refer to **Appendix P**);
- Coastal Raptor Assessment – Jacob Bebbington (refer to **Appendix R**);
- Marine Ecological Assessment – J Diversity (refer to **Appendix S**); and,
- Landscape Character and Visual Effect Assessment (refer to **Appendix Z**).

The development, whilst occurring within an area of ecological value and importance, has been designed and sited to minimise its impact on the biodiversity and ecology of the area as far as is practical.

The siting of the Project Footprint occupies an area of approximately 23.76 hectares within an allotment with a total area of approximately 2,640 hectares. As such the development footprint only occupies approximately 0.9 percent of the total site area. Comparatively, the 23.76 hectares to be cleared as a result of the Project is minimal within the context of the site and locality.

The location of the Project elements has been strategically selected to minimise disruption to the natural environment by proposing access routes that follow existing cleared vehicle tracks and siting project infrastructure in areas of lower native vegetation condition.

A Significant Environmental Benefit (SEB) offset under the Native Vegetation Act will be applied to ensure that a positive impact on the environment occurs that is over and above the negative impact presented by all proposed vegetation clearance. The overall SEB requirement for this project calculated by Southern Launch currently stands at $965,407.77. Southern Launch will either provide a SEB in the form of an inground offset provided by SEB credit providers within the region or pay the required fee into the fund.

It is also relevant to consider the prevailing use of the subject land and the impacts this presents on the ecological value of the site. The natural value of the land has been progressively degraded as a result of some of the impacts associated with its tourism use.

Some of the impacts that are evident include significant levels of scattered refuse waste abandoned by site users over many years, erosion caused by use of poorly maintained and constructed access tracks and impacts on native vegetation through use of off-road vehicles.

Under the proposed development scenario, a more rigorous management regime will be established for this site that will manage all aspects of the construction and operation of the use, control access to the subject land, outline bushfire and emergency management procedures, and ultimately ensure the ongoing protection of the area. In fact, it is a reasonable expectation that the use and management of the land in the manner proposed will allow for a degree of rejuvenation of the area and enhancement of its natural value.

Public access to the coast

The Project will impact on current public access arrangements to the coast having regard to the General Section (Council-wide) policies which seek that new development maintains and/or enhances public access to coastal areas with minimal impact on the environment and amenity.

The Project will cause the current public access arrangements across private land to coastal camping spots to be altered due to legislative, safety and/or security requirements. However, the current public access arrangements are at the pleasure of the landowner and are not a statutory requirement. At any time, the owner of the land could undertake an activity on the land or consider for any other reason that it is no longer appropriate to allow public access across the land. In this context the proposal should not be regarded as being contrary to this policy.

The locality contains substantial public lands able to fulfill that purpose.

To the extent that some public land (Crown Reserve) will be within the Exclusion Zone identified to apply on rocket launching days, limits to public access to public land within the exclusion zone will be temporarily required. Given the very limited access to such public land from public areas, essentially the sea, and the limited times this will operate, this impact will have a negligible material impact on accessibility to the coast.

Public access and use of coastal land, features and beaches that are located outside of the Project area boundary will continue in the same manner that presently occurs. This will include access to:

- Red Banks Beach;
- White Lookout; and
- Fishery Bay Beach.

Land division

Land division is proposed in the form of a lease greater than six (6) years. Whilst this technically meets the definition of land division, it does not result in the creation or issue of a separate title of land in the zone. The proposal therefore complies with the land division policies for the zone as it does not create an allotment for an existing tourist facility, nor does it create an additional allotment with access to the coast.

Other

In addition to the above, other matters of compliance with the relevant policies can be summarised as follows:

- Will have a limited impact on the flora and fauna of the region and should not severely impact of the continued existence of any species.
- The proposal does not involve and development or activity that directly impacts on, or could be affected by, coastal processes and landforms.

- Potential hazards have been addressed in the design of the development and strategy plans will be prepared to address the on-going management of hazards, in particular in relation to bushfires, chemical storage, and accidents.
- The proposal will not be affected by predicted sea-level rise.
- A site security strategy will address crime prevention issues.
- The proposal will not impact on any State of Local Heritage Place or Contributory Item, or item of Aboriginal Heritage significance.
- The proposal should not negatively impact on the continued use and management of adjacent lands. Potential intermittent impact on commercial fishing, shipping, and marine recreation will be addressed through ongoing management arrangements.
- The proposal does not affect any items of State or Local Heritage significance. The proposal will impact on Native Vegetation Heritage Agreement, and a satisfactory solution whereby more area of native vegetation will be preserved than currently has been reached with the Native Vegetation Council.
- The existing road network will adequately meet the needs of the Project without adverse impact on existing infrastructure. Existing access tracks will be upgraded and extended in places to meet the needs of the proposal with minimal impact on existing vegetation and landform. Adequate on-site parking will be provided in association with each of the activity facilities.
- The proposal will be self-sufficient in the provision of waste treatment and disposal, and essential service infrastructure including power generation and telecommunications.

19.4.1.5 Adjoining and Nearby Zones and Policies

The site adjoins a number of other zones. When a development is located adjacent to another zone, it is customary to consider the impact of the development on the adjoining zone and conversely the impact of development in the adjoining zone on the subject zone.

The following sections identify and comment on zones that adjoin or are nearby and within the locality of the development site.

Caravan and Tourist Park Zone

The Project Site adjoins the Caravan and Tourist Park Zone at its north-east extremity. The objective of the zone states:

> *"a range of short-term tourist accommodation predominantly in the form of caravan and camping sites, cabins and transportable dwellings surrounded by open landscaped areas".*

The zone is situated on private land owned by the lessor of the Project Site (refer **Section 3.2**) and has never been developed for tourist facilities, nor have any such intentions been indicated.

The zone sits outside the Exclusion Zones identified in **Section 5.6**. These zones depict an area within which all persons (other than authorised operational people) are excluded from during a rocket launch for safety reasons.

The likelihood the zone will be developed as tourist facilities is considered to be low, however; the proposal does not prejudice the development of this land in the future for this purpose should it occur, nor would a tourist facility on the land prejudice the operation of the WWOLC.

Primary Production Zone

The Primary Production Zone is distributed widely throughout the Lower Eyre Peninsula and is situated north of the boundary of the property from which a portion will be leased for the Project Site (see **Section 3** for a detailed description of the site).

The key objectives for development in the Primary Production Zone relevant to the location and operation of the proposed launch facility are:

> *"1 The long term continuation of primary production.*
>
> *2 Economically productive, efficient and environmentally sustainable primary production.*
>
> *4 Protection of primary production from encroachment by incompatible land uses and protection of scenic qualities of rural landscapes."*

The proposal will not impact on the attainment of objectives for development in the adjacent and nearby Primary Production Zone in so far as:

- The proposal will not consume or affect or encroach on any land currently being used for primary production.
- The proposal is sufficiently remote from and of a nature that should not impact on the continued use of land within the Primary Production zone for on-going primary production purposes.

19.4.1.6 Land Not Within a Council Area (Coastal Waters) Development Plan.

The Land Not Within a Council Area (Coastal Waters) Development Plan LNWCA (CW Development Plan) applied to coastal land in the State that sits between the high-water mark of the coast and a line three (3) nautical miles seaward of the low water mark, and included both the Spencer Gulf and the Gulf St Vincent, the off-shore islands and the land three (3) nautical miles seaward of the low water mark around the off-shore islands (i.e., land that is outside of a Council area Development Plan).

The Plan applied to the coastal land bordering the Project Site but was superseded by Phase 1 of the Planning and Design Code prior to lodgement of the Project development application. The Plan contained only two (2) zones (Boston Island Zone; Aquaculture Zone), neither of which are directly affected by the proposed development.

The Plan also contained a number of Objectives and Principles of Development Control. Those most relevant to the nature and location of the proposed launch facility included the form and nature of desired development, coastal impacts, environmental protection, preservation of scenic values, maintenance of public access, hazard risk minimisation, protection of physical and economic resources, settlement, tourist facilities and other appropriate development.

The former policies have been reviewed and are largely reflective of those already identified in both the Conservation Zone and General Council-wide Section of the Lower Eyre Peninsula Council Development Plan discussed and analysed above. Accordingly, no further comment is necessary.

19.4.1.7 Relevant Policies of the Planning and Design Code

Prior to lodgement of the development application, Phase 1 of the Planning and Design Code under the PDI Act came into operation. The Code applied to the unincorporated areas of the State being land not within a Council area (the outback, remote areas and offshore islands and adjoining marine waters with the limit of the State boundary). In addition to general policies, the Code contains the Coastal Waters and Offshore Islands Zone which adjoins the seaward part of the Project site.

After lodgement of the application for the proposal, Phase 2 of the new Planning and Design Code came into operation in the regional and outback areas of the State including the site of the WWOLC. The Code now replaces the Development Plans that previously applied under the Development Act.

Notwithstanding, the EIS Guidelines require the EIS describe the launch complex and site activities in terms of its consistency with both the Development Plan and the Planning and Design Code.

The Code sets out policies affecting and adjoining the site in relation to zones, sub-zones, and overlays (policies that can apply spatially over parts of the State and/or in relation to certain kinds of development identified in the Code regardless of its spatial location). The following Code zones and overlays apply to or immediately adjoin the site.

Conservation Zone (applies to site)

The Project site sits entirely within the Conservation Zone. The Desired Outcome for development in the Conservation Zone is:

> *"The conservation and enhancement of the natural environment and natural ecological processes for their historic, scientific, landscape, faunal habitat, biodiversity, carbon storage and cultural values and provision of opportunities for the public to experience these through low-impact recreational and tourism development."*

Caravan and Tourist Park Zone (adjoins site)

The Caravan and Tourist Park Zone exactly replicates the Caravan and Tourist Park Zone area applying under the Development Act. The Desired Outcome for development tin the Sub-zone states:

> *"Tourist accommodation and associated services and facilities enhance visitor experiences and enjoyment."*

The assessment provisions have been reviewed and are generally and materially the same as those applying under the Development Act and provide no substantive additional policy affecting the proposed development.

Visitor Experience Sub Zone (applies to site)

The Visitor Experience Sub-zone applies to the another set of policy over land within the Caravan and Tourist Park Zone described above. The Desired Outcome for development in the Sub-zone states:

> *"Tourist accommodation within a conservation area complements visitor experiences, and is located, sited and designed to minimise detrimental impacts on the natural environment and natural ecological processes including their historic, scientific, landscape, faunal habitat, biodiversity and cultural values."*

The assessment provisions have been reviewed and are considered generally and materially the same as those applying under the Development Act and provide no substantive additional policy affecting the proposed development.

Coastal Waters and Offshore Islands Zone (adjoins site)

The Project site is adjoined by Crown Land separating the site from the coastal water of the State which are situated in the Coastal Waters and Offshore Islands Zone. No development associated with the Project is proposed in any area subject to the said Zone. As such the Project will not impact on any of the physical and environmental policies contained in the zone provisions.

The flight path of rockets launched from the facility will overfly the marine environment situated within the zone. As a consequence, Exclusion Zones will be implemented from time to time during launch events which will restrict access within and through these areas. Accordingly, some provisions of the zone are relevant to the consideration of the Project.

The Desired Outcomes for development in the Coastal and Offshore Islands Zone are:

> *"Protection and enhancement of the natural marine and coastal environment and recognition of it as an important ecological, commercial, tourism and recreational resource and passage for safe watercraft navigation.*
>
> *Small-scale, low -impact development for the purpose of conservation, navigation, science, recreation, tourism, aquaculture or carbon storage."*

The performance outcomes for development in the zone have been reviewed and refer to land use, environmental protection, built form and character.

As there is no physical development or activity proposed directly within the zone, the policies are largely unaffected.

Performance Outcome 3.1 is of relevance to the assessment of the Project:

> *"Development is undertaken in a manner which minimises the potential for harm to the marine and coastal environment or to fisheries and aquaculture, including harm arising from actions that introduce a biosecurity risk."*

A biosecurity risk would occur primarily as result of pollutants entering the sea from the land-based operations of the launch facility, or pollution associated with an accident or planned landing of spent rocket components into the sea.

Stormwater and wastewater management is addressed in **Sections 11.4.2.1, 11.4.2.2** and **23.4.2.1** of this report. Stormwater management is designed to ensure no surface run-off will leave the site through the incorporation of retention basins. Wastewater will be treated on site in appropriately designed and constructed waste treatment facilities.

The analysis concludes that appropriate stormwater management and the installation of wastewater treatment infrastructure will minimise any chance of waster or stormwater entering the sea.

A detailed description and analysis of rockets, rocket components, and associated pollutants entering the sea both as a planned event and in the event of accident is outlined in **Section 22.4** of this report. Specific impacts on the marine environment are analysed in **Section 22.8.** Procedures for spill management are outlined in **Section 23.4.2.3**. Specific legislative requirements for sea dumping apply in local, Australian, and International waters and the Project operations will be required to comply with such provisions.

As a result of this analysis there is no evidence that indicates any substantive Impact on biosecurity that would present a risk to the on-going commercial fishing and aquaculture sectors either in South Australia or more broadly.

In addition to zones, the Code contains a number of overlays which are policies that apply to larger geographic areas and mostly reflect State-wide policies. Overlays applicable to the Project Site include:

Coastal Areas overlay

The Coastal Areas Overlay seeks to ensure the conservation of the natural coastal environment, provide for natural coastal processes, and recognise and respond to coastal hazards.

Historic Shipwrecks overlay

The Historic Shipwrecks Overlay aims to protect historic shipwrecks and historic relics from encroaching development.

Hazards (Bushfire - High Risk) overlay

The Hazards (Bushfire - High Risk) Overlay seeks to ensure development responds to the high level of bushfire risk by siting and designing buildings to mitigate threat and impact of bushfires on life and property, facilitating access for emergency service vehicles and situating activities that increase the number of people living and working in the area away from areas of unacceptable bushfire risk.

Marine Parks (Managed Use) overlay

The Marine Parks (Managed Use) Overlay seeks to ensure the protection of marine habitats and biodiversity.

Native Vegetation overlay

The Native Vegetation Overlay seeks to protect, retain, and restore areas of native vegetation.

Prescribed Wells Area overlay

The Prescribed Wells Area Overlay seeks to ensure sustainable water use in prescribed wells areas.

State Significant Native Vegetation overlay.

The State Significant Native Vegetation Overlay seeks to protect, retain, and restore significant areas of native vegetation.

Water Resources overlay

The Water Resources Overlay seeks to protect the quality of surface waters in South Australia.

19.4.1.8 Environment Protection Act 1993

The *Environment Protection Act 1993* ('the EP Act') provides the regulatory framework to protect South Australia's environment, including land, air, and water. The EP Act sets up a framework which imposes both a general environmental duty, which applies to everyone and a licencing regime, where activities of prescribed environmental significance require a licence from the EPA in order to operate.

As discussed under **Section 1.6.6**, preliminary engagement with the EPA has indicated that whilst the proposal as a whole is not captured as a specific activity of environmental significance, there are elements of the proposed facility which potentially will require a licence from the EPA.

It is expected that the extent to which a licence (or licences) is required will be confirmed by the EPA following their review of the EIS. Licences under the EP Act can only be granted once approval under the Development Act has been issued.

It is noted that an exemption from the *Environment Protection Water Quality Policy 2015* will be required if a planned launch involves any discharge of rocket hardware into State waters. If required, this too will be sought from the EPA once approval under the Development Act has been issued.

19.4.1.9 Native Vegetation Act 1991

Approval to clear native vegetation is required under the *Native Vegetation Act 1991* unless exempted under the *Native Vegetation Regulations 2017*.

The Project has been refined to minimise the amount of vegetation clearance required and the as much as possible affect areas of lower condition rating. As a result, 23.76 hectares of native vegetation will require clearing for construction including launch pads and facility sites, access tracks and associated laydown areas, and perimeter and individual facility security fencing.

Through consultation with the Native Vegetation Council (NVC) the clearance will be offset through a biodiversity offset program developed in accordance with NVC guidelines. A Significant Environmental Benefit (SEB) is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that a SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

The overall SEB requirement calculated by Southern Launch for this Project currently stands at $965,407.77. Southern Launch will either provide a SEB in the form of an inground offset provided by SEB credit providers within the region or utilise the payment option.

19.4.1.10 The Commonwealth Environment Protection Biodiversity and Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* ('EPBC Act') is designed to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places defined in the EPBC Act as matters of national environmental significance. It covers environmental assessment and approvals, protects significant biodiversity, and integrates the management of important natural and cultural places.

The EPBC Act comes into operation where a proposed development or activity has the potential to have a significant impact on a matter of national environmental significance. Such a proposal is defined as a 'controlled action' and requires approval pursuant to the EPBC Act from the Commonwealth Environment Minister.

Following initial investigations, the proponent concluded that there was a potential that the application would involve a 'controlled action' under the EPBC Act and accordingly will formally refer the application to the Commonwealth Department of Agriculture, Water and the Environment ('DAWE') for assessment.

19.4.1.11 Aboriginal Heritage Act 1988

Under section 23 of the *Aboriginal Heritage Act 1988*, it is an offence to damage, disturb or interfere with an Aboriginal site, object or remains without an authorisation.

The Project is located within the traditional lands of the Nauo speaking people. A Cultural Heritage Investigation and field surveys were undertaken to inform the design and layout of the Project (**Section 17.0**).

Two (2) areas of mythological significance and two (2) areas of archaeological significance were located within the area but not within proximity to the proposed project infrastructure.

The survey team also investigated the nominated launch sites and infrastructure sites to assess whether there were any culturally significant sites or objects present within or in proximity to these areas. Three (3) artefacts were identified within a deflated dune in the north-eastern corner of the identified boundary area of Area A.

No artefacts or other signs of Aboriginal occupation were found in the remaining areas. The investigation concluded that, subject to minor alteration to the boundary for Site A, the proposal is not expected to impact on Aboriginal sites of archaeological or anthropological significance.

The CEMP and OEMP will ensure compliance with the Act should any artefacts, sites or skeletal remains be found during construction or operation of the facility.

19.4.1.12 Heritage Places Act 1993

Places and objects of state and local heritage are protected under the *Heritage Places Act 1993* and the *Development Act 1993*. State and local heritage places and objects are listed in the South Australian Heritage Register. Local Heritage places and objects are also listed in the development plans for the areas where they are located.

There are no State or local heritage places or elements within the site. A State Heritage Place, the Former Fishery Bay Whaling Station, is located in proximity to the northern boundary of the site but is sufficiently distanced as to not be materially or practically affected by the Project (refer **Section 17.0**).

19.4.1.13 National Parks and Wildlife Act 1972

The National Parks and Wildlife Act establishes reserves and provides for the protection and management of Native plants and animals in SA. It is an offence to take a native plant or protected animal without approval. Threatened plant and animal species are listed in Schedules to the Act.

Terrestrial and Marine Fauna

It is expected there will be direct impacts to State listed terrestrial fauna species through the clearance of 23.76 hectares suitable habitat and indirect impacts from noise during operations of rocket launches. Affected fauna are identified and discussed in **Section 9.0**.

Direct impacts to State listed species are to be offset through a biodiversity offset program developed in accordance with NVC. Indirect impacts will be managed through the implementation of a CEMP and OEMP to ensure that all impacts are reduced as far as practicable utilising management measures.

The impacts of noise and vibration on terrestrial fauna is detailed in **Section 8.0** Noise and Vibration within this report, and further detailed in **Appendix O** and **Appendix P**. The WWOLC will generate noise levels equivalent to a small warehouse for the vast majority of time (more than 99.9 per cent of the time). The facility will generate a large level of noise for approximately 60 seconds, approximately 36 times per year (once every three (3) weeks). This high-level noise would be brief, but similar to the noise of a large aeroplane.

The total annual time of this high-level noise generation is approximately 36 minutes per year and represents 0.007 per cent of the time. The high-level noise would be a maximum of 130-140 dB, if based on the largest rocket that may be launched occasionally, at the launch site, but more often smaller rockets will be launched. Impacts from this noise would be dissipated by a blast walls and water deluge (e.g., reducing the noise near the source by 5-10 dB). The noise from construction through to operation and launch has been modelled to dissipate to acceptable levels to the nearest human receivers.

The Australian sea lion is currently listed as Vulnerable under the *South Australian National Parks and Wildlife Act 1972* and endangered in the *EPBC Act 1999*. Breeding sites and colonies are generally found on the surrounding offshore islands. Liguanea Island is the fifth largest of 11 breeding colonies within the Spencer Gulf (**Section 9.4.1.2**)

Neither sound nor debris (functioning as a high-speed projectile) is expected to have any significant impact on marine life below the surface because of rapid attenuation of both forms of energy on entering seawater.

In respect to impacts on the Australian Sea Lion when above water, criteria presented by Southall et al. (2007) for noise impacts on pinnipeds above water suggest that there would be no temporary hearing loss for pinnipeds at sound pressure levels below 140 dB.

Therefore, no impact is expected on the hearing of the Australian Sea Lion on Liguanea Island.

Rockets launched from either launch station with Polar or Sun Synchronous trajectories are the most likely to pass close enough to Liguanea Island to present a risk of debris falling onto the island. No impacts are expected from suborbital rockets as they would not be launched with a trajectory near Liguanea Island. A detailed risk analysis which identifies modelling results for various launch failure scenarios is provided within the Appendices of **Appendix S**. The chance of interaction with Liguanea Island and the calculation of expected seal casualties in such an event is extremely low.

In order to avoid (where possible), manage and mitigate project risks and potential impacts during all phases of the Project mitigation measures have been proposed as set out in **Section 9.4.7**, **Table 20**. These proposed mitigation measures respond to Project specific issues and opportunities, address legislative requirements, and incorporate industry standard practice.

National Parks

The proposal does not impact on any National Park designated under the Act.

19.4.1.14 Marine Parks Act 2007

The *Marine Parks Act 2007* seeks to protect and conserve marine biological diversity and marine habitats in South Australia through the declaration and management of marine parks. The proposal will not have a direct impact on marine parks.

19.4.1.15 Landscape South Australia Act, 2019

Under the *Landscape South Australia Act 2019* (LSA Act) landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation. Under the LSA Act there are eight new regional Landscape SA boards (LSA boards), responsible for administering the LSA Act.

19.4.1.16 Dangerous Substances Act 1979 (SA)

The *Dangerous Substances Act 1979* and the *Dangerous Substances (Dangerous Goods Transport) Regulations 2008* regulates the keeping (retaining), handling, transport, conveyance, and disposal of dangerous substances defined under the Act.

The Act imposes a general duty to take reasonable care in relation to the use, handling etc. of dangerous substances with respect to health and safety, damage to property and environmental harm.

Southern Launch expects to be required to be licenced as defined by the Act. The determination of what fuels or oxidisers meet the threshold limits requiring licencing will occur during detailed design. Once this is determined, the licences will be obtained in order to ensure Southern Launch complies with the relevant legislation.

The Australian Code for the Transport of Dangerous Goods by Road and Rail sets out the operational and technical requirements in the management of dangerous goods transportation. The Code should be read in conjunction with the Regulations, which include information on licence requirements. The Code is commissioned by the National Transport Commission (NTC) Australian Code for the Transport of Dangerous Goods by Road and Rail (Edition 7.6, 2018).

Southern Launch must comply with the Act in keeping, using, transporting, and otherwise dealing with dangerous substances associated with the Project. The bulk storage and management of prescribed dangerous substances (including petroleum products associated with the Project) may need to be licensed under the Act.

19.4.2 Guidelines 17.3, 17.4

17.3.	*Provide information on the operational requirements to be met with regard to the authorised space activities under the Space (Launches and Returns) Act 2018 and compliance with any relevant national and international obligations.*

17.4.	*Identify any potential implications of the proposed launch complex for International Conventions and Agreements to which the Commonwealth of Australia is a party.*

19.4.2.1 Space Innovation and Growth Strategy (South Australia) Action Plan 2016

The 'Action Plan' seeks as a South Australian Government priority to "*capture the opportunities of space to grow our economy and create high value jobs of the future*". The Action Plan has three (3) interconnected pillars focussing on:

- growing South Australia's economy through space activity;
- invigorating South Australia's space innovation ecosystem; and
- engaging international cooperation with lead countries.

Arising from the three (3) interconnected pillars is the primary action, "*To increase awareness*", which is essential in the promotion of the South Australian space economy and to increase awareness of the space sector as an innovative area to invest and collaborate.

The Action Plan recognises that the South Australian Space Industry Centre will lead the State's space industry development efforts, offering focused and responsive support to drive the growth of South Australia's space sector and deliver key projects and facilities.

The proposal exhibits a high level of consistency with this strategy, being a directly envisaged development.

19.4.2.2 The Space (Launches and Returns) Act 2018

The *Space (Launches and Returns) Act 2018* (Cth) establishes a regulatory framework to reflect and facilitate the rapidly developing local space industry in Australia. The legislation attempts to strike a reasonable balance between encouraging innovation and entrepreneurship, and the need to ensure safety of space activities. The key provisions of the Act include:

- A launch facility licence is required to operate a launch facility on Australian soil.
- A launch permit is required to launch of a space object from Australia.
- Certain insurance and financial requirements must be met to grant a licence or permit.
- A framework for liability for damage caused by Australian space objects.
- A framework for the investigation of accidents.

The facility will be required to obtain all necessary permits and licences for a facility of this nature under *the Space (Launches and Returns) Act 2018* prior to initiating operations at the proposed facility. An application will be prepared which accords with the *Space (Launches and Returns) Rules 2019*, which outlines the required information to be provided and all licences and permits that must be obtained. This process will be undertaken once the approval under the *Development Act 1993* has been resolved.

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20 HAZARD RISKS

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20.0 HAZARD RISKS

20.1 Summary

Southern Launch has prepared an Emergency Management Plan dated 12 January 2021 and associated Risk Register (**Appendix AB**) in consultation with SA Police, the South Australian Country Fire Service, and the SA Ambulance Service. The plan identifies the potential risks associated with the establishment and operation of the proposed launch complex and forms the basis of the discussion and analysis set out below. The aim of the Whalers Way Emergency Management Plan (WWEMP) is to develop a timely and coordinated response and recovery strategy for emergencies at, or in the vicinity of, the Project Site.

The WWEMP details the arrangements for control, command and coordination of the response to emergency situations.

The following have been considered in preparation of the WWEMP:

- AS/NZS ISO 31000:2018 Risk Management.
- National Emergency Risk Assessment Guidelines 2014. (Australian Emergency Management Handbook Series book 10).
- National Emergency Risk Assessment Guidelines 2015. (Australian Emergency Management Handbook Series book 11).
- Civil Aviation Safety Authority, Safety Risk Management, SMS 3, 2014.

This WWEMP provides the base document for conducting a Risk Assessment. It adapts the most appropriate interpretations of risk management for use by Southern Launch when planning for the launch of rockets from Whalers Way facility. The main aim of the risk assessment process is to maintain staff and public safety throughout the core functions of the Southern Launch operation, including lead up, assembly, refuelling, launch, post launch activity and recovery.

Southern Launch will operate a generic risk assessment list. As the nature of launches vary (from type of rocket, fuel and launch type) modifications to the risk list may occur to meet the requirements of individual launches. The risk assessment process will be constantly overviewed with analysis of the generic list of risks; identification of new or different risks and potential treatment and mitigation actions; and further analysis of the residual risk level. The following summary outlines the steps of the Risk Assessment process.

The scope of this assessment relates to the construction and operational phases of the WWOLC facility. Matters of security which also include an element of hazard and risk are considered separately in **Section 21**.

20.2 Methodology

Southern Launch has performed a risk and hazard analysis using methodology set-out in AS/NZS ISO 31000:2009 adapted from the principles of AS/NZS ISO 31000:2018 Risk Management and the National Emergency risk Management Assessment Guidelines 2014 and 2015. It recognises that launch types may vary, and therefore, provides a generic list of risks, as identified by the staff of Southern Launch. The risk list will always be subject to ongoing review during the life of the Project.

The analysis determined the risk level for different contingencies based on the following factors:

- A severity rating of between 1 and 5; and
- A likelihood rating of between 1 and 5.

These figures combined to form a risk level for the various identified contingencies. Risk treatments were then applied to the analysis and a residual risk level was calculated. Prior to treatments being applied some risks had risk level scores of up to nine (9). Through the treatments and mitigations, the highest scores were reduced to a risk level of seven (7) or less. The treatments involved measures in the categories of engineering, administration, and elimination.

Having regard to the risk assessment, Southern Launch prepared an Emergency Management Plan based on the Australian Airports Association Airport Emergency Planning Template 2012.

The plan is based on the assumption that each agency with a statutory responsibility has in place appropriate supporting emergency procedures (or standard operating procedures) which deal with that agency's response in accordance with this plan.

The risk analysis and mitigation investigations have been undertaken having regard to the following relevant legislation, policies and strategies:

- *Space (Launches and Returns) Act 2018*.
- Space (Launches and Returns) (General) Rules 2019.
- Space (Launches and Returns) (High Power Rocket) Rules.
- State Emergency Management Plan - the State-based plan laying out the State level arrangements for hazard leaders, control agencies, functional support groups and plan frameworks.
- CFS regional Bushfire Management Plan – Eyre Peninsula and West Coast - outlines potential risk, mitigation strategies and critical areas, along with responsibilities for the Region. There is no critical infrastructure as a result of this activity.

- Zone Emergency Management Plan - formulated by the Zone Emergency Management Committee, the Plan is the key regional emergency management document focussing on high level risk. It confirms the South Australian Emergency Management arrangements and how the ESO's act as hazard leaders, control agencies, functional support groups and plan frameworks. This Plan is under review, but available internally to the SES and the Zone Emergency Management Committee. This supporting plan is not for release for security reasons and Southern Launch will comply with directions given under that plan.
- South Australian Police (SAPOL) Emergency Management Plan Eyre and Western Region - an internal SAPOL document and focusses on the tactical end of operations. It focusses on specific issues within the region. Southern Launch does not have access to this supporting plan and Southern Launch will comply with directions given by SAPOL, or other agencies, under that plan.
- SAPOL Air Transport Emergency Response Plan - an internal SAPOL document that focusses on airport emergency response and supports this plan through initial SAPOL reaction to an emergency, accident, or incident. Southern Launch does not have access to this supporting plan and Southern Launch will comply with directions given by SAPOL, or other agencies, under that plan.
- Australian Government Crisis Management Framework.
- Australian Government Disaster Response Plan (COMDISPLAN).
- Space Re-entry Debris Plan (AUSPREDPLAN).
- Aviation Disaster Response Plan - should an emergency occur involving civilian aircraft, the Aviation Disaster Plan informs Southern Launch how the information flow travels in response to such an aviation incident. This supporting plan also informs Southern Launch where the relevant authorities take responsibility depending on the circumstances. However, in the event of any incident, Southern Launch is directed to defer emergency management procedures to SAPOL and comply with any directions given by SAPOL.

20.3 Relevant EIS Guidelines

Assessment Requirement 4*: the construction and operation of a launch complex involves a range of general and specific risks.*

4.1. Undertake a risk assessment to quantify hazards and potential eventualities involved with operating the orbital launch complex.

4.2. Articulate the measures taken to mitigate the risks involved in launch operations. Detail the site emergency response strategies, specifically in the event of an explosion or incomplete launch. Quantify the impact of launch vehicle failure on the pad and throughout the trajectory.

4.3. Evaluate the fire risk and danger zone for the proposed launching complex and high voltage power lines. Document measures to minimise fire risk, resources, and training required and firefighting water sources.

4.4. Identify the publicly restricted buffer and exclusion zones for each launch pad. Describe the methodology to establish the various buffers and zones and the corresponding distances, including airspace and marine waters. Articulate the anticipated security measures to ensure public safety.

4.5. Outline any risks for workplace safety procedures which mitigate and manage the operational phase of the development ensuring all activities on site are described.

4.6. Describe any hazardous materials, including propellants, with reference to storage, use, handling, and disposal of these materials during construction and operation. Document the physical and operational mitigation strategies to contain propellants and eliminate spills.

4.7. Identify any potential effects on airfields and aircraft movements and consult with the Civil Aviation Safety Authority Australia and the District Council of Lower Eyre Peninsula (Port Lincoln Airport) about the requirements for development within the vicinity of airfields and on flightpaths.

4.8. Consider and quantify the impacts of the development on commercial shipping and aircraft routes during operations.

4.9. Consider and quantify the impacts of the development on commercial and recreational fishing areas during operations i.e., safety of commercial fishermen from falling debris and the need for temporary exclusion zones.

4.10. Describe the potential impacts on the Cathedral Rocks wind farm.

4.11. Describe the likelihood of bird and bat strike and the management of such a hazard.

4.12. Evaluate the wind recirculation zones and the corresponding potential impacts on operations.

4.13. Describe risk minimisation, management, and response requirements.

4.14. Identify the impact of coastal erosion due to expected sea level rise of 0.3 metres to 2050 and 1.0 metres to 2100.

20.4 Analysis

20.4.1 Guidelines 4.1, 4.3, 4.5, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.14

4.1. Undertake a risk assessment to quantify hazards and potential eventualities involved with operating the orbital launch complex.

4.3.	*Evaluate the fire risk and danger zone for the proposed launching complex and high voltage power lines. Document measures to minimise fire risk, resources, and training required and firefighting water sources.*
4.5.	*Outline any risks for workplace safety procedures which mitigate and manage the operational phase of the development ensuring all activities on site are described.*
4.7.	*Identify any potential effects on airfields and aircraft movements and consult with the Civil Aviation Safety Authority Australia and the District Council of Lower Eyre Peninsula (Port Lincoln Airport) about the requirements for development within the vicinity of airfields and on flightpath.*
4.8.	*Consider and quantify the impacts of the development on commercial shipping and aircraft routes during operations.*
4.9.	*Consider and quantify the impacts of the development on commercial and recreational fishing areas during operations i.e., safety of commercial fishermen from falling debris and the need for temporary exclusion zones.*
4.10.	*Describe the potential impacts on the Cathedral Rocks wind farm.*
4.11.	*Describe the likelihood of bird and bat strike and the management of such a hazard.*
4.12.	*Evaluate the wind recirculation zones and the corresponding potential impacts on operations.*
4.14.	*Identify the impact of coastal erosion due to expected sea level rise of 0.3 metres to 2050 and 1.0 metres to 2100.*

In response to Guideline 4.1 the methodology described in **Section 20.2** above outlines the risk assessment undertaken by Southern Launch, and which forms the basis of this section of the EIS.

The Whalers Way Launch Complex will operate in the same fashion as many other major industrial complexes in respect to risk and hazards associated with workplace safety, hazardous material storage and use, construction and operating machinery and equipment, transport and security. All of these activities should be considered as a standard workplace with appropriate standard operating procedures and relevant application of work standards as required by relevant State and Federal legislation.

There will be a heightened possibility during rocket testing and launching of potential incident unique to the nature of the facility and requiring special consideration in the identification and management of risks.

The risk and hazard analysis undertaken by Southern Launch identified and applied a severity and likelihood rating of between 1 and 5 for each risk rated.

The outputs of the analysis are summarised within the Whalers Way Risk Register in **Appendix AB**.

In summary, the risks identified in relation to the operation of the complex can be analysed in respect to the following three (3) operational areas:

- Range infrastructure and activities, e.g., the storage and handling of rockets, hazardous substances, operational accidents.
- Rocket launching and testing.
- Off-range activity, including on land, in the sea, and airspace.

Discussion of each of the primary risks and hazards follows.

20.4.1.1 Range Activities and Infrastructure

Risks and Hazards

The following risks and hazards have potential to occur as a result of the nature of the proposed launch complex:

- Rocket malfunction on the ground leading to explosion and/or fire.
- Damage to rocket launching infrastructure leading to rocket launch delay, failure, accident, or incorrect trajectory.
- Harm to persons, flora, and fauna from hazardous materials (fuels and oxidisers), accident and malfunction or natural events (e.g., weather or environment related).

Contributory Factors

The following events could contribute to the above hazards:

- Damage to rockets whilst in storage, assembly of transport.
- Damage to rockets as a result of weather conditions (e.g., storm, lightning) or natural disaster (e.g., earthquake).
- Damage to, or failure of, hazardous material storage and handling.

- Explosive fuel storage areas that could be one (1) or more of the following:
  - LOX, LNG, RP1, AVGAS, Helium, Nitrogen;
  - Explosive storage; and
  - Dangerous materials spills.
- Damage as a result of sabotage or misdemeanour (aggressive third-party interference).
- Electromagnetic interference.
- Un-detected damage during transport.
- Unlawful/unauthorised access to the site.
- Damage from fauna roaming the site.
- Vandalism and sabotage from outside sources or from within the organisation or facility users.
- Other accident.

Consequences

Potential consequences arising from the above hazards and risks could include:

- Damage to on-range property/assets.
- Damage to third-party assets both on and off range.
- Personal harm or loss of life both on and off range.
- Harm to flora or fauna.
- Disruption to off-range third-party activities (e.g., commercial fishing, primary production, recreational pursuits).

20.4.1.2 Rocket Launching (and Testing)

Risks and Hazards

The following risks and hazards have potential to occur arising from the act of launching rockets and testing rocket motors:

- Rocket malfunction on launch or test leading to explosion and/or fire.
- Harm to persons, flora and fauna from hazardous materials, accident and/or malfunction.
- Damage to third-party structures, infrastructure and assets on land surrounding the Project site.

Contributory Factors

The following events could contribute to the above hazards:

- Un-detected damage to rockets or rocket launching infrastructure or inputs.
- Weather conditions (e.g., storm, lightning) or natural disaster (e.g., earthquake) during launch.
- Sabotage or misdemeanour from outside sources or from within the organisation or facility users.
- Other accident.

Consequences

Potential consequences arising from the above hazards and risks could include:

- Damage to on-range property/assets.
- Damage to third-party assets both on and off range (including third-party property and assets, and public infrastructure.
- Personal harm or loss of life.
- Harm to flora or fauna.
- Damage to the environment (e.g., bushfire).

20.4.1.3 Off-range Activities

Risks and Hazards

The following risks and hazards have potential to occur arising from a rocket in flight:

- Rocket malfunction leading to explosion and/or crash.
- Wrong trajectory leading to a crash (on land or sea), collision, or return to earth in the wrong location.

Contributory Factors

The following events could contribute to the above hazards:

- Un-detected damage to rockets or rocket launching infrastructure or inputs.
- Weather conditions (e.g., storm, lightning) or natural disaster (e.g., earthquake) during launch and/or flight.
- Sabotage or misdemeanour from outside sources or from within the organisation or facility users.

- Third parties not abiding by exclusion zone requirements.
- Other accident.

Consequences

Potential consequences arising from the above hazards and risks could include:

- Damage to on-range property/assets.
- Damage to third-party assets.
- Personal harm or loss of life.
- Harm to flora or fauna.
- Harm to the environment.
- Disruption to off-range third-party activities (e.g., commercial fishing, aircraft flight paths, primary production, recreational pursuits).

20.4.1.4 Homesteads and Habitation and Other Activities

No dwellings or other static accommodation exists within the allotment containing the proposed WWOLC. The closest dwelling is located approximately 3.6 kilometres to the north-east of Launch Facility B outside of the boundary of the allotment containing the WWOLC.

Noting the proposed launch path is to the south and directly over the sea, the risk of impact on surrounding dwellings and property, public infrastructure and human life arising from a catastrophic event on the range or during a launch event is considered to be minimal.

The Cathedral Rocks windfarm is located with any anticipated exclusion zone. Accordingly, there is no anticipated risk to the continued and unfettered operation of the Cathedral Rocks windfarm as a result of the proposed development.

20.4.1.5 Airfields, Overflight and Marine Danger Areas

There will be no direct hazard or risk impact on any airfield resulting from the Project as there are no third-party airfields located on or immediately adjacent to the subject land or within the anticipated launch trajectory. The risk of indirect impact on airfields would be in common with any other building or structure that lies outside of the Project site that could be impacted from a catastrophic failure or accident, as noted in **Section 20.4.1.4** above.

Southern Launch is cognisant of the commercial and private aviation that can overfly the launch site, the launch vehicle flight paths and the projected exclusion zones (refer **Sections 6.6 and 6.7** for further information on the proposed flight paths and exclusion zones).

The requirement for exclusion zones will temporarily and spasmodically disrupt airline and shipping (both commercial and recreational) from time to time. The frequency and duration of exclusion zones is addressed in **Section 6.5** of this report. Provided exclusion zones are adhered to, there is no additional risk or hazard to third-party activities other than as already addressed herein.

Extensive planning and preparations have occurred with any airlines that may be impacted by the launch of rockets from the WWOLC. As part of any launch process, Notices to Airmen (NOTAMS) for air and Notice to Mariners (NOTMAR) for sea traffic will be issued. On the day of the launch Air Services Australia will be constantly contacted to update on launch times and other relevant factors, including weather and air traffic in the vicinity.

20.4.1.6 Other Risks Identified in the Guidelines

Bird and Bat Strikes

Bird and bat strikes are anticipated to be highly unlikely, but nevertheless possible. It is not expected that a bird or bat strike would materially impact on the operation of the rocket such that it would cause risk of failure.

Sea Level Rise and Erosion

The coastline around the site consists of tall cliffs on the interface between sea and land. The majority of these cliffs range from approximately 40 metres to 120 metres in height and comprises of highly friable material that is vulnerable to minor collapse. The seas around the site are subject to significant wave motion.

The Project Footprint has been sited to minimise risk posed by sea level rise. The Project Footprint is highly elevated above sea level and substantially setback from the coastline (refer to the proposal plan set within **Appendix M**). Due to the topography of the site and the siting of the Project Footprint, it is not considered the WWOLC project or any of its proposed operations are at risk of impact from expected sea level rise of 1.0 metre forecast to the year 2100 or related erosion of the coastal cliffs.

20.4.2 Guidelines 4.2, 4.6, 4.13

4.2.	*Articulate the measures taken to mitigate the risks involved in launch operations. Detail the site emergency response strategies, specifically in the event of an explosion or incomplete launch. Quantify the impact of launch vehicle failure on the pad and throughout the trajectory.*
4.6.	*Describe any hazardous materials, including propellants, with reference to storage, use, handling, and disposal of these materials during construction and operation. Document the physical and operational mitigation strategies to contain propellants and eliminate spills.*
4.13.	*Describe risk minimisation, management, and response requirements.*

20.4.2.1 Transport of Rockets and Components

Transportation of rocket components, including engines, bodies and payloads will arrive at the complex from their port of entry into Australia and then be transported to Whalers Way. and the transport will be overseen by Southern Launch and undertaken by third-party contracted licenced transport organisations. These companies are required to comply with all relevant transport and handling safety standards. Transport of components will comply with the contracted companies standard operating procedures and is therefore not required to be considered any further as part of the operational requirements of the launch complex.

20.4.2.2 On-site Operations

Southern Launch will adopt a range of safe working practices and procedures to be managed and implemented through separate management plans (outlined in the accompanying OEMP and CEMP (refer **Section 23**) embodying the following practices:

- Launch range facilities and infrastructure; all functions will be performed by duly qualified Southern Launch staff.
- The rocket (including assembly) and the launch pad/table/erector; functions will be worked on by qualified staff from the company owning the rocket.

Appropriately trained and certified Southern Launch staff will be present whenever the Whalers Way Orbital Launch Complex is operating:

- Prepared for a rocket launch.
- Rocket hardware is on the launch site.
- During preparation of the rocket.
- During firing of the rocket.
- During the recovery of spent rocket parts.
- During the decommissioning of the launch facility.

Southern Launch staff and the subcontractors employed will all have appropriate qualifications, skills experience in working with explosives and hazardous chemicals.

Only duly trained, certified and authorised Southern Launch staff will participate in the pre-launch, launch and payload recovery activities, unless there is an incident, accident or other emergency – then emergency services personnel and appropriate civilians may become involved.

Risk Mitigation

The following practices will be built into range operations to mitigate operational risks:

- The characteristics of the rocket propellants are well known and internationally accepted. Mandated protocols will be followed at all times by appropriately experienced and certified Southern Launch engineers and suitably qualified customer staff.
- Outside of the complex, transportation of the rocket components and explosive fuels/materials will be undertaken by third-party accredited and authorised explosive transportation experts.
- Movement of rocket components within the complex will be supervised by certified Southern Launch engineers.
- Rocket manufacturer staff will be on site to ensure correct assembly and completion of all pre-flight checks.
- Electromagnetic static and interference will be minimised, including positioning of any lightning conductors.
- Launch site security will be assured by Southern Launch staff.

Preparedness and Planning

Southern Launch has consulted with stakeholders and will continue to do so during the construction and operational phases of the Project. This has included circulation of the Whalers Way Orbital Launch Complex Emergency Management Plan to stakeholders. Adequate prior notice of launches will be given to all the above stakeholders. A dedicated first aid site will be located in the Range Operations Area, to cater for minor through to potentially larger injuries.

Any on and off range incident will be overseen in accordance with the Whalers Way Orbital Launch Complex Emergency Management Plan.

Due to the nature of rocket launches, local CFS units or trained Southern Launch personnel will be present leading up to and during any launch procedure. The presence of SAAS ambulance and staff stationed at the Range Operations Area as part of standard launch SOP will be required until trained Southern Launch employees can provide this service or until the risk of incidents is reduced through repeated launches.

Site Access

No unauthorised persons will be permitted to enter the range complex during launches. The range will be treated as '*airside*' in a manner similar to a civil airport. Fencing and signage will secure the perimeter of the complex site (refer **Section 4**). Leading up to and during any launch the two entrance gates will be staffed by security personnel. Boundary patrols by security staff will occur at other times as required, but in any case, on a random basis to ensure no encroachment onto the range complex by unauthorised persons.

Clearance of the range complex prior to a launch will be the responsibility of the ROM.

Exclusions zones within the complex will be determined prior to launch and advised to emergency service organisations (ESO) during launch planning. Previous advice to ESO's by the company will have indicated locations and size of exclusion zones for each particular launch. No travel further into the range complex beyond the staging areas will be permitted without clearance from the Range Operations Manager and the accompaniment of an RRO.

A staging area for emergency services is located at the car park of the Range Operations Area. A forward staging area may be required as determined by the incident and the requirements of the ESO's.

Launch Standby

A Launch Standby condition will be declared prior to when a launch is to be conducted or about to be conducted. As a standard operating precaution, the CFS will be notified of the launch. In initial launches, the CFS will be on standby at the range. In time Southern Launch staff will be trained in firefighting and HAZMAT and will be on site as standby.

Evacuation Procedures

Evacuation procedures are incorporated within the Whalers Way Orbital Launch Complex Emergency Management Plan (Appendix C of **Appendix AB)**.

Worker safety and comfort response

Due to the limited number of staff on the launch site at any one (1) time and the proximity to Port Lincoln, adequate water, shelter and sustenance is readily available should an environmental (e.g., extreme weather) response be required. The Whalers Way Launch Complex Bushfire Management Plan will also give guidance and direction regarding a bushfire event (refer **Section 20.9 below**).

Site and event specific dangers including venomous reptiles, sun and heat exposure will be catered for in accordance with Work Safe Regulations.

20.4.2.3 Emergency Management Response

Emergency Management Committee

The Emergency Management Committee will be established as per the *Manual of Standards Part 139 – Aerodromes in* s.10.7.1.1 for planning, training and quality control. The Emergency Management Committee has the authority to:

- ensure adequate planning for emergencies exist, including evacuation and bushfire management and any accident or incident as defined per Section 85 and 86 of the *Space (Launches and Returns) Act 2018*;

- approve plans;
- conduct exercises on the Range and elsewhere in compliance with appropriate legislation and regulation; and
- modify planning as required.

The Committee will comprise the following membership:

- CEO Southern Launch.
- Range Operations Manager, Southern Launch.
- Director Southern Launch.
- CFS – Representative.
- SAPOL – Representative.
- SAAS – Representative.
- SES – Representative.

In the event of an accident, incident or other emergency a Forward Command Post will be established at the Range Operations Area from which the control of the response to any incident will take place.

20.4.2.4 Full Emergency (Incident or Accident On, or Off Range)

A full emergency is defined as a condition when:

- there has been a confirmed accident, incident, or other emergency; or
- where there is a suspected accident, incident, or other emergency either before the launch, during the launch or beyond the launch, either within the confines of the range; or
- the near vicinity, either onshore or offshore that requires a response from emergency services.

If an emergency related incident occurs away from the launch range, but as a result of the activities that have occurred within the range complex, then local or state emergency plans are to be utilised. This does not preclude a response from either ESO's, or company trained personnel operating within the launch range. Any response by trained company personnel will be at the direction and requirement of responding ESO's. A full emergency can be declared by the ROM, the Southern Launch RSO, a senior company representative, or the senior emergency services operator present.

Control Agency

Initial control will be by the ROM and then the Control Authority will go to SAPOL with support from the ROM as required. (This is still determined to be an aircraft accident until otherwise determined by Parliament).

Support Agencies

As determined by the Police Forward Commander, or the senior CFS officer if fire/HAZMAT is the primary issue.

Activation

First response authorities are to:

- isolate the site;
- manage the site as a HAZMAT situation;
- secure a safe exclusion zone around the debris to contain it; and
- consider decontaminating and/or quarantining of members of the public, personnel and equipment that may have come into contact with the wreckage or debris or whom are within proximity of the impact site.

Exclusion or Dangerous Areas

As determined by responding ESO's and with advice of Southern Launch representatives and relevant investigators.

Release of Wreckage

Responsibility for the removal of wreckage or debris will lay with Southern Launch but will not occur until all investigations have been completed and custody of the items are released by the Australian Space Agency Investigator or other authorised investigation body.

Staging Areas

Established as required and at the direction of the Police Forward Commander with advice from Southern Launch representatives.

Coordinating Agency

SAPOL

Stand Down

Determined by the Police Forward Commander with support from the ROM.

20.4.2.5 Emergency Due to an Incident Over or On Water

This is defined as a condition when:

- there has been a confirmed incident or accident over water; or
- where there is a suspected incident or accident over water.

If an emergency related incident or accident occurs away from the launch range, but as a result of the activities that have occurred within the range complex, then local or state emergency plans are to be utilised. This does not preclude a response from emergency services operating within the launch range or from stand-by vessels offshore. An emergency over, or on, water can be declared by the ROM, the Southern Launch RSO, a senior company representative, or the senior emergency services operator present.

Control Agency

The control agency will be Southern Launch and then SAPOL. Considering local equipment availability, it may be that the SES will be the first responders at the offshore impact site. SAPOL will still remain as the control agency as per an aircraft accident in the State Emergency Management Plan. (SEMP).

Support Agencies

Southern Launch/SES/SAAS/CFS

Activation

Activation is through Southern Launch through to SAPOL.

First response authorities are to:

- Isolate the site from other vessels if any are present, taking into account any HAZMAT issues that may be present.
- Manage the site as a HAZMAT situation.
- As much as possible, secure a safe exclusion zone around the wreckage or debris.
- If the wreckage or debris has sunk, mark the spot using GPS markers.
- If there are dangerous projections mark the site with a buoy.
- Consider decontaminating and/or quarantining of members of the public, personnel and equipment that may have come into contact with the wreckage or debris or whom have been in close proximity to the impact site.

Exclusion of Dangerous Areas

Exclusion of dangerous areas will occur as determined by responding ESO's and with advice of Southern Launch representatives and Australian Space Agency Investigators.

Release of Wreckage

Responsibility for the removal of wreckage or debris will lay with Southern Launch but will not occur until all investigations have been completed and custody of the items are released by the Australian Space Agency Investigator or other authorised investigation body. Recovery of the wreckage or debris may not be possible due to it having sunk.

Staging Areas

As determined by the incident and advice from Southern Launch to SAPOL.

Coordinating Agency

SAPOL.

Stand Down

Determined by the Police Forward Commander in consultation with Southern Launch.

20.4.2.6 Sabotage: Bomb Threat (Including Buildings)

A bomb threat is a statement or action, real or implied, indicating interference, or intended interference with the range complex or equipment on the range complex, or range complex personnel by use of an explosive device designed with the intention of causing destruction or injury.

A bomb threat emergency may involve two (2) conditions:

- detection of a suspect device, or
- information received by telephone, email or other media.

It is the responsibility of Southern Launch to undertake any searches when a bomb threat or similar is received. Southern Launch Policy and Standard Operating Procedures for those searches and actions on finding a device are in place.

Control Agency

SAPOL.

Support Agencies

As required.

Activation

By Southern Launch through to SAPOL.

Staging Areas

As determined by the incident and advice from Southern Launch to SAPOL.

Coordinating Agency

SAPOL.

Stand Down

Determined by the Police Forward Commander in consultation with Southern Launch.

20.4.2.7 Natural Disaster

Definition

Serious disruption to a community or region with a rapid onset that threatens or causes death, injury or damage to property or the environment that requires significant and coordinated multiagency and community response. Hazards may include bushfire, earthquake, flood, storm, cyclone, storm surge, landslide, tsunami, meteorite strike, tornado.

Control Agency

As determined by the hazard.

Support Agencies

As determined by the hazard.

Activation

Southern Launch with coordination with the Control Agency.

Staging Areas

As documented in the Emergency Management Plan **Appendix AB**.

Coordinating Agency

SAPOL.

Stand Down

To be determined by Southern Launch in consultation with the Control Agency.

20.4.2.8 Medical Emergency Response Plan

A specific Medical Emergency Response Plan (MERP) has been prepared by Southern Launch outlining the protocols and response required for such an incident (refer Appendix D of the Emergency Management Plan **Appendix AB**).

The MERP is intended to provide general guidance to any major incident at the Launch Complex. Activation of the response to any major incident requires flexibility according to the specific incident requirements. Appropriately qualified decision makers employed by Southern Launch will exercise their expertise in providing direction and coordinate the response to specific incidents. The MERP does not acquit such decision makers of their accountability for their decisions or lack thereof. All staff will be made aware of, and ensure their readiness to respond to major incidents, as detailed in the MERP, appropriate to their position.

The MERP must be read in conjunction with the Southern Launch Emergency Management Plan Whalers Way Orbital Range Complex 2019. To ensure relevancy, the MERP will be periodically reviewed and updated to incorporate launch or site-specific roles and responsibilities of Southern Launch and affiliated staff.

The aim of the MERP is to:

- Identify potential risks inherent to operations at the Whalers Way Orbital Launch Complex.
- Effectively manage and prevent (where possible) any potential risks to avoid major incidents.
- Plan for the comprehensive response to, and recovery from, any major incident.
- Cater to the needs of minor medical incidents.

<u>Minor on Site Incident</u>

Southern Launch will provide a Workplace First Aid Officer who will be responsible for monitoring and maintaining first aid facilities onsite and administering first aid where required. A dedicated Southern Launch vehicle will be allocated to transport minor medical requirements to Port Lincoln.

<u>Major Incident</u>

For any major medical incident, injured persons will be resuscitated (if required) and stabilised prior to transfer (if required). Any patient requiring ongoing monitoring or further medical intervention will be transported to the Port Lincoln Hospital Emergency Department (Port Lincoln Hospital and Health Services) via SA Ambulance Service (SAAS).

20.4.2.9 Hazardous Material Incident

A hazardous material incident is an incident where a container (or a rocket) holding a hazardous material has been broken or is suspected of being broken. Hazardous materials may include radioactive material, biological substances and chemical materials.

Control Agency

CFS/MFS.

Support Agencies

As required.

Activation

Southern Launch.

Staging Areas

As determined by Southern Launch, taking into account safe approach and prevailing winds.

Coordinating Agency

SAPOL.

Stand Down

CFS/MFS in consultation with Southern Launch.

20.4.2.10 Incident Management Team

Southern Launch Complex will establish an Incident Management Team (IMT) consisting of the following positions:

- Range Operations Manager (ROM) or delegate.
- Range Safety Officer (RSO).
- Launch Facility Leaders (or delegate).

The IMT will have the authority to:

- In the case of Bushfire threat:
  - meet to determine activities for the Launch Complex the day before or on the morning dependent upon the Fire Danger Rating; and

- take action as per the Fire Danger Rating Guidelines and in line with South Australia Power Networks power restrictions.

- In the case of an active fire:
  - initiate the Active Fire Action Plan; and
  - initiate Stage 1 or 2 of the Evacuation Plan if required.
- In the case of an incident, accident or other emergency:
  - activate the MERP if required;
  - activate the Evacuation Plan if required; and
  - deal with any incident, accident or other emergency in accordance with these plans, but with the discretion to act in a logical manner where required, to ensure the preservation of life and the safety of personnel within the Launch Complex.

The specific tasks list for the IMT is outlined in section 4.10 of the Emergency Management Plan **Appendix AB**.

20.4.2.11 Bushfire Management Plan

The site is situated in a bushfire risk area:

- The site is within the Country Fire Service (CFS) Fire Ban District "*Eyre Peninsula & West Coast*".
- The site is **not** classed as a Bushfire Safe Place by the CFS.
- This area is covered by CFS Region 6.
- The current Fire Danger Season for this site is from 1 November through to 30 April.

A specific Bushfire Management Plan has been drafted and is included within the appendices to the Emergency Management Plan (**Appendix AB**). The site operates when required. Staff are present during the week and during lead up to launches.

Approach

This plan will outline what actions are to occur and what arrangements for seeking refuge, evacuation and relocation are available. It will also highlight potential issues to be considered when taking appropriate action in the event of a bushfire approaching the site The Southern Eyre Peninsula has been subjected to extensive bush fires throughout its occupied history. Common with most bushfires burning in the southern Eyre region, is a northerly wind that blows the fire in fingers to the south and the wind changes from the south-west in the early to mid-afternoon. This creates a fire that then turns towards the north-east and burns on a broad front. This was characteristic of the devastating 2005 Wangary fire which killed nine (9) people and devastated the southern Eyre region to the north of Port Lincoln and has been a common factor in most bush fires for the southern Eyre.

While there haven't been any significant fires recorded on the area of the Launch Complex or to the north of the site where traditionally the danger comes from since 1931, there have been fires in 2012 and 2015 to the north-east.

Considerations

The land to the north of the WWOLC contains thick vegetation with broad open areas of pasture beyond. There is limited access to any of the land north of the complex as it is restricted land owned by other parties including the Cathedral Rocks Wind Farm.

The possibility of bushfire associated with the activities on the Launch Complex create a different set of issues. Dependent upon the time of day and weather conditions during the fire danger period, the wind may blow from the south-west and to the north-east. If there is an ignition point on the southern tip of the peninsula (i.e., from the launch facility) a fire may be push to the north-east and threaten aspects of the Complex itself and even some of the dwellings to the north-east. Adequate firefighting capacity, along with safe work practices on the site of the WWOLC along with quick reaction to an emergency should assist overcome some of these hazards.

20.4.2.12 Emergency Evacuation Plan

Southern Launch have developed an Emergency Evacuation Plan (Appendix C to the Emergency Management Plan **Appendix AB**. To ensure the safe staged evacuation of the Whalers Way Orbital Range Complex.

The Plan outlines:

- key personnel relative to the plan and responsibilities;
- key areas of the Whalers Way Orbital Range Complex;
- potential hazards;
- key triggers for the implementation of the Evacuation Plan;
- different levels of evacuation for different events;
- the stages to be followed in the event of an evacuation, including assembly points, shelter areas, relevant access routes;
- processes involved for accountability of all staff and visitors; and
- training and education.

20.4.3 Guideline 4.4

4.4.	*Identify the publicly restricted buffer and exclusion zones for each launch pad. Describe the methodology to establish the various buffers and zones and the corresponding distances, including airspace and marine waters. Articulate the anticipated security measures to ensure public safety.*

Southern Launch will be operating two (2) launch facilities at Whalers Way. As such, there is a requirement to have two (2) separate safety exclusions zones (refer **Section 5.6**). Analysis using the International Ammunition Technical Guideline (IATG 01.80) has been undertaken assuming detonation of the rocket whilst on the launch rail. The dimensions of the safety exclusions zone will be calculated by Southern Launch on a case-by-case basis depending on the launch vehicle type and size.

Launch Facility A will launch larger rockets (up to 100 tonnes) requiring a safety exclusion zone of up to 3,000 metres, while Launch facility B will be launching smaller rockets (up to 60 tonnes) and will require a smaller safety exclusion zone of up to 2,100 metres. It should be noted that these are calculated on the largest possible rockets capable of being launched from each site. For most launches, the safety requirements will be less, and in many cases significantly less, than these worst-case figures. When these safety exclusion zones are activated, no unauthorised personnel will be allowed to enter or be upon the land encompassed by the safety exclusion zone.

All essential range personnel operating within the safety exclusion zone during a launch process will be relocated to the Range Control Facility (Site E), which is located outside of the safety exclusion zone. Advice from the ROM or the RSO regarding safety exclusion zones will be advised on entry to the complex.

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21 SECURITY & SAFETY

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21.0 SECURITY AND SAFETY

21.1 Summary

Security and safety issues have been investigated as set out in the Protective Security Threat Assessment and Security Considerations, Southern Launch Whaler's Way Orbital Launch Complex, Spartica Australia Pty Ltd, August 2019 (**Appendix AB** – note: this Appendix is redacted from the public version of the EIS for security reasons).

The assessment focuses on the threats anticipated for the space sector within Australia, crime typical to the Port Lincoln area, and threats associated with critical infrastructure within the transport sector. The threats more likely to be seen at the facility include trespass, theft, sabotage, communicated threat/hoax, espionage and hostile reconnaissance.

The assessment considers potential vulnerabilities and offers security considerations to control threats in respect to the physical, technological, and human domains.

The recommendations of the assessment have been incorporated into many of the physical design features of the facility, and the development of the various operational, security and safety procedures as detailed elsewhere in this EIS.

21.2 Methodology

Spartica Australia Pty Ltd has prepared the Protective Security Threat Assessment and Security Considerations report with due diligence using contemporary intelligence, methodologies, established texts, international standards, blast and crash testing research material to provide recommendations in relation to the project. This security and safety assessment includes the following elements:

- Review proposal plans and other relevant documentation for the WWOLC.
- Review of relevant National Guidelines for the protection of critical infrastructure from terrorism in the context of the launch facility.
- Identify assets critical to the function of the launch facility.
- Identify and analyse relevant threats specific to critical assets.
- Report on findings and recommendations for security considerations.

The methodology adopted for the assessment included the following four steps:

- Asset identification.
- Identification of potential threats.
- Assessment of threats.
- Identification of threat controls.

The threat controls seek to ensure that appropriate security measures are recommended to manage the threat to a level acceptable to all stakeholders, whilst not adversely impacting safety standards or essential operational requirements for the complex.

21.3 Relevant EIS Guidelines

***Assessment Requirement 11**: The proposal development requires a level of security which complies with National requirements and extends across land, water and airspace.*

11.1. Where appropriate, provide information on the proposed physical equipment and structures, personnel, and procedural security measures for the launch complex for construction and operational phases.

11.2. Identify the safety and security measures anticipated to be developed for the publicly accessible areas, including any roads, or viewing locations. Articulate the anticipated security measures to ensure public safety.

21.4 Analysis

21.4.1 Guidelines 11.1, 11.2

11.1. Where appropriate, provide information on the proposed physical equipment and structures, personnel, and procedural security measures for the launch complex for construction and operational phases.

11.2. Identify the safety and security measures anticipated to be developed for the publicly accessible areas, including any roads, or viewing locations. Articulate the anticipated security measures to ensure public safety.

21.4.1.1 Threat Assessment Methodology

The Security Threat Assessment and Security Considerations analysis identifies the more probable threat type and attractive target locations of the Whaler's Way Launch complex that are most likely to be at risk from a security incident if an attack were to occur.

The assessment focussed on the protection of the following proposed assets:

- Range Control Site E facilities.
- Launch Site A infrastructure.
- Launch Site B infrastructure.
- Electricity Substation and transformers.
- Infrastructure Site D facilities.
- Communications.
- SCADA/Process Control System.

The assessment focussed on the terrorism, espionage and generic threats typical to commercial transport related critical infrastructure assets, including the following:

- Arson.
- Armed Attacker.
- Communicated Threat / Hoax.
- Cyber.
- Espionage.
- Hostile reconnaissance.
- Hostile Vehicle.
- Improvised Explosive Devices.
- Sabotage.
- Theft.
- Trespass.

Persons most likely to form a threat (threat actors) were identified to include:

- Persons acting alone.
- Terrorist or criminal groups.
- Foreign intelligence services.
- Trusted employees and contractors (manipulated by an external threat actor).
- Unintentional actors (negligence, recklessness).

The assessment determined the threat level for each assessed threat as per the Australian Standard 167:2006 Security Risk Management Handbook in relation to both the construction and operational phases of the project (Section 5.0 of **Appendix AC**). The threat level is determined by rating each assessed threat against the criteria set out in the handbook to a number out of 10.

The criteria consist of:

- Intent.
- Capability.
- Attractiveness and visibility.
- Vulnerability and opportunity.

The resulting figures from each criterion are added together to form the total threat level number out of 100 for the various potential threats. Depending on where the resulting number sits within 0 to 100 determines the likelihood rating for that threat, as follows:

- 0 – 30 = Low.
- 31 – 60 = Medium.
- 61 – 80 = High.
- 81 – 100 = Very high.

The results of the assessment identified the likelihood of most threats to be in the medium and low range of probability, with four in the high range of probability during the operational phase of the project. None of the identified threats were in the very high probability range. The result of the analysis for the construction and operational phases are summarised in **Table 21.1** and **Table 21.2** respectively.

Table 21.2: Construction Phase Threat Level Assessment Rating (Spartica 2020, pp. 87-88).

THREAT	THREAT LEVEL TOTAL/100	LIKELIHOOD RATING
Armed Attacker	34	Medium
Arson	42	Medium
Communicated Threat/Hoax	55	Medium
Espionage	46	Medium
Hostile Reconnaissance	44	Medium
Hostile Vehicle	34	Medium
Person Borne Improvised Explosive Device (PBIED)	28	Low
Emplaced IED	34	Medium
Sabotage	49	Medium
Theft	51	Medium
Trespass	55	Medium
Weaponised Drone IED or IID	29	Low
Vehicle Borne Improvised Explosive Device (VBIED)	27	Low

Table 21.3: Operational Phase Threat Level Assessment Rating (Spartica 2020, pp. 87-88).

THREAT	THREAT LEVEL TOTAL/100	LIKELIHOOD RATING
Armed Attacker	49	Medium
Arson	57	Medium
Communicated Threat/Hoax	61	High
Espionage	68	High
Hostile Reconnaissance	62	High
Hostile Vehicle	47	Medium
Person Borne Improvised Explosive Device (PBIED)	45	Medium
Emplaced IED	49	Medium
Sabotage	59	Medium
Theft	60	Medium
Trespass	62	High
Weaponised Drone IED or IID	47	Medium
Vehicle Borne Improvised Explosive Device (VBIED)	41	Medium

Table 21.3 summarises the likelihood of the identified threat actors in targeting the facility and assists in determining the appropriate security responses.

Table 21.3: Significant Threats.

CATEGORY	THREAT ACTOR	MOTIVATION	LIKELIHOOD
Fixated Person	- Extreme ideological person - Grievance fuelled person - Mental health affected person	- Activism - Terrorism - Revenge - Disruption - Public attention	Less likely
Foreign Intelligence Service	- State actor - State backed organisation	- Theft of information - Cyber attack - Espionage - Sabotage	Likely
Trusted Insider	- Disaffected employee - Disaffected contractor	- Theft of information - Malicious damage - Sabotage - Disruption	Likely

CATEGORY	THREAT ACTOR	MOTIVATION	LIKELIHOOD
Lawbreaker	- Criminal - Negligent or reckless person	- Greed / theft - Vandalism - Assault - Reckless or dangerous act	Likely

21.4.1.2 Threat Intent and Capability Analysis

Activism and Protests

In relation to "*activism*" the restriction of public access to the site, which is a popular tourist location, as well as perceived environmental impacts may inspire activists (Local Community and Environmentalist) to protest during the construction or operational phases of the project.

To minimise the risk of protests from issue motivated groups, Southern Launch will develop a communication strategy prior to closing public access to the peninsula. This will include engagement with local information services and local media inform the broader community of pending operations.

This may also include consultation with Local Government to establish and promote viewing sites, outside the launch facility's perimeter, and in public places, where people can safely view rocket launches.

Southern Launch's strong engagement and consultation with the Port Lincoln fishing community is also critical in respect to operating procedures for the establishment of the hazard zones out to sea that minimises the impact on the fishing community. Southern Launch will adhere to all requirements under the *Harbours and Navigation Act 1993* and *Navigation Act 2012* in respect to Notices to Mariners (NOTMARS).

Hostile Threats

The threats more likely to be seen at the facility are; trespass, theft, sabotage, communicated threat/hoax, espionage and hostile reconnaissance.

The Protective Security assessment (**Appendix AC**) found little historical evidence of high impact attacks targeting spaceports globally. The risk of an attack on the WWOLC facility causing large scale damage and disruption during the construction, and or operational phase of the project is currently assessed as low.

Employees and Contractors

Insider threats can be difficult to detect without a comprehensive management program, inclusive of personnel risk assessments together with a mature workforce security culture. The threat of a trusted insider has been assessed as likely.

Foreign Intelligence Service (FIS)

Commercial espionage by State based or sponsored actors can be highly sophisticated and difficult to detect. FIS typically use a range of tactics from human sources, technical (listening devices) and cyber to collect/steal sensitive information about company operations, corporate health and research undertaken. This can also involve sabotage of ICT network systems to disrupt business operations. These attacks can be motivated by investment opportunities and/or business negotiations for large contracts or general operational activities and information.

There has been evidence of recent cyber-attacks from state-based actors on Australian government and commercial businesses in Australia. The current threat of foreign state espionage to the project is assessed as likely.

Lawbreaker

Lawbreakers can be criminals or people whose actions are reckless and dangerous. Criminal activity is typically motivated by financial greed, grievance or notoriety. Construction and demolition zones both nationally and internationally have historically attracted criminal activity in terms of opportunistic theft of plant equipment, appliances and scrap recyclable metals or other materials. Part of the attraction of trespass and theft at these sites is partly associated with the perceived low probability of being detected, particularly during the hours of darkness.

The threat of trespass and theft during the construction phase of the facility is assessed as likely.

21.4.1.3 Security Considerations - Infrastructure

Critical Infrastructure

National security requirements are built into the Protective Security Policy Framework (PSPF). This framework applies to non-corporate Commonwealth entities and assets subject to the *Public Governance, Performance and Accountability Act 2013*. Some State and Territory government entities have also aligned with parts of the Framework.

Southern Launch and the WWOLC is a privately-owned corporation and therefore fall outside the scope and requirements of the PSPF.

The Australian Government defines critical infrastructure (CI) as:

> *'Those physical facilities, supply chains, information technologies and communication networks which, if destroyed, degraded or rendered unavailable for an extended period, would significantly impact the social or economic wellbeing of the nation or affect Australia's ability to conduct national defence and ensure national security.'*

The WWOLC will be a commercially operated business providing a unique satellite launching service to companies nationally and internationally. The importance of the facility to the nation or indeed South Australia is yet to be fully assessed by the relevant government agencies.

The Australian Government's commitment in developing capability within the space sector will likely place this physical facility, once established, as significantly critical to the social and economic wellbeing of the nation.

The *Commonwealth Security of Critical Infrastructure Act 2018* sets out specific requirements for owners and operators of certain critical infrastructure sectors, namely assets that fall within the following relevant industries:

- Power/Electricity.
- Gas.
- Ports.
- Water.
- An industry prescribed by the rules under the Act.

The primary function of the WWOLC facility does not appear to fall within the *'relevant industry'* and therefore may not be subject to the Act if it is later accepted as national critical infrastructure unless specifically prescribed.

The National Guidelines for the protection of Critical Infrastructure from Terrorism are designed to provide guidance for Commonwealth, State and Territory governments, police and owners and operators of CI assets.

Critical infrastructure falls within the following sectoral groups:

- Key government services.
- Banking and Finance.
- Communications.
- Energy.
- Health.
- Food & grocery.
- Water.
- Transport.

The transport sector includes air, land and sea transport. If accepted as critical infrastructure, WWOLC would likely come under the 'transport' sector group.

The key protective principle of the guidelines focuses on prevention, preparedness, response and recovery from an attack or incident. The document provides responsibilities that are expected from owners and operators of critical infrastructure. This includes:

- Maintain an awareness of their operating environment.
- Provide adequate security for their assets, based on threat and risk.
- Actively apply risk management techniques to their planning processes.
- Conduct regular reviews of risk assessments and security, emergency and contingency plans.
- Report any incidents or suspicious activity to State or Territory police.
- Develop and regularly review business continuity plans, including identifying interdependencies.
- Conduct training and exercise their security, emergency management and contingency plans.
- Participate in government exercises to assist in harmonising prevention, response and recovery arrangements with relevant controlling agencies.

These principles are informative to the Southern Launch facility in developing a security plan.

Assets Requiring Protection

Security protection will be required for the following proposed assets:

- Launch Sites A and B.
- The two launch pads will be designed to carry the largest rockets, up to 100 tonnes. The facility will contain a range of fuels and hazardous materials that support the launch vehicle. Range Control Building (Site E):
    - the Range Control building will house the administrative functions of the site providing direct control of all operations across the launch facility and is therefore assessed as a critical asset to the operational function of the complex;
    - in the event the range control building is disrupted or destroyed Southern Launch can deploy a portable control centre to the site with full functionality;
    - based on the design plans, the Range Control Building will be bounded by a perimeter fence with gates installed at the entry and exit driveways. Collectively, this shall provide a reasonable level of access control for the building and its critical utilities; and
    - when selecting the perimeter fence, consideration will be given to Australian Standard 1725.1 - 2010 chain link fabric security fences and gates as a baseline.

- Site Services infrastructure:
  - electricity generators, fuel storage, potable water, fire-fighting water and infrastructure, waste treatment and disposal.
- Communications infrastructure:
  - internet and other telecommunication feeds into the facility would be critical to the functional operation of the facility; and
  - threats include equipment failure, accident and sabotage.

21.4.1.4 Security Considerations - Operational Requirements

The facility will only operate at full capacity leading up to and during launches. Outside of these times, the complex will be largely unattended other than by operational and maintenance staff. Nevertheless, full-time security guard presence on site will be considered as part of the operational and security threat environment once the facility has been established.

Staffing of critical points, such as the primary access gate and northern, secondary access areas will be key to maintaining the integrity of the complex. Operating the complex in a similar fashion to an airport "*airside*" during leading up to and during launches and subsequently during run down will enhance the secure environment.

Given the remoteness of the location, there is a real risk of vandalism and break and enter thefts occurring at the Range Control Building, particularly if the building is unoccupied for periods of time. The perimeter fence line serves as a deterrent and delay mechanism but will not necessarily stop a determined attacker. The installation of CCTV cameras that capture all four sides of the building and fence line, together with warning signage, will provide further deterrence and detection capability against these types of threats.

Cameras play an important role within the security domain. They provide remote visual monitoring of the security or operational environment of the facility and act as a detection and verification system.

The selection, placement and number of CCTV cameras will be informed by a comprehensive assessment of the operational and security requirements for the facility.

Public Access

The site is a popular tourist attraction for sightseeing and camping. The site forms part of a larger privately owned property where public access is possible via a permit system. Access into the peninsula is provided by Whaler's Way Road, which intersects with Right Whale Road near the lookout. Access to this road is controlled by a locked metal swing gate which is adjacent to an old, abandoned gatehouse.

Unmanaged public access to the site would:

- provide an unacceptable threat to maintaining security of the facility;
- create an unacceptable risk to public safety during both construction and operational phases of the development (accident, danger, dangerous goods, etc);
- the ability for hostile individuals to surveil and/or access launch site or other areas to commit sabotage, espionage, theft or vandalism (high threat); and
- the risk that campers could be in hazard zones without the knowledge of Southern Launch during a launch. This could lead to fatalities or serious injuries if a launch vehicle were to catastrophically fail on the launch pad (medium risk). Unregulated public access will need to be prohibited once construction of the site commences.

The boundary of the leased site, if not physically demarcated, will exist simply as a line on a map with no physical barrier to unauthorised access. This presents a security risk to Southern Launch where members of the public may unknowingly cross onto the site into danger.

If it is possible to extend the leased area to the full extent if the allotment, an existing stock fence on the northern boundary of the allotment will be retained and signage placed along the entire length of the fence prohibiting access. All access gates will be secured.

If the lease cannot be extended, or can be extended to include the exclusion zones, as an alternative signage stating no entry may be placed on star pickets periodically along the boundary.

The coastline around the site consists of tall cliffs on the interface between sea and land. The majority of these cliffs range from approximately 40 metres to 120 metres in height. The seas around the site are subject to significant wave motion. These features provide a significant barrier to individuals accessing the site from the sea. Nevertheless, signage as recommended above will be contemplated for inclusion in areas of potential public access from the coast.

Safety Exclusion Zones

Safety exclusion zones are required to exclude the public and commercial operators (fishing and aviation) from areas of potential danger during the launch, flight and return to earth of spent rocket parts.

This topic is discussed in more detail in relation to launch operation procedures and hazard and risks in **Section 20**. Detailed discussion in relation to spent rocket parts is outlined in **Section 22**.

21.4.1.5 Security Recommendations

The protective security regime operates over the three security domains of physical, technological and human. These domains complement each other providing a layered approach to the security of a site as part of an overarching system.

The following security considerations have been provided to Southern Launch to consider when reviewing security controls across the physical, technological and human domains identified below.

Most of the recommendations below are reflected in the current design and layout of the facility and incorporated with the construction and operational procedures outlined in **Section 23** of this report. Recommendations that have not been incorporated into the design and layout at the present stage are under further consideration and may be adopted and incorporated at a later stage in the detailed design for the project.

Physical Domain

- If possible, extend the boundary of the current site lease to include the area of the exclusion zone. Further increase, if possible, to the northern stock fence as identified in this document, to ensure:
  - Southern Launch to more effectively control who enters the safety hazard zones which is vital to public safety;
  - the current stock fence used as a physical boundary line and barrier;
  - a reduction of the risk to members of the general public entering the site without realizing it; and
  - the additional land forms a greater level of protection to the launch sites as hostile, or issue motivated actors will have a significantly larger distance to cover before accessing those sites. This provides more time and distance for unwanted actors to be detected and intercepted.
- Consider the erection of signage along Right Whale Road and the entrance of Whaler's Way Road that details the change in public access arrangements for Whaler's Way peninsula and dates when public access is to be limited.
- Clear deterrent signage should be erected at the boundary of the leased area, warning trespassing prohibited in areas where pedestrian access may be likely.
- Upgrade the driveway gate and locking system at the entrance to Whalers Way Road, including the placement of 'no public access' warning signage on the gate at times when access is restricted.
- Consider the installation of a security rated driveway gate for entrance and exit driveways of the range control centre, including signage that indicates the area is under 24/7 CCTV surveillance.

- Consider the feasibility of increasing artificial lighting around the range control centre to increase natural surveillance and CCTV imagery during hours of darkness.
- All external access doors at the centre should be security rated with a minimum of three hinge points, not accessible from outside. The doors should also have anti-thrust plates installed on the external face of the door, overlapping the edge and covering the gap between the door and frame to prevent tampering of the latch or bolt.
- Instal security fencing that encapsulates the Launch Sites A and B and Range Control Facility as per the design plans. As a minimum, the security fencing should be consistent with Australian Standard 1725, chain link fabric fence with concertina razor wire capping and a total height no less than 2.4 metres.
- Signage be erected to notify the general public that there is no entry. This can be simple signs on star pickets placed periodically along the boundary.

Technological Domain

- Consider the installation of CCTV cameras to capture all sides of the range control centre, perimeter fence and critical utilities.
- Consider the installation of SCEC endorsed passive infrared volumetric detection sensors at entry points inside the range control centre, the server room and the two launch platform workshops. The sensors should be integrated with an active alarm system that sends alerts to a security monitoring service, or guard on site.
- Consider the installation of CCTV cameras across launch platform facilities A and B to capture all critical areas and potential access points. An assessment on the operational requirements in terms of the number and type of cameras should be conducted.
- Consider the installation of lockable SCEC endorsed pits for telecommunication cable and/or fibre optic runs.

Human Domain

- Public access to the Whaler's Way peninsula managed with consideration to security and safety obligations upon the commencement of the construction phase. Continued management of public access should continue while Whaler's Way is under license/lease by Southern Launch.
- Consider the establishment of a Trusted Insider Program that integrates with Southern Launch's current People and Culture policies. The program should be designed to manage the threat of trusted insiders and include; the conduct of personnel risk assessments, staff awareness campaigns, supervisor and manager training workshops, together with enhancements of current pre-employment screening and employee exit policies.

- Consider developing an awareness training program for key management staff on the threat of espionage and tactics used to steal confidential information by foreign intelligence services and or State sponsored actors.
- Consider the development of a Facility Security Plan that includes the following:
  - roles and responsibilities of security officers;
  - security patrols of the site during the construction and operational phases, to ensure no unauthorised persons trespassing;
  - auditing and recording the physical condition of security fences, the operation of CCTV cameras, access doors, vehicle gates, daisy chain locks, door held open alarms and functionality of infrared volumetric detection room sensors. The audits should be timetabled daily, weekly, monthly or quarterly in preference of importance and threat escalation;
  - identify positions responsible (portfolio holders) for auditing and review;
  - maintain a maintenance schedule for repairs of security equipment and infrastructure nominating persons responsible and completion dates.
  - install and record any supplementary security arrangements required while existing security infrastructure is out of service, or its integrity significantly compromised; and
  - security posturing escalation and de-escalation subplan for times of increased threat and or during rocket launching operations.
- Consider incorporating into the Site Security Plan, the conduct of regular audits of access card usage to monitor conflicts or unusual access behaviour during times of increased threat.
- Consider adopting the Australian Signals Directorate guidance on best practice to mitigate against cyber threats. Visit: https://www.cyber.gov.au/publications/strategies-to-mitigate-cyber-security-incidents for more information on the Australian Signals Directorate's top:
  - mitigation strategies to prevent malware delivery and execution;
  - mitigation strategies to limit Cyber Security Incidents;
  - mitigation strategy to detect cyber security incidents and respond;
  - mitigation strategy to recover data and system availability; and
  - mitigation strategy to prevent malicious insiders.
- Consider implementing an awareness campaign for all staff on the threat of phishing emails that are directed toward staff from well-crafted and purportedly legitimate sources.
- Consider incorporating the Australian & New Zealand Counter Terrorism Committee (ANZCTC) Active Armed Offender Guidelines for Crowded Places as part of the site security plan, including lockdown arrangements.

- That Southern Launch conduct regular discussion exercises on specific security threats and emergency management incidents, to test the effectiveness of their preparation, prevention, response and recovery arrangements.
- Consider incorporating as part of the site security plan, the procedure of White Level Inspections (WLI) and Hot Alerts. This procedure requires staff to actively monitor for and identify any suspicious packages within the workplace during their shift. The procedure should also include the management of a suspicious package and reporting escalation. Include within the Range Control Standard Operating Procedures and / or site security plan, the requirement of a comprehensive patrol of the launch site by security officers, to ensure no trespassers are on the property before the authorisation is given to proceed with the launch.

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22 SPENT (DISCARDED) LAUNCH VEHICLE MANAGEMENT

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22.0 SPENT (DISCARDED) LAUNCH VEHICLE MANAGEMENT

22.1 Summary

The proposal will result in components from launch vehicles landing in the sea under two (2) flight scenarios, being:

- successful launches; and
- unsuccessful launches.

In the normal event of a successful launch, as the fuel and oxidiser are expended, each stage is ejected from the launch vehicle in sequence at varying distances down range. The ejected stage falls to earth and lands in the ocean.

In the event of an unsuccessful launch the launch vehicle fails during flight resulting in the vehicle exploding or falling to earth in an unpowered and uncontrolled manner. In the event of an explosion, fuel and oxidiser would likely burn up during decent and pieces of the vehicle would fall to the ocean over a large area. In the event of an uncontrolled descent, the vehicle would strike the ocean as a single unit.

The nature of the vehicles proposed to be launched from the facility means that recovery of spent vehicles from the ocean is not practical or viable, and does not, therefore comprise part of the proposal. Whilst recovery of components of space vehicles has occurred for many decades (such as recovery of solid rocket boosters from the space shuttle from the ocean and, more recently, automated recovery of components of SpaceX vehicles, such recovery is only viable for very expensive components of heavy launch systems.

The spent vehicles will therefore strike the ocean, and the debris will remain in the marine environment. This has been the approach for space launches since the inception of the space industry and well-established international law and protocols exist for dealing with spent space launch materials.

22.2 Methodology

The Space Industry in New Zealand has developed rapidly over the past decade, including the establishment of the Rocket Lab facility on the Mahia Peninsula of the eastern North Island.

In 2017 the New Zealand Ministry of the Environment commissioned a study to investigate the ecological risk of the impact of debris from space launches on the marine environment (NIWA, 2017). Whilst this study assessed the ecological impact on the benthic environment around New Zealand, it contains consideration of the specific risks of the impact of the components of launch vehicles similar in nature to those proposed to be utilised at the WWOLC.

The NIWA report undertook a detailed risk assessment for the components entering the marine environment and concluded that the risk to all ecosystem components of each environmental class from the activities considered was low. The risk scores were driven principally by consequence scores of zero or one (1), representing negligible or minor consequence, respectively.

The NIWA report has been considered in more detail in the Marine Ecological Assessment contained in **Appendix S**.

The risks relating to spent vehicles entering the ocean exists over a very large area, meaning that whilst the localised consequences of an event may be greater, the level of risk across the entire area is low.

The specific impacts of more localised risks of the proposed development are addressed separately in **Section 9** (Effect on Native Fauna) and **Section 20** (Hazard Risks) and considered in detailed in the Marine Ecological Assessment contained in **Appendix S**.

22.3 Relevant EIS Guidelines

Assessment Requirement 13: *The proposed development has the potential to cause spent (discarded) launch vehicles to accumulate on the seafloor and coastlines.*

13.1 *Detail how spent (discarded) launch vehicles and associated debris will be managed, including any retrieval of spent vehicles. Document the likely impacts on the adjacent Marine Park. Take account of State, National and International legal requirements, agreements and conventions (e.g. Commonwealth Environment Protection (Sea Dumping) Act 1981, London protocol etc.).*

13.2 *Identify how the movement and accumulation of spent (discarded) launch vehicles and associated debris will be monitored, including any tracking.*

13.3 *Outline how potential environmental impacts will be monitored, associated with spent (discarded) launch vehicles (including any impacts at the species and ecosystem level) and associated debris.*

13.4 *Propose operational management strategies to minimise potential environmental impacts of spent (discarded) launch vehicles and associated debris, including any retrieval of spent launch vehicles/debris that may wash up onto coastlines.*

22.4 Analysis

22.4.1 Guidelines 13.1, 13.2, 13.3, 13.4

13.1	*Detail how spent (discarded) launch vehicles and associated debris will be managed, including any retrieval of spent vehicles. Document the likely impacts on the adjacent Marine Park. Take account of State, National and International legal requirements, agreements and conventions (e.g. Commonwealth Environment Protection (Sea Dumping) Act 1981, London protocol etc.).*
13.2	*Identify how the movement and accumulation of spent (discarded) launch vehicles and associated debris will be monitored, including any tracking.*
13.3	*Outline how potential environmental impacts will be monitored, associated with spent (discarded) launch vehicles (including any impacts at the species and ecosystem level) and associated debris.*
13.4	*Propose operational management strategies to minimise potential environmental impacts of spent (discarded) launch vehicles and associated debris, including any retrieval of spent launch vehicles/debris that may wash up onto coastlines.*

22.4.1.1 Sea Dumping Scenarios

Components of the launch vehicle will land in the sea under two (2) flight scenarios.

The first being the normal event of a successful launch, as the fuel and oxidiser are expended, each stage is ejected from the launch vehicle in sequence at varying distances down range. The ejected stage falls to earth and lands in the ocean. Launch vehicle components could potentially fall into international waters (greater the 250 nautical miles (NM) downrange), in the Exclusive Economic Zone (EEZ) (greater than 12NM and less than 250NM downrange) and/or state waters (less than 12NM downrange – this only applies to sub orbital launches).

The second being an unsuccessful launch where the launch vehicle fails during flight resulting in the vehicle exploding or falling to earth in an unpowered and/or uncontrolled manner. In the event of an explosion, fuel and oxidiser would likely burn up during decent and pieces of the vehicle would fall to the ocean over a large area. In the event of an uncontrolled descent without explosion, the vehicle would strike the ocean as a single unit.

Casings that have not already broken up during re-entry would generally shatter into thousands of pieces on impact with sea surface, with the possible exception of some thick carbon fibre components. All fragments would sink, with the possible exception of some small pressure vessels, which would be expected to have negligible impact.

Unspent fuel would float and may burn, evaporate (liquid fuels) or remain floating (rubber based solid fuels). Launch vehicle components could potentially fall into international waters, in the EEZ and/or state waters, depending on when the vehicle failure occurs.

22.4.1.2 Launch Vehicle Components

The rockets launched from the WWOLC are largely composed of inert components with some components which have minimal impact on the environment.

The rockets are made up of:

- Carbon Fibre Reinforced Plastic (CFRP).
- Plastic.
- Plastic (Bakelite).
- Aluminium.
- Stainless Steel.
- Titanium.
- Glass.
- Copper wire.
- Li-Ion Batteries.
- Computer chips.
- Fuel/Oxidiser.
- Other gases.

22.4.1.3 Types of Fuel, Oxidiser and Other Gases

Past launch vehicle types have caused environmental concern due to the use of highly toxic fuels such as hypergolic UDMH-nitric acid fuel.

These highly toxic fuels will never be used on launch vehicles operating from the WWOLC. Modern micro, mini and small rockets use fuels such as methane gas, RP-1 (a pure form of kerosene) or forms of rubber in solid fuelled motors. These fuels and their associated oxidisers cause lower levels of harm, particularly when consideration is given to the very small number of spent launch vehicles and components over vast areas of sea. Additionally, it should be noted that in successful launches, there will only be minimal amounts of fuels and oxidisers remaining in the vehicle when it contacts the water.

The launch vehicles can be powered in three (3) configurations – Liquid Fuelled, Hybrid Fuelled and Solid Fuelled. Other gases are used for cooling and other functions. Fuels, oxidisers and other gases used include:

- Fuels:
  - Liquid Natural Gas (Liquid Fuelled);
  - Rocket Propellant-1 (Liquid Fuelled);
  - Styrene Butadiene Rubber (SBR) (Hybrid/Solid Fuelled);
  - Liquid Methane (Liquid Fuelled); and
  - Paraffin Wax (Hybrid Fuelled, Solid Fuelled).
- Oxidisers (Liquid and Hybrid Fuelled):
  - Liquid Oxygen;
  - Nitrous Oxide; and
  - High Test Peroxide (HTP).
- Other Gases (Liquid Fuelled, Hybrid Fuelled and Solid Fuelled):
  - Oxygen; and
  - Hydrogen.

22.4.1.4 Component Descriptions

Carbon Fibre Reinforced Plastic (CFRP)

Carbon Fibre Reinforced Plastic (CFRP) has been used for many years for aerospace products. The material is light, very strong and workable into complex aerodynamic shapes. Launch vehicles use CFRP for the majority of the structure including the skin that forms the external shape of the rocket, as well as the structure that forms the rocket motors and fuel tanks. Many modern rockets are constructed using this material such as Rocket Lab's Electron vehicle, flown out of their launch site in New Zealand. CFRP is inert and does not leach any harmful chemicals into the environment.

Plastic

Plastic is used within the launch vehicle to form a protective outer cover for electrical wiring. Plastic is non-reactive and does not leach any harmful chemicals into the environment.

Plastic (Bakelite)

Plastic (Bakelite) is a common plastic used extensively for common household goods. It is used within the launch vehicle to form a protective outer cover of critical components given Bakelite's resistance to heat, electricity, and non-reactivity. Bakelite does not leach any harmful chemicals into the environment.

Aluminium

Aluminium is used within the aerospace industry to create light metallic structures. Aluminium is used within launch vehicles for structural elements, holding key components within the rocket in place. Aluminium is a natural element and does not leach any harmful chemicals into the environment.

Stainless Steel

Stainless steel is used within the aerospace industry to create temperature resistant metallic structures or structures that can be subjected to large aerodynamic loads. The Stage 1 uses stainless steel in critical components of the rocket motors as well as forming components of the rocket motor actuator system. Stainless steel is does not leach any harmful chemicals into the environment.

Titanium

Titanium is used within the aerospace industry to create temperature resistant metallic structures or structures that can be subjected to large aerodynamic loads. The launch vehicle uses titanium in critical components of the rocket motors as well as forming components of the rocket motor actuator system. Titanium does not leach any harmful chemicals into the environment.

Lithium-Ion Battery

Rupture of the batteries on connection with the ocean surface or with the seabed could release highly reactive Lithium (Li) to the seawater – which would produce highly alkaline seawater conditions in the region surrounding the battery and dissolution of the Li into the seawater. This effect would be transient and localised and assessed as being low risk to sea life due to the small size of the batteries and the vast area of potential drop zones.

Glass

There is the potential for glass to be used in payload items. Glass is inert and does not leach any harmful chemicals into the environment.

Copper Wire

Copper wire is used for electrical wiring in the launch vehicle and the payload.

Copper can have negative effects on sea life, but due to the tiny mass of copper in the vast area of the drop zone, this is considered a negligible impact.

Liquid Natural Gas (Liquid Fuelled)

Any unburnt liquid natural gas is expected to vaporise on contact with the ocean and not form part of any emission.

Rocket Propellant-1 (Liquid Fuelled)

Rocket Propellant – 1 is a highly refined form of kerosene. The liquid is expected to be burnt up prior to the stage striking the ocean

Styrene Butadiene Rubber

Styrene Butadiene Rubber (SBR), a synthetic rubber used for many household goods such as shoe heels, rubber gaskets and pneumatic tyres, is the fuel used within Stage 1 and should be completely expended prior to Stage 1 entering the ocean.

SBR is inert in its solid form and non-reactive with the natural environment. Should any unburnt SBR remain in Stage 1 when it enters the ocean, the SBR will not leach any dangerous chemicals.

Liquid Methane (Liquid Fuelled)

Liquid Methane is expected to be expended before the vehicle component enters the ocean. Any unburnt liquid methane is expected to vaporise on contact with the ocean and not form part of any emission.

Paraffin Wax (Hybrid Fuelled, Solid Fuelled)

Paraffin wax is mostly found as a white, odourless, tasteless, waxy solid, with a typical melting point between about 46 and 68 degrees Celsius. The wax is expected to be expended prior to the vehicle stage striking the water.

Oxygen

Any remaining liquid oxygen is expected to vaporise on contact with the ocean.

Nitrous Oxide

Nitrous Oxide, also known a NOS or laughing gas is used as an oxidiser. Any unburnt nitrous oxide is expected to vaporise on contact with the ocean and not form part of any emission.

Hydrogen

Any unburnt hydrogen is expected to vaporise on contact with the ocean and not form part of any emission.

22.4.1.5 Procedure to Dump Rocket Components at Sea

Legislative requirements in relation to rocket components depend on whether the item lands in international waters or Australian territorial waters.

22.4.1.6 International Waters

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 – the "*London Protocol*" is an international convention to protect the marine environment from human activities. The objective of the London Protocol is to control all sources of marine pollution and to take practical steps to prevent pollution of the sea from waste.

The United Nations Convention on the Law of the Sea "*Law of the Sea*" sets out the regime of law governing the uses of all oceans and their resources. It concerns the territorial sea, exclusive economic zones and addresses the issue of pollution.

Nation-states environmental legislation are informed by the London Protocol and the Law of the Sea.

Southern Launch is compliant with the United Nations Convention on the Law of the Sea. The dumping that will occur in international waters is incidental to the rocket launch from Whalers Way. As this dumping is incidental to the rocket launch and it is not a deliberate act for the purpose of dumping, it does not contravene the convention.

Any debris falling into international waters will be of the same size and materiality as that falling in both the State and Federal Exclusive Economic Zone. International waters extend out to 250NM.

There is no adoption of the London Protocol or Law of the Sea to international waters from Australia's standpoint; however, the material being disposed of in national waters is compliant with national legislation that is governed by both conventions. Southern Launch respects the conventions as the rocket components being dumped in state and federal waters are the same material to be dumped in international waters. The rocket components will be inert, therefore causing minimal environmental impact to international waters.

22.4.1.7 Australian Waters

Australian Waters consists of state waters (out to 12 NM) and the EEZ (greater than 12NM and less than 200NM downrange). Waters surrounding Australia's coastlines are increasingly threatened by wastes and pollution that are dumped at sea.

Australia regulates the loading and dumping of waste at sea under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act). This Act also fulfils Australia's international obligations to prevent marine pollution by controlling dumping of wastes and other matter.

Under the Sea Dumping Act, the Commonwealth aims to minimise pollution threats by:

- prohibiting ocean disposal of waste considered too harmful to be released in the marine environment, and
- regulating permitted waste disposal to ensure environmental impacts are minimised.

The Sea Dumping Act applies to all vessels, aircraft and platforms in Australian waters and to all Australian vessels and aircrafts in any part of the sea.

Permits are required for all sea dumping operations. Permits are most commonly issued for dredging operations and the creation of artificial reefs. Permits have also been issued for dumping of vessels, platforms or other man-made structures and for burials at sea.

The Act does not apply to operational discharges from ships, such as sewage and galley scraps. These are regulated under legislation administered by the Australian Maritime Safety Authority.

22.4.1.8 South Australian Waters

Southern Launch will be required to make applications pursuant to Section 38 of the *Environment Protection Act 1993* (SA) ('the Act') for the Environmental Protection Authority to grant an exemption pursuant to Section 37 of the Act in respect of all launches. Each application will be specific to each launch, each launch vehicle and the components of that vehicle.

The purpose of these exemptions is to authorise Southern Launch to carry out the specified activity (rocket launches) which involve spent launch vehicle hardware landing in State waters.

Southern Launch will take all reasonable and practicable measures to ensure that any environmental harm is minimised both in terms of risk and in terms of impact. The materials intended to land in state waters will not cause any environmental harm and do not pose a risk of potential harm.

22.4.1.9 Areas of Dumping

The potential landing zone of a stage for a particular launch vehicle is shown on Marine Exclusion Zone (**Figure 22.1**). This is an example for one (1) particular vehicle only, and the zone will be calculated individually for each launch, as it will vary both based on the vehicle, payload and mission requirements.

It should be noted that the potential stage drop zone for this vehicle is approximately 13,500 square kilometres.

Each different launch vehicle will have its stage drop zones calculated on a case-by-case basis. Drop zones for the final stage could be over 1,000 kilometres down range and the zone of potential Impact Zone could be as much as 1,000 kilometres long by 400 kilometres wide (400,000 square kilometres).

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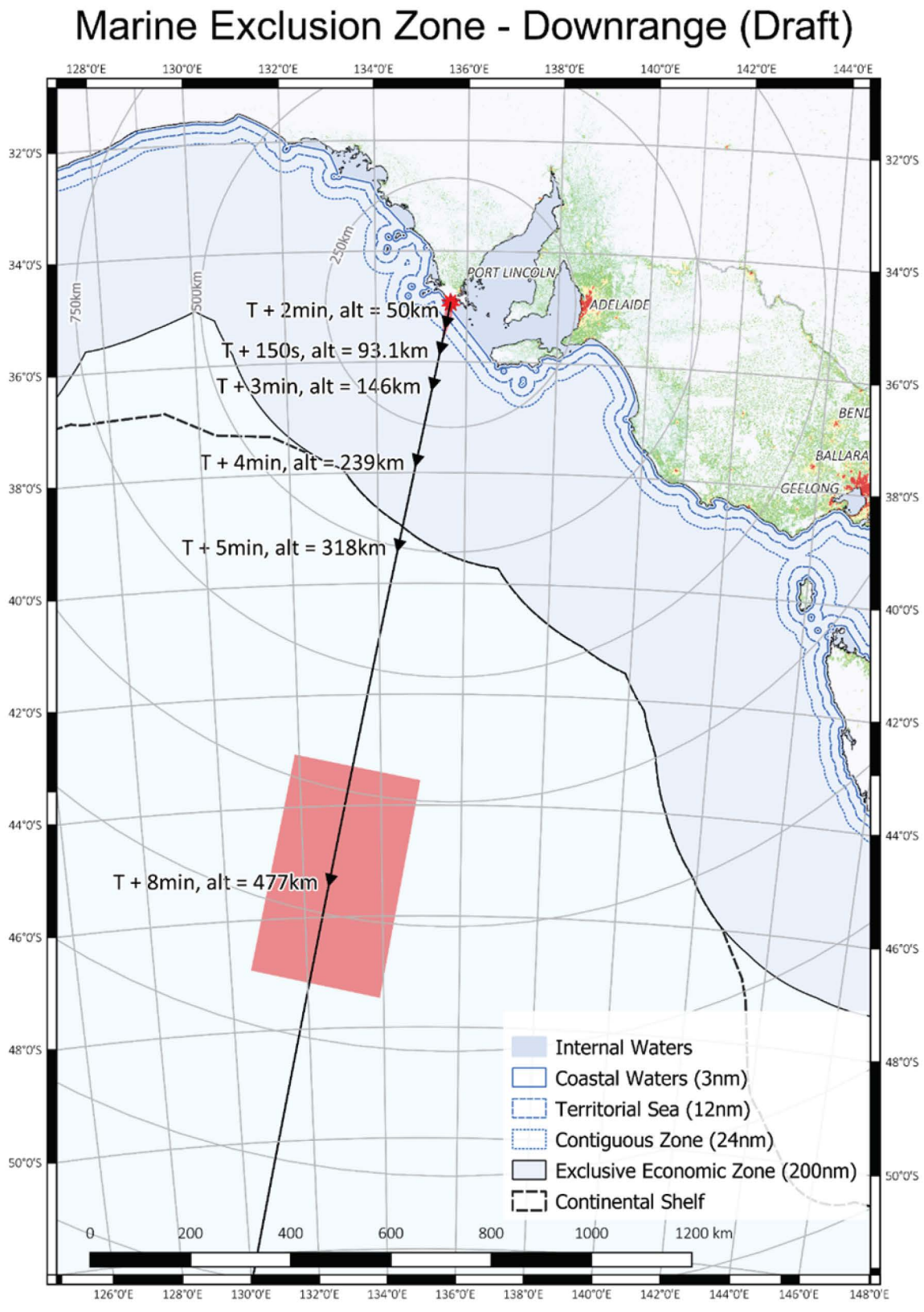

FIGURE 22.1

EXAMPLE STAGE DROP ZONES

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22.4.1.10 Impact of Spent Rocket Components on the Marine Environment

As highlighted above, typically rocket stages that fall into the sea are generally not recovered.

The impact of spent rocket components on the marine environment has been assessed in **Appendix S**. This assessment was informed by the aforementioned study undertaken by NIWA (2017), which is particularly relevant to Southern Launch as it was specifically undertaken to consider small launch vehicles.

The assessment in **Appendix S** concludes that:

- *Debris from successful launches would not impact on Liguanea Island fauna (provided that suborbital launches avoid trajectories over the Island). An air burst over Liguanea Island would be a very rare event that could result in mortalities but there would be negligible impact at subpopulation level. Ground bursts on Liguanea Island would be a rarer event than an air burst (provided a flight termination system is used) but could impact more individuals. Although this may result in temporary reductions in ASL pup production, no long-term impact is expected at subpopulation level;*
- *Within the Southern Ocean, including the waters of the Thorny Passage Marine Park surrounding Liguanea Island, there may be rare debris strike impacts on individual animals on the sea surface but no impact at population level; and*
- *Other debris impacts, including ingestion by marine fauna, crushing or smothering of biota, emission of toxic contaminants, noise from debris striking the sea surface and provision of habitat, would be highly localised, the area impacted would be insignificant in comparison to the extent of the receiving environment and population level effects would be negligible.*

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23 CONSTRUCTION & OPERATIONAL ENVIRONMENTAL MANAGEMENT

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23.0 CONSTRUCTION AND OPERATIONAL ENVIRONMENTAL MANAGEMENT

23.1 Summary

Southern Launch proposes to establish and operate the Whalers Way Orbital Launch Complex using an Environmental Management Framework (EMF) that is consistent with Australian Standards (i.e., AS/NZS ISO 14001:2015 Environmental Management Systems).

Southern Launch has developed separate strategies to manage potential environmental impacts during the construction, operational and de-commissioning phases of the Project.

Draft Management Plans have been prepared and are included herein as follows:

- Construction Environmental Management Plan (CEMP) – see **Appendix AD**.
- Operational Environment Management Plan (OEMP) - see **Appendix AE**.

The Project de-commissioning strategy is included in the OEMP.

Each of the draft Managements Plans have been prepared based on the detailed environmental investigations undertaken as described throughout this EIS, and in accordance with relevant legislative requirements, and the proponent's environmental policies and commitments. The plans have also incorporated relevant matters arising from the hazard and risks analysis (**Section 20**) and the security and safety analysis (**Section 21**).

The overall goal of the EMF is to avoid, mitigate, and manage any potential adverse impacts of the construction, operation, and de-commissioning phases of the Project on the biological, physical, social, or economic environment. The Management Plans reflect the commitments of Southern Launch to environmental management and contain the following information:

- summary of the potential impacts of the proposal;
- relevant legislative requirements and legal obligations and governing agencies;
- the environmental values requiring protection;
- the environmental objectives and goals to be achieved through implementation of the EMP's;
- the measures required to manage and/or mitigate potential impacts;
- the assessment criteria required to assess the effectiveness of the management measures;
- monitoring programs to ensure continued compliance with the management measures;
- a reporting process to keep the public and government agencies informed on the performance of the management measures; and
- a process for review and refinement of the management measures based on performance and/or change in circumstances/scope of the Project.

In addition to the CEMP and OEMP, a number of detailed stand-alone management plans and/or procedures will be prepared to provide more detailed processes in relation to matters identified in the OEMP. These are outlined in **Section 23.4.1.4**.

The draft Management Plans will be fully detailed and finalised following assessment and approval of the EIS having regard to the assessment outcome, public submissions, agency comments and/or requirements, and any conditions of approval, and will reflect the final design and scope of the Project as approved.

The final CEMP and OEMP will be re-submitted to the Minister and the relevant Government agencies for approval prior to construction and operation of the facility respectively.

23.2 Methodology

The draft CEMP and OEMP have been prepared by Southern Launch. The methodology adopted in the preparation of the management plans utilises an environmental management framework (EMF) that is consistent with Australian Standards (i.e., AS/NZS ISO 14001:2015 Environmental Management Systems).

ISO 14001 is the international standard that specifies requirements for an effective Environmental Management System (EMS). It provides a framework that an organisation can follow, rather than establishing environmental performance requirements.

The preparation of the management plans was also informed by a review of relevant industry guidelines and legislative requirements, as well as the proponent's own internal environmental policies and commitments. The following environmental legislation, regulations and guidelines provide the regulatory framework around which the plans are based:

- *Environment Protection Act 1993*.
- *Environment Protection (Water Quality) Policy 2015*.
- *Environment Protection (Air Quality) Policy 1994*.
- *Environment Protection (Noise) Policy 2007*.
- National Environment Protection (Ambient Air Quality) Measure.
- National Environment Protection (National Pollutant Inventory) Measure.
- Guideline for Air Quality Impact Assessment Using Design Ground Level Pollutant Concentrations (*EPA South Australia 2006*).
- Guideline for the use of the Environment Protection (Noise) Policy (*EPA South Australia 2007*).
- Guidelines for the Assessment and Remediation of Groundwater Contamination (*EPA South Australia, 2009*).

- *Space (Launches and Returns) Act 2018*.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (*ANZECC & ARMCANZ 2000*).
- Prevention of Marine Pollution by Dumping of Wastes and Other Matter (*London Convention, 1972*).
- 1996 Protocol to the Convention on the *Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972* (London Protocol).

In preparing the draft content of the CEMP and OEMP a detailed review was undertaken of all the investigations outlined in this EIS. The findings of these investigations have informed the content and management practices outlined within the CEMP and OEMP attached (**Appendix AD** and **Appendix AE**).

The CEMP sets out the management processes in respect to a number of environmental components. The CEMP outlines the legal requirements, values, objectives, management measures, and the monitoring procedures for each identified environmental component. The key environmental components include:

- land disturbance;
- terrestrial fauna;
- community interaction;
- generation of waste and discharges; and
- emissions from plant and equipment.

The OEMP follows the approach undertaken for the CEMP, in that it breaks down the management process by a number of environmental components. The OEMP outlines the legal requirements, values, objectives, management measures, and the monitoring procedures for each identified environmental component. These key environmental components include:

- terrestrial fauna;
- community interaction;
- generation of waste and discharges; and
- emissions from plant and equipment.

23.2.1 Construction Roles and Responsibilities

All personnel involved in the Project including Southern Launch employees, contractors and sub-contractors, will be required to work in accordance with the CEMP, and in accordance with all relevant Acts, Policies and Regulations. The draft CEMP outlines the roles and responsibilities for the implementation of the CEMP. Throughout detailed planning and construction phases, names will be allocated to the roles prescribed in the CEMP.

All staff and contractors will be required to undertake training in environmental management as part of their induction to the site and its activities before their participation in any construction activities can begin.

Southern Launch will also ensure that its employees have relevant permits and that contractors provide copies of their permits and licences to Southern Launch. Contractors would also be required to be responsible for ensuring their staff had relevant permits and licences before they commence work on the development.

The CEMP would adhere to the conditions of these licences, ensuring that all onsite operations are compliant.

23.2.2 Operational Roles and Responsibilities

All personnel involved in the Project including Southern Launch employees, contractors and sub-contractors, will be required to work in accordance with the OEMP and in accordance with all relevant Acts, Policies and Regulations. The draft OEMP outlines the roles and responsibilities for the implementation of the OEMP. Throughout operational phases, names will be allocated to the roles prescribed in the OEMP.

All staff and contractors will be required to undertake training in environmental management as part of their induction to the site and its activities before their participation in any construction activities can begin.

Southern Launch will also ensure that its employees have relevant permits and that contractors provide copies of their permits and licences to Southern Launch. Contractors would also be required to be responsible for ensuring their staff had relevant permits and licences before they commence work on the development.

The OEMP would adhere to the conditions of these licences, ensuring that all onsite operations are compliant.

23.3 Relevant EIS Guidelines

***Assessment Requirement 15**: The proposed development would require a range of impacts to be minimised, mitigated and monitored through an environmental management plan framework across the construction and operational phases.*

15.1. Provide information on any baseline data or monitoring established prior to development on the site. Document the anticipated monitoring on site throughout the construction and operational phases.

15.2. Document the development's construction techniques, methodology, including site preparation works, activities, timeframes and staging (if proposed). Detail the proposed management arrangements to mitigate the negative environmental, public health and amenity impacts and subsequent implementation of these procedures.

15.3. Outline the timing of construction and the time of year it is likely to occur.

15.4. Describe the soil erosion and drainage management plan to be implemented, including the proposed stormwater management solution. Document any storage, detention and treatment proposed for the development. Surface water and groundwater quality is to be addressed with specific regard to spill containment. Detail the dust management mitigation measures for the construction phase, in particular for the concrete batching plant and site access.

15.5. Identify the water sources for construction and operations, in particular for the site amenities, firefighting and concrete batching plant.

15.6. Identify the location, extent and details of all infrastructure and site services required on site to support the launch operations including, but not limited, to solar arrays, water tanks, propellant storage, generators, lighting rods, anemometer towers, fibre optic and satellite communication systems and high voltage powerlines (including alignment). Detail all utilities to be provided or connecting, including water, gas, electricity, wastewater treatment and disposal, drainage, trenches or conduits.

15.7. Describe the volume and source of cut and fill required for all proposed built form and associated works, including access tracks, launch pads, permanent and temporary structures, and the effect on the natural topography of the site.

15.8. Identify the location, extent and details of any temporary buildings, structures and activities proposed, including but not limited to the concrete batching plant, offices, assembly buildings, laydown areas, fuel and chemical storage locations and access tracks.

15.9. Identify the anticipated launches and activities carried out on site and the operational management regimes for each. The OEMP is to demonstrate mitigation of negative environmental, public health and amenity impacts. The plan is to collate the key operational information for the project, including hazard and risk documentation, waste and debris procedures, fire and explosion response strategy, noise and vibration monitoring and transport and access.

15.10. Prepare a waste management and minimisation plan which documents all waste streams during construction and operation, identifies the location of waste storage areas and disposal facilities. Identify the opportunities for recycling and reuse of equipment and componentry.

15.11. Document the site rehabilitation and decommissioning strategy for all temporary and permanent elements

23.4 Analysis

23.4.1 Guidelines 15.1, 15.2, 15.3, 15.9

15.1	*Provide information on any baseline data or monitoring established prior to development on the site. Document the anticipated monitoring on site throughout the construction and operational phases.*

15.2	*Provide information on any baseline data or monitoring established prior to development on the site. Document the anticipated monitoring on site the development's construction techniques, methodology, including site preparation works, activities, timeframes and staging (if proposed). Detail the proposed management arrangements to mitigate the negative environmental, public health and amenity impacts and subsequent implementation of these procedures.*

15.3.	*Outline the timing of construction and the time of year it is likely to occur.*

15.9.	*Identify the anticipated launches and activities carried out on site and the operational management regimes for each. The OEMP is to demonstrate mitigation of negative environmental, public health and amenity impacts. The plan is to collate the key operational information for the project, including hazard and risk documentation, waste and debris procedures, fire and explosion response strategy, noise and vibration monitoring and transport and access.*

23.4.1.1 Summary of Baseline Monitoring Undertaken Prior to the Development

Site investigations have been undertaken in respect to all aspects of the environment in order to form baseline data on the existing environmental conditions of the subject land. Whilst not documented in the draft CEMP or OEMP, these site investigations are discussed throughout the EIS, and the relevant supporting technical investigations noted within the Appendices. In summary, baseline monitoring has consisted of:

- Native vegetation field surveys and targeted searches (as discussed in **Section 7.0** and the Terrestrial Ecological Assessment contained in **Appendix P**);
- Unattended baseline noise monitoring at five (5) different sites within the Whalers Way area (as discussed in **Section 8.0** and described in the Noise and Vibration Assessment contained in **Appendix O**);
- Native and introduced fauna surveys and targeted searches (as discussed in **Section 9.0** and described in the Terrestrial Ecological Assessment contained in **Appendix P**);
- Desktop investigation of Coastal Raptor species population distribution drawing from relevant survey data (as discussed in **Section 9.0** and described in the Coastal Raptor Assessment contained in **Appendix R**); and

- Desktop investigation of marine flora and fauna population distribution drawing from relevant survey data (as discussed in **Section 7.0** and **Section 9.0** and described in the Marine Ecological Assessment contained in **Appendix S**).

These investigations have provided a clear picture of the existing environmental conditions within the Whalers Way area. The findings provide baseline data from which to consider the potential impacts associated with the construction and operational phases of the development and allow for the development of effective mitigation and management practices in response to these impacts as outlined in the CEMP and OEMP attached.

23.4.1.2 Monitoring Procedure During Construction

The monitoring procedures for the Construction stage of the Project have been documented for the various environmental components, discussed previously in **Section 23.2,** and are summarised as follows:

Land disturbance during construction

Table 23.1 below outlines the assessment criteria and monitoring procedure to be adopted in respect to land disturbance impacts during construction:

Table 23.1: Land disturbance criteria and monitoring procedure for construction (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
All native vegetation clearance undertaken as approved under the *Native Vegetation Act 1991*.	Post clearance audit of cleared areas and comparison of approved clearance areas.
No evidence of increased pest animals in the development area.	Regular inspections of waste storage facilities and pest control devices.
No spread of existing weed species or introduction of new weed species to the development area.	Staffed trained to identify declared weed species. Regular site inspection for declared weed species.
No unauthorised disturbance to Aboriginal or European heritage.	Staff trained to identify potential heritage items and trained in appropriate response actions and reporting.
No land contamination from leaks or spills of fuels or chemicals.	Regular inspection of fuel/chemical storage areas.

A series of reporting procedures are also documented within the CEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Any suspected breaches of authorised clearance areas to be reported to DEW, with SEB offsets to be revised where required.
- Any observed increases in weeds or pests to be reported to the WWOLC Project Director.
- Should any heritage items or sites be discovered within the development area, findings will be reported and recorded as detailed in the Heritage Management Plan.
- Any leaks/spills of fuels or chemicals to be reported to WWOLC Project Director and the relevant authorities as required by the relevant legislation.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Terrestrial fauna impacts during construction

Table 23.2 below outlines the assessment criteria and monitoring procedure to be adopted in respect to terrestrial fauna impacts during construction:

Table 23.2: Terrestrial fauna criteria and monitoring procedure for construction (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
No preventable death or serious injury to Western Whipbirds or Southern Emu Wrens during clearing or construction works	Inspection of the development area prior to commencement of clearing or construction activities for Western Whipbird and Emu Wren individuals and nesting sites. Visual inspections of open trenches and excavations.
No preventable death or serious injury to any native animal species during the construction phase.	Inspection of the development area prior to commencement of clearing or construction activities. Visual inspections of open trenches and excavations. Speed limits on vehicles operating on site to reduce risk. Regular inspection of road network for dead animals. Staff to report any dead animals.
No increase in attractors for predatory feral animals such as cats and foxes.	Regular inspection of road network for dead animals. Staff to report any dead animals. Dead animals to be removed.

A series of reporting procedures are also documented within the CEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Fauna encountered during pre-clearance checks to be reported to WWOLC Project Director.
- Any fauna deaths that appear to be the direct result of construction activities to be reported to the WWOLC Project Director and the construction and project manager/s immediately.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.
- Staff and contractors to report any sightings of dead animals to the construction and project manager/s immediately.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Community interaction issues during construction

Table 23.3 below outlines the assessment criteria and monitoring procedure to be adopted in respect to community interaction issues during construction:

Table 23.3: Community interaction criteria and monitoring procedure for construction (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
Respond proactively to issues or complaints raised by the adjacent landowners and the community.	Review of adherence to processes and timeframes in Complaints Management Procedure/Stakeholder Engagement Plan.

A number of reporting procedures are also documented within the CEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Record and respond to complaints in accordance with the Complaints Management Procedure/Community Engagement Plan.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Generation of waste and discharges during construction

Table 23.4 below outlines the assessment criteria and monitoring procedure to be adopted in respect to impacts resulting from the generation of waste and discharges during construction:

Table 23.4: Generation of waste and discharges criteria and monitoring procedure for construction (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
No direct stormwater discharge from the construction site to the ocean or to any other surface water source.	Regular inspection of stormwater management system.
Spills/accidental releases of fuel/chemicals are contained.	Containment and clean-up of accidental spills will be monitored against Spill Response Plan.
All waste material to be appropriately classified and segregated for reuse, recycling or offsite disposal as per the Waste Management and Minimisation Plan.	Implement a regular inspection program to monitor storage handling and disposal of wastes as per the Waste Management and Minimisation Plan.

Reporting procedures in respect to the generation of waste and discharges during construction are also documented within the CEMP. The reporting procedures is to implement a regular inspection program. Results of inspections will be documented, and any uncontrolled releases or spills reported. All waste disposed of off-site would be documented as per the Waste Management and Minimisation Plan. Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Emissions from plant and equipment during construction

Table 23.5 below outlines the assessment criteria and monitoring procedure to be adopted in respect to issues resulting from emissions from plant and equipment during construction:

Table 23.5: Emissions from plant and equipment criteria and monitoring procedure for construction (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
Investigation of air quality and/or noise complaints raised by the community indicates no exceedance of project air quality and/or noise criteria due to construction activities.	Daily visual monitoring and observation of dust/noise and implementation of adaptive management strategies as required.

A number of reporting procedures are also documented within the CEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Record and respond to complaints in accordance with the Complaints Management Procedure/Community Engagement Plan.
- Summary of monitoring results and any complaints received to be documented in monthly report.
- Compliance reporting would be undertaken in accordance with relevant licenses/permits issued by government regulators.

23.4.1.3 Monitoring Procedure During Operation

The monitoring procedures for the operational stage of the Project have been documented for the various environmental components, discussed previously in **Section 23.2.2** and are summarised as follows:

Terrestrial fauna impacts during operation

Table 23.6 below outlines the assessment criteria and monitoring procedure to be adopted in respect to impacts on terrestrial fauna during operations:

Table 23.6: Terrestrial fauna criteria and monitoring procedure for operation (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
No preventable death or serious injury to Western Whipbirds or Southern Emu Wrens during operations	Inspection of the operational area prior to commencement of launch activities for Western Whipbird and Emu Wren individuals and nesting sites. Visual inspections of immediate surrounding area. Use of gas guns or other noise generating equipment to remove birds form any high-risk zones.
No preventable death or serious injury to any native animal species during the operations	Speed limits on vehicles operating on site to reduce risk.
No increase in attractors for predatory feral animals such as cats and foxes	Regular inspection of road network for dead animals. Staff to report any dead animals. Dead animals to be removed. Regular inspections of waste storage facilities and pest control devices. Waste management plan to be implemented to ensure no waste to attract predatory feral animals.

A series of reporting procedures are also documented within the OEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Fauna encountered during pre-clearance checks to be reported to WWOLC Manager.
- Any fauna deaths that appear to be the direct result of operations activities to be reported to the WWOLC Manager immediately.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.
- Staff and contractors to report any sightings of dead animals to the WWOLC Facility Manager immediately.

Community interaction issues during operation

Table 23.7 below outlines the assessment criteria and monitoring procedure to be adopted in respect to community interaction issues during operation:

Table 23.7: Community interaction criteria and monitoring procedure for operation (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
Respond proactively to issues or complaints raised by the adjacent landowners, stakeholders, and the community. **Ensure there is a defined notification process to ensure neighbours, stakeholders and general community understand when high noise level events will occur.** **Have a defined liaison process with neighbours, stakeholders, and the general community.**	Review of adherence to processes and timeframes in Complaints Management Procedure/Stakeholder Engagement Plan.

A number of reporting procedures are also documented within the OEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Record and respond to complaints in accordance with the Complaints Management Procedure/Community Engagement Plan.
- Record notification/liaison interactions with neighbours, stakeholders and general community.
- Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Generation of waste and discharges during operation

Table 23.8 below outlines the assessment criteria and monitoring procedure to be adopted in respect to impacts resulting from the generation of waste and discharges during operation:

Table 23.8: Generation of waste and discharges criteria and monitoring procedure for operation (Southern Launch, 2020).

ASSESSMENT CRITERIA	MONITORING PROCEDURE
No direct stormwater discharge from the construction site to the ocean or to any other surface water source.	Regular inspection of stormwater management system.
Spills/accidental releases of fuel/chemicals are contained.	Containment and clean-up of accidental spills will be monitored against Spill Response Plan.
All waste material to be appropriately classified and segregated for reuse, recycling or offsite disposal as per the Waste Management and Minimisation Plan.	Implement a regular inspection program to monitor storage handling and disposal of wastes as per the Waste Management and Minimisation Plan.

Reporting procedures in respect to the generation of waste and discharges during construction are also documented within the OEMP. The reporting procedures is to implement a regular inspection program. Results of inspections will be documented, and any uncontrolled releases or spills reported. All waste disposed of off-site would be documented as per the Waste Management and Minimisation Plan. Compliance reporting would be undertaken in accordance with relevant licences/permits issued by government regulators.

Emissions from plant and equipment during operation

Table 23.9 below outlines the assessment criteria and monitoring procedure to be adopted in respect to issues resulting from emissions from plant and equipment during operation:

Table 23.9: Emissions from plant and equipment criteria and monitoring procedure for operation (Southern Launch, 2020)

ASSESSMENT CRITERIA	MONITORING PROCEDURE
Investigation of air quality and/or noise complaints raised by the community indicates no exceedance of project air quality and/or noise criteria due to construction activities.	Daily visual monitoring and observation of dust/noise and implementation of adaptive management strategies as required. Ongoing noise monitoring will be undertaken until a detailed understanding/confirmation of the noise impacts of launches is understood.

A number of reporting procedures are also documented within the CEMP in the event monitoring identifies any non-conformance with the assessment criteria. The reporting procedures include:

- Record and respond to complaints in accordance with the Complaints Management Procedure/Community Engagement Plan.
- Summary of monitoring results and any complaints received to be documented in monthly report.
- Compliance reporting would be undertaken in accordance with relevant licenses/permits issued by government regulators.

23.4.1.4 Construction and Operational Impacts Management and Mitigation Methods

Many activities associated with the construction of the WWOLC have the potential to cause environmental impact. The CEMP and OEMP identify the main areas of potential impact (or environmental matter), the person or persons responsible for action, and the environmental management measures applicable to each matter within a series of tables under the relevant environmental component chapter headings as previously discussed (e.g., land disturbance, terrestrial fauna, etc.). Given the length and number of tables provided within the CEMP and OEMP these have not been replicated herein.

The following Tables within the CEMP (**Appendix AD**) provide a detailed outline of the environmental matters and draft construction management measures:

- Table 3 – Land Disturbance Management (p.19 of **Appendix AD**);
- Table 4 – Terrestrial Fauna Management (p.25 of **Appendix AD**):
- Table 5 – Community Interaction Management (p.30 of **Appendix AD**);
- Table 6 – Waste and Discharge Management (p.35 of **Appendix AD**); and
- Table 7 – Emission Management (p.38 of **Appendix AD**).

The following Tables within the OEMP (**Appendix AE**) provide a detailed outline of the environmental items and draft operational management measures:

- Table 3 – Terrestrial Fauna Management (p.19 of **Appendix AE**);
- Table 4 – Community Interaction Management (p.25 of **Appendix AE**);
- Table 5 – Waste and Discharge Management (p.30 of **Appendix AE**); and
- Table 6 – Emission Management (p.33 of **Appendix AE**).

The management measures to be implemented during construction and operational activities as outlined within the above-listed tables are to be supplemented by a series of stand-alone management plans and/or procedures. These would be developed/finalised prior to the commencement of construction and operational stages to address specific activities that may result in environmental issues and will include:

- Air Quality Management Plan;
- Biosecurity Management Plan and Response Procedure;
- Bushfire Hazard Management Plan;
- Coastal Acid Sulphate Soil (CASS) Management Contingency Plan;
- Contamination Management Contingency Plan;
- Emergency Management Plan;
- Flora and Fauna Management Plan;
- Fuel and Chemical Storage and Handling Plan;
- Heritage Management Plan;
- Native Vegetation Management Plan;
- Noise Management Plan;
- Offset Implementation Plan;
- Planting Guide;
- Soil Erosion and Drainage Management Plan (SEDMP);
- Spill Response Plan;
- Stormwater Management Plan;
- Waste Management and Minimisation Plan; and
- Water Quality Management Plan.

23.4.1.5 Timing of Construction

Establishment of the Project is anticipated to be undertaken in five (5) phases between 2021 and 2025. A detailed breakdown of the construction methodology is provided within **Section 5.6** of this EIS.

23.4.2 Guidelines 15.4

15.4	*Describe the soil erosion and drainage management plan to be implemented, including the proposed stormwater management solution. Document any storage, detention and treatment proposed for the development. Surface water and groundwater quality is to be addressed with specific regard to spill containment. Detail the dust management mitigation measures for the construction phase, in particular for the concrete batching plant and site access.*

23.4.2.1 Stormwater Management

The Stormwater Management Plan prepared by WGA (**Appendix U**) adopts a Total Surface Water Cycle Management (TSCM) for each of the site elements outlined in **Section 5**. This approach is based on the principal design philosophy that no site generated surface runoff will be permitted to leave each site. All sites will incorporate a retention basin designed to capture and store all site generated runoff.

All site stormwaters will be captured and retained on the site footprint. Water will be stored in a lined multi-function detention basin at the downstream end of each of the launch sites (Site A and Site B). The detention basin will also be utilised for the storage water to service the operational needs of the Project. A combined detention capacity of 12,760 cubic metres is proposed. The TSCM will also incorporate the following stormwater management elements within each site:

- onsite stormwater re-use;
- open drainage swales;
- spill management (where required), and
- surface grading throughout each site.

The stormwater management strategy is centred on ensuring that all site generated rainfall and runoff is captured within the TSCM framework. Therefore, the primary focus of the stormwater quality management basis is to prevent any potential pollutants in stormwater from entering the receiving environment.

Upstream of each of the launch sites overland flows will either be captured and retained or intercepted and diverted around the site to the detention basin.

23.4.2.2 Soil Erosion Management

Soil erosion mitigation measures are documented within the CEMP (**Appendix AD**) and OEMP (**Appendix AE**) as follows:

- Construction stage: Table 6 – Waste and Discharge Management (p.35 of **Appendix AD**).
- Operational stage: Table 5 – Waste and Discharge Management (p.30 of **Appendix AE**).

All works will be conducted as per the CEMP and OEMP in respect to the mitigation of soil erosion. A Soil Erosion and Drainage Management Plan (SEDMP) will be prepared as part of the CEMP and OEMP stand-alone management plans and procedures. This will occur following the resolution of the planning approval but prior to the construction or operational stages.

The SEDMP shall be implemented in accordance with the *Environment Protection Act 1993*. A plan will be prepared to meet the requirements in accordance with the Code of Practice for the Construction and Building Industry (1999) as part of the construction documentation for the development.

23.4.2.3 Spill Management

Spill management measures are documented within the CEMP (**Appendix AD**) and OEMP (**Appendix AE**) as follows:

Construction stage:

- Table 3 – Land Disturbance Management (p.19 of **Appendix AD**); and
- Table 6 – Waste and Discharge Management (p.35 of **Appendix AD**).

Operational stage:

- Table 5 – Waste and Discharge Management (p.30 of **Appendix AE**).

In the event of an accidental release or spill of a fuel or chemical action will be taken as per the CEMP and OEMP. A Spill Response Plan and a Fuel and Chemical Storage and Handling Plan will be prepared as part of the CEMP and OEMP stand-alone management plans and procedures. This will occur following the resolution of the planning approval but prior to the construction or operational stages.

Additionally, it is noted that the keeping (retaining), handling, transport, conveyance, and disposal of dangerous substances is subject to the *Dangerous Substances Act 1979* (the Act) and the *Dangerous Substances (Dangerous Goods Transport) Regulations 2008*. Southern Launch expects to be required to be licenced as defined by the Act. The Act and licences issued under the Act, will impose a general duty to take reasonable care in relation to the use, handling, and storage of dangerous substances with respect to health and safety, damage to property and environmental harm.

23.4.2.4 Dust Mitigation Measures

Dust mitigation measures are documented within the CEMP (**Appendix AD**) and OEMP (**Appendix AE**) as follows:

Construction stage:

- Table 5 – Community Interaction Management (p.30 of **Appendix AD**); and
- Table 7 – Emission Management (p.38 of **Appendix AD**).

Operational stage:

- Table 4 – Community Interaction Management (p.26 of **Appendix AE**); and
- Table 6 – Emission Management (p.34 of **Appendix AE**).

All works will be conducted as per the CEMP and OEMP, for the suppression of dust control; any exposed areas which allow revegetation to be used as dust control barrier, (Stockpiles, Mounds) will be applied as soon as practical, otherwise, a water cart will be allocated for works in areas, where dust control during construction works and operations is required.

23.4.3 Guideline 15.5

15.5. Identify the water sources for construction and operations, in particular for the site amenities, firefighting and concrete batching plant.

23.4.3.1 Detention Basins

As discussed previously, all site stormwaters will be captured and retained on the site footprint within detention basins at Site A and B. Water will be stored in a lined multi-function detention basin at the downstream end of each site. The detention basin will also be utilised for the storage of launch deluge water. Subject to meeting ongoing quality requirements, the basin will also provide water for irrigation and firefighting purposes.

The detention basin for Site A will have a capacity of approximately 6,380 cubic metres. The detention basin for Site B will have a capacity of approximately 6,380 cubic metres. Both basins will be lined with geotextile lining and will be within the fenced enclosure of the whole launch site. The basins will also be covered with a floating geotextile cover to avoid presenting an artificial water source attractive to birds.

23.4.3.2 Dam

The detention basins will be capable of being automatically refilled from the main dam at the infrastructure site on an as needs basis once the main dam has been developed. The dam will measure approximately 100 metres long by 75 metres wide and have a nominal depth of 5.0 metres providing a capacity of 30 megalitres.

Sealing of the dam will be by polymer lining. The dam will be enclosed by a 1.8 metre chain wire mesh fence with three (3) stands of barbed wire for a total fence height of 2.4 metres. The dam will be bounded by a gravel roadway to allow for vehicle access for maintenance and connected to the main complex access roadway.

23.4.3.3 Pump Station

The water stored in the dam will be pumped directly to water storage on sites Launch Site A and Launch Site B and Range Control Site E.

It is proposed that above ground pipes will be used to connect the dam to each of the sites, with the pipes being located within the cleared access roadways.

23.4.3.4 Deluge Water Reuse

Captured stormwater will be utilised in the water deluge system which ameliorates acoustic impacts during the launch. The deluge system will result in significant demand for retained stormwater, through water being converted to steam during the launch process.

The launch pad and surrounds are designed so the water generated during a launch flows into the flame trench. The water will be tested for contaminants. If the water is below required levels, it will be pumped into the detention basin. If the water tests above the required levels of contaminants it will either be treated prior to being pumped into the detention basin or it will be pumped into truck for offsite disposal as per legislative requirements.

23.4.3.5 Potable Water Supply

All assembly activities associated with the proposed development are 'dry' and do not involve processes which require large quantities of potable water. Water demand will primarily be human requirements for kitchen, ablution and hygiene purposes. The potable water demand is therefore sufficiently low that on-site capture and storage will be able to supply the majority of demand, with tanker augmentation as required.

Initially, potable water will be supplied by truck and stored on-site in tanks. As the site is developed, the potable water will be sourced from roof collection, treated and then pumped into the tanks. To cater for up to 50 staff on site during peak periods, potable water will be stored in up to four (4) 25,000 litre water tanks located at each launch site.

23.4.3.6 Wastewater

The proposed use is not anticipated to generate large quantities of wastewater, which will predominantly derive from kitchen and ablution facilities. Site operations, other than the deluge water for the launches, will have a low water demand and therefore low generation of wastewater. Each site will have a package wastewater treatment system with the capacity to cater for the requirements of 50 people.

Either a soakage system or an aerobic system which irrigates onto landscaped areas of the site is anticipated to be used.

23.4.3.7 Firefighting Water Supply

Initially, water for firefighting needs will be trucked in and stored in two (2) 150,000 litre tanks between the assembly building and the perimeter of the site. Fire hydrants, pumps and associate infrastructure will be distributed around the site as indicated on the site plan.

Once developed, firefighting needs will be supplied from retention main dam.

23.4.3.8 Irrigation Water Supply

Areas surrounding the assembly building, launch pad and roadway will be landscaped with grasses and low shrubs and are to be irrigated. Native species will be utilised to minimise irrigation water demand and reduce the potential for non-indigenous species to spread into the surrounding environment.

Irrigation water will be sourced from the wastewater treatment system and supplied by the retention basin.

23.4.4 Guideline 15.6

15.6 Identify the location, extent and details of all infrastructure and site services required on site to support the launch operations including, but not limited, to solar arrays, water tanks, propellant storage, generators, lighting rods, anemometer towers, fibre optic and satellite communication systems and high voltage powerlines (including alignment). Detail all utilities to be provided or connecting, including water, gas, electricity, wastewater treatment and disposal, drainage, trenches or conduits.

Details of all elements of the Project are set out within **Section 5.0** of the EIS. All constructed elements of the Project are detailed here, including infrastructure, utilities, power generation, and permanent and temporary structures. Additional detail is provided within the proposal plans in **Appendix M**.

23.4.5 Guideline 15.7

15.7 Describe the volume and source of cut and fill required for all proposed built form and associated works, including access tracks, launch pads, permanent and temporary structures, and the effect on the natural topography of the site.

The earthworks required in the preparation of the four (4) project sites is described in detail in **Section 5.0** of this EIS and reiterated here. The likely impact on the natural topography and character of the landscape is discussed within **Section 16.0** of the EIS.

23.4.5.1 Launch Site Earthworks

Earthworks required to prepare suitably level pads for each of the launch sites. These earthworks will involve cut and fill, and the importation of suitable material to create pads for the development of the launch facilities.

The level pad will have nominal slopes of 2 per cent longitudinal and 2 per cent lateral. The lateral slopes will be towards the centre of the sites, ensuring that all runoff is directed to the dam, and not allowed to enter the surrounding environment.

Batter slopes at the outer edges of the launch sites will match the sites into the surrounding topography.

23.4.5.2 Infrastructure Site D Earthworks

Earthworks for Site D will principally involve the excavation of the dam. The material won from the excavation will be utilised as fill on the remainder of the sites and upgraded access roadways.

The dam will have side slopes at a 1 in 3 batter. The dam will have a base level of 5.4 metres AHD and a top level of 10.4 metres AHD.

Individual pads will be created for the magazine, workshop/maintenance building and ancillary structures to enable each building/structure to be matched to prevailing topographic conditions and the extent of earthworks minimised.

23.4.5.3 Range Control Building Site E Earthworks

The range control site is roughly square in configuration measuring approximately 55 metres long and 55 metres wide. The site is located on the western side of the existing access roadway near the entrance to the overall WWOLC site.

The clearance footprint of Range Control Site E is shown in the Site E – Preliminary Earthworks Plan (**Figure 5.14**).

23.4.6 Guideline 15.8

15.8.	*Identify the location, extent and details of any temporary buildings, structures and activities proposed, including but not limited to the concrete batching plant, offices, assembly buildings, laydown areas, fuel and chemical storage locations and access tracks.*

Temporary infrastructure associated with construction of the development, includes:

- temporary concrete batching plant;
- temporary site and construction offices and facilities;

- temporary laydown areas; and
- temporary access tracks.

The location of the temporary infrastructure is shown in the proposal plans contained in **Appendix M** of the EIS. Temporary infrastructure will be removed as part of the finishing works at the completion of the construction stage, including the removal of temporary construction compounds, removal of the concrete batching plant, and general site clean-up.

23.4.7 Guideline 15.10

15.10. Prepare a waste management and minimisation plan which documents all waste streams during construction and operation, identifies the location of waste storage areas and disposal facilities. Identify the opportunities for recycling and reuse of equipment and componentry.

A Waste Management and Minimisation Plan (WMMP) will be prepared as part of the CEMP and OEMP stand-alone management plans and procedures. Finalisation of this plan will occur following the resolution of the planning approval but prior to the construction or operational stages. The objective of the WMMP would be to minimise the generation of general wastes, maximise their reuse and recycling and ensure safe and lawful disposal of all wastes at all project stages.

23.4.8 Guideline 15.11

15.11. Document the site rehabilitation and decommissioning strategy for all temporary and permanent elements

Unanticipated events could result in the unplanned closure of the facility before the development and implementation of a closure and rehabilitation plan. Should the launch facility cease operation and no other viable activity is proposed for the site, the site would be de-commissioned, all structures removed, and the site rehabilitated to as close to its original condition as is reasonable.

Prior to closure, a detailed Decommissioning and Rehabilitation Plan would be prepared in accordance with the following objectives:

<u>Environmental</u>

- Rehabilitation of disturbed sites to support re-vegetation over time.
- Initiate re-vegetation of disturbed sites in accordance with prevailing vegetation condition in the locality.
- Return disturbed land to as close to pre-development condition as far as is practical.

- De-contamination of soils at activity sites in accordance with a site contamination survey and rehabilitation plan.
- Protection of groundwater.
- Return to natural surface water flow.

Social

- Minimise rehabilitation impacts on adjacent landowners and the public.
- Ensure the site is physically safe and devoid of hazards.
- Ensure there are no residual health risks to future landowners or the public.

No form of bond or economic fund for rehabilitation is considered necessary in this case, given that the decommissioning of the site would be a relatively straight-forward process due to the small footprint of the site and simple nature of the on-ground structures.

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BIBLIOGRAPHY

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- AAC (2017), Application for a Five-Year Programmatic Permit for Small Takes of Marine Mammals Incidental to Launching of Space Launch Vehicles, Long Range Ballistic Target Missiles, and Smaller Missile Systems at Pacific Spaceport Complex Alaska, Kodiak Island, Alaska. Alaska Aerospace Corporation.
- AAR. (2020). Weapons and Tactics: Armed Attacker, ASIO, 006/2020, February 2020.
- ABC (May 2020) South Australia bird enthusiasts hope 24-hour osprey live-stream could help save the species, cited online at: https://www.abc.net.au/news/2020-05-12/wild-osprey-raptor-eaglebreeding-island-video-surveillance-nest/12235164.
- ABC (November 2020) Endangered ospreys tagged with satellited trackers in Australia-first research into declining population, cited online at: https://www.abc.net.au/news/2020-11-09/south-australiaosprey-satellite-trackers-population/12864028.
- AECOM (2020). Whalers Way Orbital Launch Complex, Terrestrial Biodiversity Technical Report. AECOM, pp.i – Appendix G.
- AECOM (2020a) Whalers Way Orbital Launch Complex Terrestrial Biodiversity Technical Report. September 2020.
- AECOM (2020a), *Whalers Way Orbital Launch Complex Terrestrial Biodiversity Technical Report*, report prepared for Southern Launch Pty Ltd by AECOM Australia Pty Ltd.
- AECOM (2020b) Whalers Way Orbital Launch Complex – Environmental Assessment Report – Noise and Vibration. September 2020.
- AECOM (2020b), *Whalers Way Orbital Launch Complex Environmental Assessment Report: Noise and Vibration*, report prepared for Southern Launch Pty Ltd by AECOM Australia Pty Ltd.
- AECOM 2020. Whalers Way Orbital Launch Complex - Environmental Assessment Report – Noise Assessment.
- ANZCTC. (n.d.). AAO Guidelines for Crowded Places.
- ANZCTC. (n.d.). Hostile Vehicle Guidelines for Crowded Places.
- ANZCTC. (n.d.). IED Guidelines for Crowded Places.
- ANZCTC. (n.d.). National Crowded Places Strategy.

- Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/82950-conservation-advice.pdf
- AQAP. (n.d.). Inspire Magazines
- ASIO Weapons and Tactics: Vehicle Borne Improvised Explosive Devices, AAR018/2020, March 2020.
- ASIO. (2017). Security Managers Guide – Unmanned Aircraft Systems: Managing Security Risks., T4 Protective Security.
- ASIO. (2019). Australia: Security Threats to Critical Infrastructure Sectors. ASIO ATA093/2019 May 2019.
- ASIO. (2019). Weapons and Tactics: Biological Weapons, AAR 038/2019, April 2019.
- ASIO. (2019). Weapons and Tactics: Improvised Incendiary Devices. AAR 132/2019, November 2019.
- ASIO. (2019). Weapons and Tactics: Person-borne and emplaced improvised explosive devices. ASIO AAR 145/2019, December 2019.
- ASIO. (2020) Weapons and Tactics: Radiological and Nuclear Weapons, AAR 013/2019, January 2019.
- ASIO. (2020). Australia: Alleged extreme right-wing individual charged with terrorism. ASIO ATA037/2020, March 2020.
- ASIO. (2020). Australia: Terrorist use of Weapons and Tactics, , AAR 010/2020.
- ASIO. (2020). Security Managers Guide – Critical Infrastructure Security. T4 Protective Security.
- Atlas of Living Australia (ALA), 2020. Open access to Australia's biodiversity data. Available at: ala.org.au.
- Australian and New Zealand Environment and Conservation Council (ANZECC) / Agriculture and Resource Management Council of Australia and New Zealand, 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).
- Australian Bureau of Statistics (ABS) (2012), 2011 Census of Population and Housing, Table Builder Database.

- Australian Bureau of Statistics (ABS) (2016), Australian National Accounts: State Accounts, 2015-2016, Cat No. 5220.0.
- Australian Bureau of Statistics (ABS) (2019a), '5206.0 Australian National Accounts: National Income, Expenditure and Product, Table 5. Expenditure on Gross Domestic Product (GDP), Implicit price deflators.
- Australian Bureau of Statistics (ABS) (2019b), 'Labour Force, Australia, Detailed, Quarterly', May 2017, Cat No. 6291.0.55.001.
- Australian Bureau of Statistics (ABS) (2019c), 'Wage Price Index, Australia', Cat No. 6345.0.
- Australian Bureau of Statistics (ABS) (2019d), 'Australian National Accounts: Input-Output Tables, 2014-15', cat. no. 5209.0.55.001.
- Australian Museum (2021a), White-faced Heron, Viewed February 2021, https://australian.museum/learn/animals/birds/white-faced-heron/
- Australian Museum (2021b), Little Penguin, Viewed February 2021, https://australian.museum/learn/animals/birds/little-penguin
- Australian Museum (2021c), Cape Barren Goose, Viewed February 2021, https://australian.museum/learn/animals/birds/cape-barren-goose
- Australian Standard 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*
- Australian Standard AS 2187.2-2006 *Explosives – Storage and use Part 2: Use of explosives*
- Australia-New Zealand Counter-Terrorism Committee (ANZCTC). (n.d.). National Guidelines for the Protection of Critical Infrastructure from Terrorism
- Baghurst, B (undated), Seeking whole-of-system understanding: *An integrated study of environmental, economic and social values.* Presentation.
- Baker, J.L & Clarkson, P (2014), *Rare and Endemic Mollusc and Specimen Shells in Spencer Gulf*. Chapter 20, Part 3. In - Shepherd, S.A., Madigan, S.M., Gillanders, B.M., Murray-Jones, S. and Wiltshire, D.J. 2014. Natural History of Spencer Gulf. Royal Society of South Australia Inc.
- Bali, R. 2005. Discussion Paper – Compensating for Edge Effects, Ecosense Consulting for the NSW Roads and Traffic Authority, Sydney.

- Bannister, J (2018), *Project A7 - Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2015-2018: Final Report on Activities for 2017*, National Environmental Science Program, Marine Biodiversity Hub.
- Barrett, G., A. Silcocks, S. Barry, R. Cunningham & R. Poulter 2003. *The New Atlas of Australian Birds*. Melbourne, Victoria: Birds Australia.
- Beason, R. C. 2004. What can birds hear? *21st Vertebrate Pest Conference* (pp. 92-96). Visalia, California: University of California, Davis.
- Bennett, A.F 1990, Habitat corridors and the conservation of small mammals in a fragmented forest environment. Landscape Ecology, Vol. 4, 109–122 (1990).
- Bilgmann, K., Parra, G. J., Holmes, L., Peters, K. J., Jonsen, I. D. and Möller, L. M. (2019). Abundance estimates and habitat preferences of bottlenose dolphins reveal the importance of two gulfs in South Australia. *Scientific Reports* 9: 8044.
- Bilgmann, K., Parra, G.J. and Möller, L.M. (2014). Inshore Cetacean Survey between Ceduna and Coffin Bay, eastern Great Australian Bight. Great Australian Bight Research Program, GABRP Research Report Series Number 1, 40pp.
- BirdLife Australia (2021a), *Cape Barren Goose*. Viewed February 2021, https://birdlife.org.au/bird-profile/cape-barren-goose.
- BirdLife Australia (2021b), *Silver Gull*. Viewed February 2021, https://birdlife.org.au/bird-profile/silver-gull.
- BirdLife Australia (2021c), *Sooty Oystercatcher*. Viewed February 2021, https://birdlife.org.au/bird-profile/sooty-oystercatcher.
- BirdLife Australia (2021d), *Pacific Gull*. Viewed February 2021, https://birdlife.org.au/bird-profile/pacific-gull.
- BirdLife Australia (2021e), *Black-faced Cormorant*. Viewed February 2021, https://birdlife.org.au/bird-profile/black-faced-cormorant.
- BirdLife Australia (2021f), *Pied Cormorant*. Viewed February 2021, https://birdlife.org.au/bird-profile/pied-cormorant.
- BirdLife International (2021a), Species factsheet: Slender-billed Prion *Pachyptila belcheri*. Viewed February 2021, http://datazone.birdlife.org/species/factsheet /slender-billed-prion-pachyptila-belcheri.

- BirdLife International (2021b), Species factsheet: Atlantic, Yellow-nosed Albatross *Thalassarche chlororhynchos*. Viewed February 2021, http://datazone.birdlife.org/species/factsheet/atlantic-yellow-nosed-albatross-thalassarche-chlororhynchos.
- Birdlife, 2020. Birdlife Australia. Online resource http://birdlife.org.au/.
- Birdsall, J.L., McCaughey, W. and Runyon, J.B. 2012. Roads Impact the Distribution of Noxious Weeds More Than Restoration Treatments in a Lodgepole Pine Forest in Montana, U.S.A, Restoration Ecology, vol. 20, no. 4, pp. 517 – 523.
- Blakers, M., S.J.J.F. Davies & P.N. Reilly 1984. *The Atlas of Australian Birds*. Melbourne, Victoria: Melbourne University Press.
- Blue Ridge Research and Consulting. (2017). *RUMBLE Launch Vehicle Acoustic Simulation Model Version 2.0 User Guide.* Asheville.
- BMT WBM (2018), *Whale strike probability monitoring,* Technical memo for Kangaroo Island Plantation Timbers, Smith Bay Wharf EIS.
- Bowles, A. E. (2000). *Potential Impact of USAF Atmospheric Interceptor Technology (ait) Launches from the Kodiak Launch Complex, Kodiak Island, Alaska. Monitoring of Noise Levels During the Launch of ait-2.* San Diego: Hubbs-SeaWorld Research Institute.
- Bowles, A.E. 2000. Potential Impacts of USAF atmospheric interceptor technology (*ait*) Launches from the Kodiak Launch Complex, Kodiak Island, Alaska: Monitoring of Noise Levels During the *ait*-2 Launch, 15 September 1999. Final Report Prepared by Hubbs-Sea World Research Institute, San Diego, CA for U.S. Air Force Space and Missile Systems Center. September 5, 2000.
- Brandle R, 2010. Biological Survey of the Eyre Peninsula South Australia. Department for Environment and Heritage, South Australia.
- Bray, D.J (2021a). Fishes of Australia. Shortfin Mako, (*Isurus oxyrinchus*), viewed February 2021, https://fishesofaustralia.net.au/home/species/3255#moreinfo.
- British Standard 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites –Part 1: Noise.*
- Brown & Root Environmental (1996), *Environmental Assessment of the Kodiak Launch Complex Kodiak Island, Alaska*, South Carolina, United States of America.
- Brown, C.M., Stephenson, A.E., 1991, Geology of the Murray Basin, South-eastern Australia, Bureau of Mineral Resources, Australia. Bulletin, 235, 430pp.

- Bryars, S (2003), *An Inventory of Important Coastal Fisheries Habitats in South Australia, Fisheries Habitat Program*, Department of Primary Industries and Resources of South Australia, Adelaide.
- Bryars, S., Brook, J., Meakin, C., McSkimming, C., Eglinton, Y., Morcom, R., Wright, A. and Page,
  B. (2016), *Baseline and predicted changes for the Thorny Passage Marine Park,* DEWNR Technical report 2016/15, Government of South Australia, through Department of Environment, Water and Natural Resources, Adelaide.
- Bureau of Meteorology (BOM), 2020. Climate Data Online. Online resource accessed 25-Mar-2020 http://www.bom.gov.au/climate/data/.
- Burnell, SR (2001), Aspects of the reproductive biology, movements and site fidelity of right whales off Australia, *Journal of Cetacean Research and Management,* vol. *2 (*special issue), pp. 89–102.
- Caltrans. (2013). *Transportation and Construction Vibration Guidance Manual*. Sacramento: California Department of Transportation.
- Cane, S., 2020. A Cultural Heritage Investigation of the Whaler's Way Orbital Launch Complex Lower Eyre Peninsula, SA. pp.1 - 20.
- Cann, J.H., Gostin, V.A., 1985, Coastal sedimentary facies and foraminiferal biofacies of the St Kilda Formation at Port Gawler, South Australia, Royal Society of South Australia. Transactions, 109(4), p121-142.
- Carpenter, G., A. Black, D. Harper & P. Horton, 2003. Bird Report, 1982-1999. *South Australian Ornithologist*. 34:93-151.
- Carroll, E, Patenaude, N, Alexander, A, Steel, D, Harcourt, R, Childerhouse, S, Smith, S, Bannister, J, Constantine, R & Baker, C (2011), 'Population structure and individual movement of southern right whales around New Zealand and Australia', *Marine Ecology Progress Series,* vol. 432, pp. 257–268.
- Center for Conservation Biology America (2020), accessed online at: http://www.ospreywatch.org/nests.
- Charlton, C, Guggenheimer, S & Burnell, S (2014a), *Long term southern right whale population monitoring at Head of Bight (1991-2013).* Final Report to Commonwealth Government, Australian Antarctic Division, Australian Marine Mammal Centre.

- Charlton, C, Guggenheimer, S, Burnell, S & Bannister, J (2014b), *Southern right whale abundance at Fowler Bay and connectivity to adjacent calving ground, Head of Bight, South Australia*. Report to Commonwealth Government, Australian Antarctic Division, Australian Marine Mammal Centre.
- Charlton, CM (2017), *Southern Right Whale (*Eubalaena australis*) Population Demographics in Southern Australia*. PhD Thesis, Faculty of Science and Engineering, Centre for Marine Science and Technology, Curtin University, Perth.
- Cheshire, A.C., Collings, G.J., Edyvane, K.S. and Westphalen G. (2000), *Overview of the Conservation Status of Australian Marine Macroalgae*. A report to Environment Australia. Department of Environmental Biology, University of Adelaide, July 2000.
- Coffin, A.W. 2007. From roadkill to road ecology: A review of the ecological effects of roads, Journal of Transport Geography, vol. 15, no. 5, pp. 396 – 406.
- *Commonwealth Space (Launches and Returns) Act 2018*.
- Conn, BJ 1986, *Prostanthera* in Jessop, J & Toelken, HR (eds) 1986, *Flora of South Australia*, Government Printer, Adelaide, pp. 1209-1219, viewed 5 May 2008, <http://www.flora.sa.gov.au/cgibin/texhtml.cgi?form=speciesfacts&family=Labiatae&genus=Prostanthera&species=calycina>.
- Copley, PB (1996), The Status of Seabirds in South Australia, in GJB Ross, K Weaver & JC Greig (eds) *The Status of Australia's Seabirds: Proceedings of the National Seabird Workshop*, Canberra,
1-2 November 1993, pp 139-180. Biodiversity Group, Environment Australia: Canberra.
- CPNI. (2013). Insider Data Collection Study – Main Findings April 2013.
- CPNI. (2014). Personnel Security and Contractors – Good Practice Guide for Employers July 2014.
- CSIRO (n.d.). Visit CSIRO Parkes radio telescope. [online] Australia Telescope National Facility. Available at: https://www.atnf.csiro.au/outreach/visiting/parkes/index.html [Accessed 3 Feb. 2021].
- D. Schuch, G. F. (2017). The Use of an Atmospheric Model to Simulate the Rocket Exhaust Effluents Transport and Dispersion for the Centro de Lançamento de Alcântara. *Journal of Aerospace Technology and Management*, vol.9 no.2 São José dos Campos Apr./June 2017 https://www.scielo.br/scielo.php?script=sci_arttext&pid=S2175-91462017000200137.
- DAWE (2018), *Australian Marine Parks*. GIS Metadata. Department of Agriculture, Water and the Environment.

- DAWE (2021a), *Protected Matters Search Tool*. Department of Agriculture, Water and the Environment, Australian Government, Canberra, viewed February 2021, https://www.environment.gov.au/epbc/protected-matters-search-tool.
- DAWE (2021b). Species Profile and Threats Database. Department of Agriculture, Water and the Environment, Australian Government, Canberra, viewed February 2021, http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.
- Dean, J. (2017). Record attendance prompts new KSC visitor complex contract. [online] floridatoday.com. Available at: https://www.floridatoday.com/story/tech/science/space/2017/05/02/ksc-extends-visitor-complex-contract/101217210/ [Accessed 3 Feb. 2021].
- DEE (2018), Consultation Document on Listing Eligibility and Conservation Actions: *Neophoca cinerea* (Australian Sea Lion). Australian Government Department of the Environment and Energy.
- Dennis TE (2013) Paper presented to Australian Raptor Conference Adelaide 2013 reported on http://www.naturalresources.sa.gov.au/kangarooisland/news/131022-conference-hearsseaeagleresearch.
- Dennis TE and Baxter CI (2006) The status of the White-bellied Sea Eagle and Osprey on Kangaroo Island in 2005. South Australian Ornithologist 35, 47–51. December 2006.
- Dennis TE and Clancy G P (2014). The status of the Osprey (*Pandion haliaetus cristatus*) in Australia. Journal of Raptor Research 48: 408-414.
- Dennis TE and Detmar SA (2018) A review of White-bellied Sea Eagle distribution and population stability over time in South Australia. November 2018. In South Australian Ornithologist Pp.55-71.
- Dennis TE, Detmar S and Patterson C (2015) The White-bellied Sea Eagle as a key indicator species by which to measure the health and stability of coastal biodiversity in South Australia. Prepared for KINRMB 2014, updated 2015).
- Dennis TE, Detmar SA, Brooks AV and Dennis HM (2011a) Distribution and status of White-bellied Sea eagle, *Haliaeetus leucogaster*, and Eastern Osprey, *Pandion cristatus*, populations in South Australia. The Journal of The South Australian Ornithological Association Inc. V37 (Part 1).
- Dennis TE, Fitzpatrick GJ and Brittain RW (2012) Phases and Duration of the White-bellied Sea Eagle Haliaeetus leucogaster breeding season in South Australia and the implications for habitat management. Corella 36:63-68.
- Dennis TE, McIntosh RR and Shaughnessy PD 2011b. Effects of human disturbance on productivity of White-bellied Sea Eagles (Haliaeetus leucogaster). Emu 111:179-185.

- Dennis, T.E. 2007a. Distribution and status of the Osprey *(Pandion haliaetus)* in South Australia. 107:294-299.
- Department for Environment and Heritage (DEH), 2006. Threatened Species of the South Australian Murray-Darling Basin Western Whipbird (eastern subspecies) *Psophodes nigrogularis leucogaster* Fact Sheet.
- Department for Environment and Heritage, 2008. Adelaide and Mount Lofty Ranges South Australia Threatened Species Profile – *Stagonopleura guttata*. Biodiversity Conservation Unit, Adelaide Region.
- Department for Environment and Water (DEW) 2017. Southern South Australia Soil Group Map, Department of Environment Water and Natural Resources, SA.
- Department for Environment and Water (DEW), 2020a. Biological Database of South Australia (BDBSA) for threatened flora and fauna species listed under the South Australian *National Parks and Wildlife Act 1972* (NPW Act). http://www.environment.sa.gov.au/Science/Information_data/Biological_databases_of_South_Australia.
- Department for Environment and Water (DEW), 2020b. NatureMapss Vegetation Mapping. Online resource accessed 15/02/2018 at http://spatialwebapps.environment.sa.gov.au/NatureMapss/?locale=en-us&viewer=NatureMapss.
- Department for Water Resources, Understanding The Southern Basins Rescribed Wells Area,
Draft Document, January 2001 Government of South (DWR 2001).
- Department of Agriculture, Water and the Environment (DAWE 2020f). Species Profile and Threats Database - Eastern Osprey - *Pandion cristatus*. Available at https://www.environment.gov.au/cgibin/ sprat/public/publicspecies.pl?taxon_id=952.
- Department of Agriculture, Water and the Environment (DAWE) 2020c. Species Profile and Threats Database - Australian Fairy Tern - *Sternula nereis nereis*. Available at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82950.
- Department of Agriculture, Water and the Environment (DAWE) 2020d. Species Profile and Threats Database – for Mallee Whipbird - (*Psophodes leucogaster leucogaster*). Available at https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64448.
- Department of Agriculture, Water and the Environment (DAWE), 2020a. Protected Matters Search Tool. Online resource accessed 14-Feb-2020 https://www.environment.gov.au/epbc/protectedmatters-search-tool.

- Department of Agriculture, Water and the Environment (DAWE), 2020b. Species Profiles and Threats Database. Online resource accessed 24-Mar-2020 https://www.environment.gov.au/cgibin/sprat/public/sprat.pl.
- Department of Agriculture, Water and the Environment (DAWE), 2020e. Species Profile and Threats Database - Southern Emu-wren (Eyre Peninsula) (*Stipiturus malachurus parimeda*) —. Available at https://environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26006.
- Department of Environment and Science (2016) Information Sheet Wildlife Management Osprey Nest Platform Manual. NCS/2016/3186 V1) cited online at https://environment.des.qld.gov.au/__data/assets/pdf_file/0033/89169/is-wl-osprey-nest.pdf.
- Department of Planning, Transport and Infrastructure (DPTI) 2020. Terrestrial Biodiversity Assessment Guidelines for Whalers Way Orbital Launch Complex.
- Department of Planning, Transport and Infrastructure(DPTI) (2020) GUIDELINES For the preparation of an ENVIRONMENTAL IMPACT STATEMENT Whalers Way Orbital Launch Complex Southern Launch. Space Pty Ltd23 July 2020. State Planning Commission.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 2011.
- Department of the Environment (DotE) 2013a. Conservation advice for Southern Emu-wren (Eyre Peninsula) (*Stipiturus malachurus parimeda*) —. Available from https://environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=26006.
- Department of the Environment (DotE), 2013b. Approved Conservation Advice for *Pleuropappus phyllocalymmeus* (silver candles). Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/21123-conservation-advice.pdf.
- Department of the Environment and Energy (DotEE) 2016. Threat abatement plan for competition and land degradation by rabbits. Available from https://www.environment.gov.au/system/files/resources/bf9352c2-35ae-4a80-8828-96de630731a9/files/tap-rabbit-2016.pdf.
- Department of the Environment, Land, Water and Planning (DELWP), 2016. National Recovery Plan for the Mallee Emu-Wren *Stipiturus mallee*, Red-lored Whistler *Pachycephala rufogularis*, Western Whipbird *Psophodes nigrogularis leucogaster*.
- Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008. Approved Conservation Advice for *Prostanthera calycina* (West Coast Mintbush).

Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/9470-conservation-advice.pdf.

- Department of the Environment, Water, Heritage and the Arts (DEWHA), 2013. Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, Department of the Environment, Water, Heritage and the Arts.
- Detmar SA and Dennis TE (2018), A review of Osprey distribution and population stability in South Australia. South Australian Ornithologist 43 (1-2).
- DEW 2020a, EGIS data: *Marine Benthic Habitats*, viewed September 2020, http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1224&pu=y&pa=dewnr. Department for Environment and Water, Adelaide, South Australia.
- DEW 2020d, EGIS data: *Benthic Habitat Survey Sites*, viewed September 2020, http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1234&pu=y&pa=dewnr. Department for Environment and Water, Adelaide, South Australia.
- DEW 2021a, EGIS data: *Coastal Shoreline Classification*, viewed February 2021, http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1149&pu=y&pa=dewnr. Department for Environment and Water, Adelaide, South Australia.
- DEW 2021b, EGIS data: *Marine Benthic Habitats*, viewed February 2021, http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1224&pu=y&pa=dewnr. Department for Environment and Water, Adelaide, South Australia.
- DEW 2021c, EGIS data: *New Zealand Fur Seal Colonies*, viewed February 2021, http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1213&pu=y&pa=dewnr. Department for Environment and Water, Adelaide, South Australia.
- DEWNR (2012), *Thorny Passage Marine Park Management Plan*, Department of Environment, Water and Natural Resources, Adelaide, South Australia.
- DEWNR (2015e) should be DEW(2020) disambiguated with some letter but the whole reference list needs cleaning up.
- DIN 4150-3, 2016 Edition, December 2016 - *Vibrations in buildings - Part 3: Effects on structures*.
- Director of National Parks (2013), *South-east Commonwealth Marine Reserves Network Management Plan 2013-23*, Director of National Parks, Canberra.
- Director of National Parks (2018), *South-west Marine Parks Network Management Plan 2018*, Director of National Parks, Canberra.

- Dooling, R. J., & Popper, A. N. (2016). *Technical Guidance for Assessment and Mitigation of the Effects of Highway and Road Construction Noise on Birds*. Sacramento, CA: California Department of Transportation, Division of Environmental Analysis.
- Dooling, R. J., & Popper, A. N. 2007. *The effects of highway noise on birds.* Sacramento, CA: California Department of Transportation Division of Environmental Analysis.
- DSEWPaC (2012), *Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011–2021*, Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DSEWPaC (2013), *Issues Paper for the White Shark (*Carcharadon carcharias*).* Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.
- Ecosphere 2020. Native Vegetation Clearance – Southern Launch Whalers Way Data Report.
- Edyvane, K 1999, Conserving Marine Biodiversity in South Australia Part 2, Identification of Areas of High Conservation Value in South Australia, SARDI Report Number 39, PIRSA, F2007/000565-9. SARDI Research Report Series No. 816.
- Edyvane, K 1999, *Conserving Marine Biodiversity in South Australia Part 2, Identification of Areas of High Conservation Value in South Australia*, SARDI Report Number 39, PIRSA, F2007/000565-9. SARDI Research Report Series No. 816.
- Einoder, L. (2009) *Foraging and reproductive ecology of short-tailed shearwaters terns*. PhD thesis, University of Adelaide, Australia.
- Environment Australia, May 2000, Environment Assessment Report Proposal To Construct And Operate A Satellite Launching Facility on Christmas Island (EAus 2000).
- EPA 2007. SA EPA Environmental Noise Guidelines – Audible Bird Scaring Devices.
- FAA (2016), *Final Environmental Assessment, Finding of No Significant Impact/Record of Decision for the Kodiak Launch Complex Launch Pad 3.* Federal Aviation Administration, United States of America.
- FAA, 14 CFR Part 150 - Airport Noise Compatibility Planning.
- FAA. (2009). *Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications.*
- FAA. (2018). *FAA History of Noise.* FAA.

- Fahrig, L. 2002. Effect of habitat fragmentation on the extinction threshold: a synthesis, Ecological Applications, vol. 12, no. 2, pp. 346 – 351.
- Fahrig, L. 2002. Effect of habitat fragmentation on the extinction threshold: a synthesis, Ecological Applications, vol. 12, no. 2, pp. 346 – 351.
- Fanning, C.M., 1981, The Carnot Gneisses, southern Eyre Peninsula., Geological Survey of South Australia, Quarterly Geological Notes, 80, p7-12.
- FAO (2021), Species Fact Sheets: *Arctocephalus gazella* (Peters 1875). Food and Agriculture Organization of the United Nations, Viewed February 2021, http://www.fao.org/fishery/species/3579/en.
- Federal Aviation Administration (FAA). 2009. *Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications*.
- Federal Aviation Administration. (2020). Draft Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station, February 2020.
- Forman, R.T.T., Sperling, D., Bissonette, J.A., Clevenger, A.P., Cutshall, C.D., Dale, V.H., Fahrig, L., France, R., Goldman, C.R., Heanue, K., Jones, J.A., Swamson, F.J., Turrentine, T. and Winter, T.C. 2000. Road Ecology. Science and Solutions., Island Press, Washington.
- Gales NJ, Shaughnessy PD & Dennis TE (1994) Distribution, abundance and breeding cycle of the Australian sea lion, *Neophoca cinerea* (Mammalia: Pinnipedia). *Journal of Zoology, London* 234, 353–370.
- Garnett, S., ed. 1993. Threatened and Extinct Birds of Australia. *RAOU Report 82*. Melbourne: Royal Australasian Ornithologists Union, and Canberra: Australian National Parks and Wildlife Service.
- Garnett, S.T. & G.M. Crowley 2000. *The Action Plan for Australian Birds 2000*. Canberra, ACT: Environment Australia and Birds Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/action/birds2000/index.html.
- Geological Survey of South Australia, 2017. Lincoln Sheet – Digital Edition. Department of State Development, SA.
- Geoscience Australia Brochure "Kast Hazards" https://www.ga.gov.au/__data/assets/pdf_file/0009/86490/Karst-Hazard.pdf.

- Gill, P.C. (2016). Offshore cetacean aerial surveys in the Great Australian Bight. Final report to SARDI. Great Australian Bight Research Program. Research Report Series Number 10, 26pp.
- Goldsworthy, S. D., and Shaughnessy, P. D. (1994). Breeding biology and haul-out pattern of the New Zealand fur seal, *Arctocephalus forsteri*, at Cape Gantheaume, South Australia. *Wildlife Research* 21, 365–376.
- Goldsworthy, S.D. & Page, B (2010) *Review of the distribution of crested terns, little penguins, short-tailed shearwaters and flesh-footed shearwaters in the South-west Marine Region off South Australia*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000609-1. SARDI Research Report Series No. 451.12p.
- Goldsworthy, S.D. (2020). Australian sea lion listing assessment. Report to the Department for Environment and Water, Department of Agriculture, Water and the Environment. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2020/000131-1. SARDI Research Report Series No. 1056. 26pp.
- Goldsworthy, S.D., Bailleul, F., Nursey-Bray, M., Mackay, A., Oxley, A., Reinhold, S-L., and Shaughnessy, P.D. (2019), *Assessment of the impacts of seal populations on the seafood industry in South Australia,* Adelaide, June. South Australian Research and Development Institute (Aquatic Sciences).
- Goldsworthy, S.D., Hodgson, J. and Holman, D. (2020). Australian sea lion investigations: 2018-19. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2020/000052-1. SARDI Research Report Series No. 1051. 88pp.
- Goldsworthy, S.D., Mackay, A.I., Bilgmann, K., Möller, L.M., Parra, G.J., Gill, P., Bailleul, F., Shaughnessy, P., Reinhold, S-L. & Rogers, P.J. (2017). Status, distribution and abundance of iconic species and apex predators in the Great Australian Bight. Final Report GABRP Project 4.1. Great Australian Bight Research Program, GABRP Research Report Series Number 15, 227pp.
- Goldsworthy, S.D., Page, B. (2009) *A Review of the Distribution of Seals in South Australia*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, SARDI Publication No. F2009/000368-1, 21pp.
- Goldsworthy, SD, Mackay, AI, Shaughnessy, PD and Holman, D (2015). Maintaining the monitoring of pup production at key Australian sea lion colonies in South Australia (2014/15. Final report to the Australian Marine Mammal Centre. South Australian

Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000665-5. SARDI Research Report Series No. 871. 73pp.

- HCl. (n.d). PH estimates https://www.oxy.com/OurBusinesses/Chemicals/Products/Documents/hydrochloricacid/tech-calculated_ph_values_HCl.pdf.
- Higgins PJ, Peter JM, (Eds). 2002. Handbook of Australian, New Zealand and Antarctic Birds. Volume 6. Pardalotes to Spangled Drongo. Oxford University Press, Melbourne.
- Hoang, T.2013. A literature review of the effects of aircraft disturbance on seabirds, shorebirds and marine mammals. *(Presented to NOAA, Greater Farallones National Marine Sanctuary and The Seabird Protection Network).*
- Hughes. R., Inouye. B.D., Johnson, M.T., Underwood. N, and Vellend. M. 2008. Ecological consequences of genetic diversity. Ecology Letters, vol 11, issue 6, pp. 609-623.
- IFAW & MCRL (2013), *Final report for a survey of cetaceans in the eastern Great Australian Bight 26th April – 8th May 2013*, International Fund for Animal Welfare and Marine Conservation Research Limited.
- Interim Biogeographic Regionalisation for Australia (IBRA), 2012. Interim Biogeographic Regionalisation for Australia, Version 7. Department of the Environment and Energy, Canberra.
- International Union for Conservation of Nature (IUCN), 2001. Categories & Criteria (version 3.1). Online resource accessed 7/03/2018 at http://www.iucnredlist.org/static/categories_criteria_3_1.
- IPCC. (1995). *Second Assessment Report - Working Group I: The Science of Climate Change*. Intergovernmental Panel on Climate Change. Retrieved from http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml.
- IPCC. (2007). *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt,M. Tignor and H.L. Miller (eds.). Cambridge, UK and New York, NY, USA: Cambridge University Press. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html.
- IPCC. (2013). *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

- Iron Road (2014), *Central Eyre Iron Project Infrastructure Environment Protection and Biodiversity Conservation Act 1999 (Cth). Referral to Australian Government*. Central Eyre Iron Project.
- ISIS. (n.d.). Rumiyah Magazines.
- ISO IWA 14-1:2013 Vehicle security barriers – Part 1: Performance requirement, vehicle impact test method and performance rating.
- ISO IWA 14-2:2013 – Part 2: Application Standards Australia Handbook 167:2006 Security Risk Management.
- Jacobs 2020. Whalers Way Eastern Osprey and White-bellied Sea Eagle Detailed Assessment. Kutt, A.S., Vanderduys, E.P., Ferguson, D. and Mathieson, M. 2012. Effect of small-scale woodland clearing and thinning on vertebrate fauna in a largely intact tropical savanna mosaic, Wildlife Research, vol. 39, no. 4, pp. 366 – 373.
- Jansen et al. (1988). L H J M Janssen, J H A van Wakeren, H van Duuren ans A J Elshout, A Classification of NO Oxidation Rates in Power Plant Plumes Based on Atmospheric Conditions. *Atmospheric Environment*, Vol 22 No 1pp 43-53.
- Journal of Cleaner Production, Volume 255, 10 May 2020, 120209, The environmental impact of emissions from space launches: A comprehensive review, J.A. Dallas, S. Raval, J.P. Alvarez-Gaitan, S. Saydam, A.G. Dempstera (Dallas, et.al 2020).
- Loyn, R.H., Runnalls, R.G., Forward, G.Y. and Tyers, J. 1983. Territorial bell miners and other birds affecting populations of insect prey, Science, vol. 221, pp. 1411 – 1412.
- Lubert, C. P. (2017). *Sixty years of launch vehicle acoustics.* Proc. Mtgs. Acoust. 31.
- Mackay, A.I. and Goldsworthy, S.D. (2015). *Monitoring southern right whale abundance, distribution and population dynamics at the Great Australian Bight aggregation*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2014/000052-2. SARDI Research Report Series No. 835. 28pp.
- Maguire G. S. 2005. Behavioural Ecology of the Southern Emu-wren (*Stipiturus malachurus*) Phd thesis. Department of Zoology, University of Melbourne.
- Marzin, C (2018), *Takes of Marine Mammals Incidental to Specified Activities: Taking Marine Mammals Incidental to Boost-Back and Landing of Falcon 9 Rockets,* National Marine Fishery Service, Federal Register / Vol. 83, No. 221.
- McClatchie, S, Middleton, J, Pattiaratchi, C, Durrie D & G Kendrick (eds), (2006), *The South-west Marine Region: ecosystems and key species groups*, report for the Department

of the Environment and Water Resources, Hobart, pp. 47–519, viewed February 2021, www.environment.gov.au/coasts/mbp/publications/south-west/sw-ecosystems.html.

- McFarlane, D (2016), *Cape Wiles Fur Seal Colony – Kruising Around Australia,* viewed February 2021, https://dimcfarlane369.wordpress.com/tag/cape-wiles-fur-seal-colony.
- McKenzie, J., Page, B., Shaughnessy, P. D. and Hindell, M. A. (2007b). Age and reproductive maturity of New Zealand fur seals (Arctocephalus forsteri) in southern Australia. *Journal of Mammalogy*, 88(3): 639-648.
- McLeay. LJ (2014). Seabirds and Shorebirds of Spencer Gulf. Part B: Seabirds of Southern Spencer Gulf -In Natural History of Spencer Gulf. Chapter 3 Biological systems.
- McLeay. LJ, Page BP & Goldsworthy, SD (2017). But first, are you experienced? The consequences of timing, age, and adult condition on reproductive performance in Greater Crested Terns *Thalasseus bergii*. Marine Ornithology 45: 205–215.
- McNamara, D. 1966. The Western Whipbird on Eyre Peninsula. *South Australian Ornithologist*. 24:93.
- Moenting, A.E. and Morris, D.W. 2006. Disturbance and habitat use: is edge more important than area?, Oikos, vol. 115, no. 1, pp. 23 – 32.
- Moenting, A.E. and Morris, D.W. 2006. Disturbance and habitat use: is edge more important than area?, Oikos, vol. 115, no. 1, pp. 23 – 32.
- Möller, L.M., Parra, G.J. and Bilgmann, K. (2012). *Population size, structure and habitat preferences of common dolphins in South Australia: enhancing the assessment, reduction and mitigation of fisheries operational interactions*. Australian Marine Mammal Centre, Australian Antarctic Division, Hobart, Australia.
- Morrice, M.G., P.C. Gill, J. Hughes and A.H. Levings (2004). Summary of aerial surveys conducted for the Santos Ltd EPP32 seismic survey, 2-13 December 2003. Report # WEG-SO 02/2004, Whale Ecology Group-Southern Ocean, Deakin University.
- NASA, 1983, Technical Paper 2258, Space shuttle exhaust cloud properties, BJ Anderson, VW Keller (NASA 1983).
- NASA. (2019, August 12). *Global Climate Change - Vital Signs of the Planet*. (E. S. Laboratory, Editor) Retrieved August 8, 2019, from National Aeronautics and Space Administration: https://climate.nasa.gov/causes/.
- National Aeronautics and Space Administration, November 2011, Environmental Assessment for Launch of Routine Payloads (NASA 2011).

- National Health and Medical Research Council, 2011, National Water Quality Management Strategy Australian Drinking Water Guidelines 6, Version 3.5 Updated August 2018 (NHMRC 2011).
- National Institute of Water & Atmospheric Research Ltd, April 2017, Ecological Risk Assessment of the impact of debris from space launches on the marine environment Prepared for Ministry for the Environment, Geoffroy Lamarche et.al (NIWAR 2017).
- Native Vegetation Council 2017. Guide for applications to clear native vegetation Under the Native Vegetation Act 1991 and Native Vegetation Regulations 2017. Native Vegetation Management Unit, Govt. of South Australia.
- Native Vegetation Council, 2019. Bushland Assessment Manual, Native Vegetation Management Unit, Govt. of South Australia.
- NatureMaps, 2020. Enviro Data SA. Online resource: https://data.environment.sa.gov.au/NatureMapss/Pages/default.aspx.
- NCAR. (2019). *Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, Z. Liu, J. Berner, W. Wang, J. G. Powers, M. G. Duda, D. M. Barker, and X.-Y. Huang, 2019: A Description of the Advanced Research WRF Version 4. NCAR Tech. Note NCAR/TN-556+STR, 145 pp.*
- New Zealand Ministry for the Environment, 2017, Agency Disclosure Statement Regulatory Impact Statement: Regulation of deposit of jettisoned material from space vehicle launches under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, (NZME 2017).
- Nicholson, A.F. and Cane, S.B. 1994 Pre-European coastal settlement and use of the sea. *Australian Archaeology* 39:108-117.
- Nolan, D. (2018). Handbook of Fire and Explosion Protection Engineering Principles for Oil, Gas, Chemical and Related Facilities, 4th Edition by Dennis Nolan, October 2018.
- Northern Agricultural Catchments Council (NACC), 2020. Threatened Species of the Week: *Sternula nereis nereis* (Australian Fairy Tern). Available at: https://www.nacc.com.au/threatenedspecies-weeksternula-nereis-nereis-australian-fairy-tern/.
- Oak Ridge National Laboratory,1991, DOE Interagency Agreement No. 1016-1844-Al, Project Order No. 87PP8774, Characterization of Rocket Propellant Combustion Products Chemical Characterization and Computer Modeling of the Exhaust Products from Four Propellant Formulations A. A. Jenkins, C.W. Nesor, C. V. Thompson, T. M. Gayle, C.Y.Ma, B. A. Tomkins, R. L. Moody (Jenkins 1991).

- Oliver, J (2006), *Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launches from Kodiak Island, AK,* National Marine Fishery Service, Federal Register / Vol. 82, No. 12.
- Pickett M, 2002. Status Review and Action Plan for the Eyre Peninsula Southern Emu-wren I *malachurus parimeda*. Southern Eyre Birds Inc. and National Parks and Wildlife, South Australia.
- Pickett M, 2006. Habitat Management Guidelines for the Eyre Peninsula Southern Emu-wren. Port Lincoln, South Australia. Department of Environment and Heritage, Port Lincoln South Australia.
- Pickett, M. 2003. Status and Distribution of the Eyre Peninsula Southern Emu-wren at the Proposed Cathedral Rocks Windfarm Site. Unpublished report prepared for Hydro Tasmania, Hobart.
- Pickett, M. 2004a. Recovery Planning for the Eyre Peninsula Southern Emu-wren - 2004 Survey. Unpublished report prepared for the Department for Environment and Heritage, South Australia.
- Pickett, M. 2004b. Draft Recovery Plan for the Eyre Peninsula Southern Emu-wren (*Stipiturus malachurus parimeda*) 2005 - 2009. Unpublished draft prepared for the Department for Environment and Heritage, South Australia.
- Pickett, M. 2004c. Eyre Peninsula Southern Emu-wren and Western Whipbird Monitoring at the Cathedral Rocks Wind Farm Heritage Agreement Area - Spring 2004. Unpublished report prepared for Hydro Tasmania, Hobart.
- Pickett, M. 2005. Eyre Peninsula Southern Emu-wren and Western Whipbird Monitoring at the Cathedral Rocks Wind Farm Heritage Agreement Area - Spring 2005. Unpublished report prepared for Hydro Tasmania, Hobart.
- Pitcher B (2018) *Australian Sea Lion Monitoring Framework: background document*. Report prepared for the Department of the Environment, Canberra.

- Pitcher, C.R., Rochester, W., Dunning, M., Courtney, T., Broadhurst, M., Noell, C., Tanner, J., Kangas, M., Newman, S., Semmens, J., Rigby, C., Saunders T., Martin, J., Lussier, W. (2018) *Putting potential environmental risk of Australia's trawl fisheries in landscape perspective: exposure of seabed assemblages to trawling, and inclusion in closures and reserves — FRDC Project No 2016-039*. CSIRO Oceans & Atmosphere, Brisbane, 71 pages.
- Pizzey G, Knight F, 2007. The Field Guide to the Birds of Australia. Harper Collins Publishers, Sydney Australia.
- Project Description (2020). Southern Launch / AECOM document for inclusion in approval documentation.
- Radford A, Morley E, Jones G, 2012. The Effects of Noise on Biodiversity (NO0235). Department for Environment Food and Rural Affairs, United Kingdom.
- Rassler, D. (2018). The Islamic State and Drones – Supply, Scale and Future Threats.
- Rauch, SD (2017), *Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Space Vehicle and Missile Launch Operations at Pacific Spaceport Complex Alaska, Kodiak Island, Alaska***,** National Marine Fishery Service, Federal Register / Vol. 84, No. 69.
- Rauch, SD (2019), *Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Air Force Launches and Operations at Vandenberg Air Force Base, California*, National Marine Fishery Service, Federal Register / Vol. 84, No. 69.
- Reef Life Survey (2021), *Reef Life Survey Data Portal*, viewed February 2021, http://reeflifesurvey.imas.utas.edu.au/static/landing.html.
- Reid, T.A., Hindell, M.A., Eades, D.W. & Newman, M (2002), Seabird Atlas of South-eastern Australian Waters, Birds Australia Monograph 4, Birds Australia, Melbourne.
- Robinson, AC, Canty, P, Mooney, P & Rudduck, P (1996), *South Australia's Offshore Islands,* Australian Heritage Commission and Department of Environment and Natural Resources, South Australia.
- Rogers PJ, Drew M, Bailleul F and Goldsworthy SD (2016). *Offshore survey of the biodiversity, distributions and habitat use of pelagic sharks in the Great Australian Bight*. GABRP Research Report Number 7, Great Australian Bight Research Program, August 2016, 77pp.
- Rogers, C. 2003. Bird report 2001. *South Australian Ornithologist*. 34:57-69.

- Rowden, P., Steinhardt, D. and Sheehan, M. 2008. Road crashes involving animals in Australia, Accident Analysis and Prevention, vol. 40, no. 6, pp. 1865 – 187.
- SA. (2016). *South Australia Environment Protection (Air Quality) Policy. Adelaide: South Australian Government.*
- Santithammarak, V. (2011). Vulnerability of Electric Power Systems to Terrorist Attack.
- SARIG, 2020. South Australian Resources Information Gateway. Online resource: https://map.sarig.sa.gov.au/.
- Schürmann, C.W. 1844 *A Vocabulary of the Parnkalla Language Spoken by the Natives Inhabiting the Western Shores of Spencer's Gulf, to Which is Prefixed a Collection of Grammatical Rules Hitherto Ascertained.* Adelaide: George Dehane.
- Schürmann. C.W. 1997 [1879] The Aboriginal Tribes of Port Lincoln in South Australia, Their Mode of Life, Manners, Customs, Etc, in J.D. Woods (ed.), *The Native Tribes of* South Australia, pp. 209–251. Adelaide: Friends of the State Library of South Australia, [Originally published Adelaide: E.S. Wigg & Son, 1879].
- Shannon, G., McKenna, M. F., Angeloni, L. M., Crooks, K. R., Fristrup, K. M., Brown, E.
- Shaughnessy, P. D., Dennis, T. E. and Seager, P. G. (2005). Status of Australian sea lions, *Neophoca cinerea*, and New Zealand fur seals, *Arctocephalus forsteri*, on Eyre Peninsula and the Far West Coast of South Australia. *Wildlife Research*, 32(1): 85-101.
- Shaughnessy, P.D., Goldsworthy, S.D and Mackay, A. (2014). Status and trends in abundance of New Zealand fur seal populations in South Australia. Final report to the Australian Marine Mammal Centre. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2014/000338-1. SARDI Research Report Series No. 781.33pp.
- Shepherd, S. A. & Brook, J. B. (2005). *A Survey of the Western Blue Groper on Southern Eyre Peninsula, South Australia*. Report for Reef Watch, Conservation Council of South Australia, Adelaide.
- Shepherd, SA, Brook, JB & Bloomfield, A (2005). *A Survey of the Western Blue Groper on Southern Eyre Peninsula, South Australia*. Report for Reef Watch, Conservation Council of South Australia, Adelaide.
- Skira, I.J. (1991). The short-tailed shearwater: a review of its biology. *Corella* 15:45-52.
- SLR Consulting Australia Pty Ltd, Whalers Way Orbital Launch Complex, Air Quality Impact Assessment, SLR Ref No: 640.30035-R01-v1.1 (SLR 2020).

- South Australia *Environmental Protection (Noise) Policy 2007 (Noise EPP)*.
- South Australian *Development Act 1993*.
- South Australian *Environment Protection Act 1993*.
- Southall, B., Bowles, A., Ellison, W., Finneran, J., Gentry, R., Greene, C., Kastak, D., Ketten, D., Miller, J., Nachtigall, P., Richardson, W., Thomas, J. and Tyack, P. (2007). Aquatic Mammals Noise Exposure Criteria - Southall et al (2007) Aquatic Mammals Aquatic Mammals Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*, [online] 33(4).
- Southall, BL, Bowles, AE, Ellison, WT, Finneran, JJ, Gentry, RL, Greene, CR, Kastak, D, Ketten, DR, Miller, JS, Nachtigall, PE, Richardson, WJ, Thomas, JA & Tyack, PL (2007), Marine mammal noise-exposure criteria: initial scientific recommendations, *Aquatic Mammals*, 33(4), pp.411-521.
- Southern Launch (2021), *Liguanea Island Seal Risk Assessment*.
- SpaceX. (2019). *Draft Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Centre (KSC)*.
- SpaceX. (2020). *Draft Environmental Assessment for SpaceX Falcon Launches at Kennedy Space Centre and Cape Canaveral Air Force Station*.
- SpaceX. 2019. Draft Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Centre (KSC).
- SRC. (2011). *CALPUFF Modelling System Version 6 User Instructions*.
- Standards Australia 31000:2009 Risk Management Principles and Guidelines.
- Threatened Species Scientific Committee (TSSC), 2015. Conservation Advice *Halobaena caerulea* blue petrel. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1059-conservation-advice-01102015.pdf.
- Threatened Species Scientific Committee (TSSC), 2016a. Conservation Advice *Limosa lapponica baueri* Bar-tailed godwit (western Alaskan). Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/86380-conservation-advice-05052016.pdf.

- Threatened Species Scientific Committee (TSSC), 2016b. Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberian). Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/86432-conservation-advice-05052016.pdf.
- Threatened Species Scientific Committee (TSSC), 2019. Conservation Advice Botaurus poiciloptilus Australasian Bittern. Canberra, ACT: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1001-conservation-advice-18012019.pdf.
- Threatened Species Section (2006) Threatened Tasmanian Eagles Recovery Plan 2006-2010. Department of Primary Industries and Water, Hobart.
- Tixier P, Lea M, Hindell MA, Guinet C, Gasco N, Duhamel G, Arnould JPY. 2018. Killer whale (Orcinus orca) interactions with blue-eye trevalla (Hyperoglyphe antarctica) longline fisheries.
- University of Michigan Department of Electrical and Computer Engineering Space Physics Research Laboratory Ann Arbor, Michigan, NASA Contractor Report NASA-CR-129003, 1973, Assessment of possible environmental effects of space shuttle, R.J. Cicerone, et. al. (NASA 1973).
- USAF (1997), Environmental Assessment for the U.S. Air Force *atmospheric interceptor technology PROGRAM*. United States Air Force, Los Angeles Air Force Base, CA. 1v plus Appendices.
- USAF (2018), Application for Incidental Take Regulations and Letters of Authorization; U.S. Air Force Launches, Aircraft and Helicopter Operations at Vandenberg Air Force Base, California. United States Air Force.
- USAF. (1998). *Final Environmental impact Statement - Evolved Expendable Launch Vehicle Program.* U.S. Air Force. 1260 Air Force Pentagon, Washington, D.C.: HQ USAF/ILEVP.
- Vella, G., Rushforth, I., Mason, E., Hough, A., England, R., Styles, P., . . . Thorne, P. (2001). *Assessment of the effects of noise and vibration from offshore wind farms on marine wildlife*. Centre for Marine and Coastal Studies Ltd (CMACS).
- VicFlora, 2020. Flora of Victoria. Online resource. https://www.rbg.vic.gov.au/.
- Wallbridge Gilbert Aztec, 11 August 2020, Southern Launch Southern Launch Whaler's Way Stormwater Management Plan Project No. WGA181404 Doc No. WGA181404-CV-RP-0001 Rev. A (WGA 2020b).

- Wallbridge Gilbert Aztec, 13 August 2020, Southern Launch Proposed Whalers Way Development, Preliminary Geotechnical Investigation, Project No. WGA181404, Doc No. WGA181404-RP-GE-0001, Rev. A (WGA 2020a).
- Way SL, van Weenen J, 2008. Eyre Peninsula Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus whitei*) Regional Recovery Plan. Department for Environment and Heritage, South Australia.'
- Wilson RP, Culik WB, Danfeld R, Adelung D (1991) People in Antarctica-how much do Adélie penguins *Pygoscelis adeliae* care? Polar Biol 11:363–370.
- Wittemyer, G. 2016. A synthesis of two decades research documenting the effects of noise on wildlife. *Biological Reviews*, 91:982-1005.
- WRI. (2004). A Corporate Accounting and Reporting Standard – Revised Edition. World Resources Institute / World Business Council for Sustainable World Business Council for Sustainable Development.
- Wyle. (2003). *Noise Basics and the Effect of Aviation Noise on the Environment.* Wyle.
- Wyle. 2003. Noise Basics and the Effect of Aviation Noise on the Environment. USA: Wyle.