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Subject	Whaler's Way Raptors	Project Name	Southern Launch Ecology Advice
Attention	Andrew Curran	Project No.	IS357400
From	Zeta Bull and Larry Bebbington		
Date	16 November 2020		
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1. Purpose

The Whalers Way Orbital Launch Complex project is currently preparing planning approval documentation. A preliminary Terrestrial Biodiversity Technical Report (AECOM 2020a) and Noise assessment (AECOM 2020b), along with other assessments have been prepared to support planning approvals.

The guidelines received for the project approval (EIS guidelines discussed further below (DPTI 2020 cited in AECOM 2020a) requested further information specifically regarding impacts to fauna. In addition, initial comments from the Department of Environment and Water also suggested more information was required regarding Eastern Osprey and White-bellied Sea Eagle. They suggest these species require specialist assessment to determine status, likely impact and potential mitigation measures while minimising survey impact. They suggest detailed assessment be undertaken by a suitably qualified coastal raptor expert. This document provides background and summary desktop information as a starting point for discussions with coastal raptor experts and regulators regarding this project proposal, as well as information to inform EIS and potentially Environment Protection Biodiversity Conservation Act referral documentation.

Whilst Dr Zeta Bull is not a 'qualified coastal raptor expert', she has PhD in ecology and over 16 years environmental consulting experience. She has undertaken numerous desktop and field assessments for a range of regulatory approval documents (e.g. Environmental Impact Statements, MARP / Program for Environment Protection and Rehabilitation, Mineral Lease Proposals Development Applications) for common and threatened species and prepared several EPBC referrals. Where necessary and required, she has the ability to liaise with coastal raptor experts and DEW regarding this project.

Larry Bebbington, an independent consultant, has well over 30 years' experience monitoring and rehabilitating raptors including coastal raptors. Larry has been accredited by DEW for approximately 20 years on Eyre Peninsula for the rescue, rehabilitation and release of raptors. Larry in his role as an environmental consultant has also worked and liaised with Terry Dennis (private raptor expert) and Sharie Detmar (DEW – Coastal) on coastal raptor surveys, coastal development applications and coastal landform rehabilitation.

Project details, including noise estimates and assumptions have been provided by Southern Launch and associated background assessments.

2. Background

On 29 August 2019, the Minister for Planning ('the Minister') declared the Whalers Way Orbital Launch Complex to be assessed as a Major Development pursuant to Section 46 of the Development Act 1993 (the Act) (DPTI 2020). Guidelines were developed for the EIS (DPTI July 2020), suggesting that broader assessment and investigation was required regarding impacts to threatened species, including noise impacts. It is noted that the guidelines suggested that the proponent concluded with a high degree of certainty that the proposal would not involve a controlled action and would therefore not be formally referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) to seek approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). However as per the September version of the terrestrial biodiversity assessment for the project (AECOM 2020a), the project will now be referred.

The EIS guidelines (July 2020) for the project suggest that critical assessment / further detail is required for flora and fauna of the following, that are relevant to this technical note:

- Thorny Passage Marine Park
- Jussieu Peninsula to Coffin Bay Peninsula
- Offshore Island Liguanea Island (Australian Sealion Colony, short-tailed Shearwater colony) within Lincoln National Park.
- Provide details on potential for impacts, mitigation measures and management measures
- Development impacts on coastal clifftops
- Extent of fauna, nature of impacts (noise / fire)
- Buffer distances that would be required including coastal access points
- Any compensatory activities

The guidelines also suggest that 'medium assessment' was also required for noise impacts to avifauna. In addition, DEW require further information on the status, impact and mitigation measures for the Eastern Osprey and White-bellied Sea Eagle (WBSE) as a result of the project proposal.

AECOM (2020a) biodiversity assessment was finalised in September 2020, and addressed the DPTI EIS guidelines. Regarding the raptors in question, the report concluded that White-bellied Sea-Eagle was recorded at the site, and a known Osprey nest was recorded at the site, but that significant impacts following construction and during operation of the project were not anticipated. Whilst this may be true, DEW require further assessment and information. Some of this information is provided below.

It is noted that in response to concerns raised the scope of the project has been reduced and the total area of vegetation clearance / ground disturbance has been minimised. The Project now involves the following sites:

- Launch Site A,
- Launch Site B,

- Warehouse and Maintenance Site,
- Range Control Building,
- Roads to be upgraded

Whilst Osprey and WBSE were recorded flying overhead during vegetation assessment and both species are regularly seen flying overhead past coastal areas (Mike Damp pers. Comm.), no active nests are known for the cliffs below the proposed project sites.

3. Project Information Summary

Launch vehicles (rockets) will range from approx. less than 1 tonne through to 100 tonne. It is believed the majority of launch vehicles will be in the micro range and be less than 15 tonne, with a very small percentage of launches involving vehicles above 40 tonne. The noise modelling has been based on the worst case scenario of the largest vehicles generating 140 dB, but this is likely to be a rare occurrence. It is believed that the smaller vehicles will generate approximately 120 dB.

To put this in perspective, the Space Shuttle (2030 tonne) is launched from Kennedy Space Center in Florida. The space shuttle generates approximately 190 dB on lift off. The Kennedy Space Center site is 570 km², with the spaceport infrastructure utilising approximately 9% (51 km²). Given much of the installation is a restricted area and only nine percent of the land is developed, the Kennedy site also serves as an important wildlife sanctuary. Mosquito Lagoon, Indian River, Merritt Island National Wildlife Refuge and Canaveral National Seashore are other features of the area. The refuge supports one of the highest numbers of threatened and endangered species anywhere in the nation. Wildlife indigenous to the area include; the endangered Bald Eagle, American Alligators, Eastern Diamondback Rattlesnakes, the endangered Florida Panther, dolphins, Florida Manatees and a broad range of marine fauna.

The Whalers Way Orbital Launch Facility will generate noise levels equivalent to a small warehouse for the vast majority of time (more than 99.9% of time). The facility will generate a large level of noise for approximately 60 seconds, approximately 36 times per year (once every 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% 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 flame trench 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, which are a similar or lesser distance than the nearest abandoned Osprey nests at the location (> 2 km from launch pads) (refer AECOM 2020b).

There is existing background noise / disturbance at the Whaler's Way site. The site is currently an unmanaged Vegetation Heritage Agreement with unmanaged public access. Vehicles, rubbish, camping, dogs, and people walking along cliff tops above two abandoned Whalers Way Osprey nests. The Department of Defence have also used the cliffs near the abandoned nest for military training / abseiling, helicopter presence.

The land is subject to a Native Vegetation Heritage Agreement (HA 148) 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. It should also be noted that the site does not include the adjacent Crown Land Allotment 102 - CR 5993/375 which comprises the coastal reserve surrounding the subject site. The proposed launch sites will be a sufficient distance away from the cliff edge to ensure it is outside any wind recirculation zones that might endanger rocket launch events. This recirculation zone typically occurs within the boundaries of the Crown Land (refer planning approval documents for further information, Project Description June 2020).

In its current condition, the subject site is predominantly an undeveloped vegetated coastal area, which is punctuated by access roadways, open areas including car parking and picnic/camping areas together with supporting infrastructure such as tables, bins, signage and fencing. 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 (Project Description June 2020).

The majority of the site is covered in remnant vegetation which varies in form primarily based on the distance from the coastline and the nature of the ground conditions. Some areas have been historically cleared, with varying degrees of regrowth evident in these areas. A series of access tracks exists throughout the site, 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 (Project Description June 2020).

The character of the land is typically that of an undeveloped vegetated coastal area, with a material degree of human modification to support access and passive recreational uses having occurred over time. Much of the infrastructure supporting passive recreational uses is reaching the end of its economic life and evidences a limited amount of maintenance in recent years (Project Description June 2020).

Key conservation areas adjacent the site include:

- The Lincoln National Park exists on the peninsula to the north-east of the subject site and the Cathedral Rocks wind farm comprising of 33 Wind Turbines, is located on abutting land with frontage to the coast to the north-west of the subject site.
- The Thorny Passage Marine Park is located off the coast to the south of the subject land within the Southern Ocean.
- The State Heritage listed Former Fishery Bay Whaling Station, and Thorny Passage Marine Park are located on land abutting the north-eastern boundary of the land which is the subject of the development proposal.

The proposed project involves staged development of infrastructure to support domestic and international launch vehicles providing a safest and cost-effective orbital launch site servicing the growing demand for Polar and Sun Synchronous Orbit satellite insertion. Further detail is provided in 'Project Description June 2020', provided by Southern Launch.

As per AECOM 2020a: Indirect impacts during construction and operation will be managed through a Construction and Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) which will be developed for the Project.

The mitigation hierarchy as devised by the Native Vegetation Council (NVC) (NVC 2017) has been applied during the design of the Project (refer AECOM 2020a). This included reducing the footprint as far as practicable to avoid clearing native vegetation and implementing a CEMP and OEMP to manage indirect impacts. Proposed measures are listed in AECOM 2020a (Table 19), examples include:

- The size of the Project Area has reduced in size from 70.58 ha to 35.24 ha from concept design;
- Proposed access tracks have been aligned with existing tracks where possible;
- The Project incorporates micro-lift and small-lift rocket vehicles that do not require large areas for infrastructure;
- Areas that will be temporarily cleared for lay-down areas will be rehabilitated in accordance with the CEMP; and
- Mitigation measures outlined in the CEMP and OEMP will include monitoring and contingency actions to ensure that proposed management is effective and fit-for-purpose.
- Fauna management actions include scheduling vegetation clearance activities to avoid breeding seasons as far as practicable, establishing fauna exclusion fencing, fauna removal / handling protocols etc.

Operational noise from the project are considered to be:

- Warehouse level noise when the complex is idle for approximately 30% of the time (given a portion of the work for each launch would happen offsite at a Pt. Lincoln Warehouse)
- Noise level maximum of 130-140 dB (at one of two project launch sites) for approximately one minute, once or twice every year (for larger launch vehicles) and much lower dB for smaller launch vehicles (once every 3-4 weeks) up to maximum of 36 launches per year.
- Mitigation measures such as scare gun (120 dB) used prior to launch times to remove sensitive fauna from immediate noise zone (see below)
- Flame trench and water deluge system will dissipate noise at the source by and estimate 5-10 dB.

Launch trajectory

It is estimate that the launch vehicles would launch at an angle of 74 degrees for approx. 10 km, which would not cause disturbances to raptors (or other fauna) on the coast or Liguanea Island.

3.1 Audible Bird Scaring Devices (Scare Gun)

It should be noted that the 2007 Audible bird scaring devices - Environmental noise guidelines issued by the South Australian EPA allow for maximum accumulated peak level (APL) for impulsive noise devices of 118 dB. This level is determined by the location of the nearest human receptor. These devices generate approx. 120 dB and can be used multiple times throughout hours of 7am to 8pm. Primary producers set these devices to generate loud noise bursts for 6 to 10 (or more) bursts per day which results in potentially over 130 (or more) loud and sudden bursts of noise per day. Southern

Launch's proposal involves one loud burst of noise every three weeks to encourage fauna in the immediate vicinity of the launch to move away from the area (e.g. priority for smaller threatened birds, Western Whipbird and Southern Emuwren).

3.2 Terminology

As per Dennis and Detmar (2018) and Detmar and Dennis (2018) key terminology related to breeding for both the Eastern Osprey and the White-bellied Sea Eagle is as follows:

Occupied territory: where an adult pair is observed together during the breeding season near nest(s) with nest repair or territory defence behaviours observed.

Active nest or territory: where incubation behaviour is observed, or where young are recorded.

Successful nest or territory: where young are fledged.

Failed nest or territory: where eggs fail to hatch, or where eggs or young are lost.

Abandoned territory: found to be unoccupied over two or more consecutive seasons and where nest structures have fallen into disrepair.

Vacant territory: where no birds were seen nearby for one season and the nest structure was intact, but no evidence of recent repair or occupation was apparent.

Primary nest: the most frequently used nest within a territory.

Alternative nest: one of sometimes several nest structures within a territory.

Core territory: the defended area around a primary nest site.

Guard-roosts: strategic nest defence vantage points within the core territory.

4. Osprey

4.1 SA distribution / status

The Eastern Osprey / Australian Osprey (*Pandion haliaetus cristatus*) is not specifically listed under the EPBC Act. However, at the species level the Osprey (*Pandion haliaetus*), which has global representation, is listed as Migratory and Marine under the EPBC Act. The Eastern Osprey is listed as Endangered under the SA *National Parks and Wildlife Act 1972*.

Comprehensive surveys of Osprey distribution in SA are regularly undertaken, with recent surveys being undertaken in 2008-2010 (Dennis et al. 2011a) and 2015-2017 (Detmar and Dennis 2018). Comparison of the two surveys has revealed a decline in occupied territories from 58 to 43. The greatest decline has occurred at western SA locations and on Kangaroo Island. Of the 43 remaining known territories, only 30 occur on the mainland. Recent studies also considered that the current population is considered to be unstable with a number of nest relocations and 'refugee' pairs relocating to start new territories. Multiple contributing factors are likely to be influencing the instability in the current distribution (Detmar and Dennis 2018).

In Australia the species occurs in coastal and estuarine northern temperate and subtropical regions, with the isolated SA population considered to be on the extreme southern edge of the species preferred bioclimatic range (Dennis and Clancy 2014).

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). The site is considered to be within the south-eastern extent of the 'western Eyre Peninsula' bioregion. A number of nests in this bioregion, particularly those on 'sea-stacks' were severely damaged in the storms of 2015/2016. A total of 17 occupied territories were located between Wahgunyah CP (Far West) and Cape Catastrophe (south eastern point of Lincoln National Park) during the recent surveys (Detmar and Dennis 2018). It is noted that there were eight territories recorded east of the project site, six of which are on offshore islands. Three nearby territories being the near-shore artificial platform at the Port Lincoln Marina, a remote area of Lincoln National Park (located in 2015 by sea-based survey) (Detmar and Dennis 2018), and one on Thistle Island (see 4.4.2 below).

4.2 Breeding

In SA the Osprey breeding habitat is limited to mostly semi-arid open coastal landscapes with low coastal vegetation (Dennis et al. 2011a). In such habitats nests are typically on an exposed cliff, broken terrain, with no visual screening of on near-shore sea- stacks that are vulnerable to damage from storm surge and severe weather. In comparison Ospreys in the north of Australia will have nests in trees and occur in mangrove areas and largely undeveloped areas. The exposed habitats of South Australia are similar to those of *Pandion haliaetus* habitats of north-west African and Italy. In those countries nest sites that are exposed are subject to frequent human disturbance, resulting in breeding failures. It is noted that in NSW Osprey populations have been boosted by provision of artificial nesting platforms (Dennis and Clancy 2014). Nesting platforms are readily adopted by Osprey pairs, e.g. resident pair near Oyster Farm (Denial Bay, near Ceduna) that has been occupied since 1991.

The Osprey is known to form long-term pair bonds and use the same nesting locations over long time periods, where preferred nest sites can be used for successive generations (Dennis 2007b cited in Dennis and Detmar 2018). Breeding occurs during May and December. Surveys are usually conducted from late October to mid-December, to avoid critical disturbance periods and when active pairs have settled into daily patterns. Key behavioural activities during this time include nest provisioning and territory defence.

4.3 Disturbance

Known threats that are assessed during regular distribution surveys include: recreation activities within the core territory, landscape scale habitat degradation (e.g. vegetation clearance, fire, landuse change, overgrazing, development); proximity to dwellings, tracks, walking trails, drone use areas, marine-industry, impacts to prey availability). Other known disturbances include recreational activities above nest level, access by humans and predators (e.g. fox), surfing, lookouts / carparks (Detmar and Dennis 2018). In addition other threats to Osprey relate to interspecies conflicts, e.g. kleptoparasitism (food / prey stealing) and spatial competition from White-bellied Sea Eagle (Clancy 2006, Dennis 2007a cited in Dennis and Clancy 2014).

4.4 Known records / nests near proposed site

Whilst no active nests are known for the proposed location, it is acknowledged that Osprey have historically been present in the immediate region. Active nests are also known to occur between Whalers Way and Port Lincoln.

Government data records(Biological Databases of South Australia and Birdlife Australia) for a 20 km buffer on the Whalers Ways site are summarised as:

- 34 records between 1970 and 2018 (BDBSA and Birdlife records, DEW extract Nov 2020).
- A number of these records would be the same birds /pairs as they are seen at similar locations within a couple days of each other
- Of the 34, 3 Records between 1970 and 1971 and 12 have low spatial reliability and 12 records between 2009 and 2015 have not spatial reliability entered.

Table 1: Summary of all Eastern Osprey records near Whalers Way

Year (s)	Number of records	Number of Osprey	Location / comments	Source
1970, 1971, 1975	4	Not counted	1.8 km WSW of Lincoln National Park (LNP)	BDBSA
1982	1	Not counted	5.5 km SSW of LNP	BDBSA
1/09/1999	1	1	6.4 km SSE of Sleaford / HA 148 / Fishery Bay	BDBSA
14-28/091999	3	Not counted	Sleaford Bay, LNP, Whalers Way (8.3 k SSW of Sleaford / HA 152)	Birdlife
28/09/2000	1	Not counted	Wanna - Lincoln NP	Birdlife
24/07/2001	1	1	5.1 km SSW of Lincoln National Park / Wanna	BDBSA
20/01/2001	1	Not counted	Whalers Way (8.3 k SSW of Sleaford / HA 152)	Birdlife
30/08/2002 – 28/10/2002	3	Not counted	SSW of LNP (One Apostle Rock, Wanna Bay, Wanna Head	Birdlife
18/09/2004	1	Not counted	Whalers Way / 8.1 km SSE of Sleaford / HA 148	Birdlife
113-15/12/2004	2	1 then 2 (days apart)	7.5 km SSE of Sleaford (Fishery Bay) / 7.2 km SSW of Sleaford (Red Banks Beach	BDBSA
1/10/2006	1	Not counted	10 km SSE of Sleaford / Cape Wiles	Birdlife
29/12/2006	1	Not counted	1.9 km WSW of LNP	BDBSA
2008	1	1	2.4 km NNE of Tulka	BDBSA
20/01/2009	1	1	4.3 km SSE of Sleaford	BDBSA

12/08/2009	1	Not counted	2.8 km NNE of Tulka / Proper Bay	Birdlife
15/07/2010	1	Not counted	9.8 km SSE of Sleaford (Whalers Way to Cape Wiles)	Birdlife
15-19/08/2011; 17/10 and 17/11 2011	4	Not counted	Whalers Way (2), Proper Bay, Wanna Car Park	Birdlife
16-17/09/2014	2	Not counted	Pt Lincoln FF (1.9 km NNE of Tulka); Whalers Way (HA 152)	Birdlife
2015	1	Not counted	NNW of LNP	Birdlife
2016	1	1	0.4 km NNE of Tulka	BDBSA
2017	1	Not counted	0.7 km SW of Tulka	Birdlife
2018	1	1	5.5 km SSW of Lincoln National Park / very exposed rugged coastline	BDBSA

4.4.1 Whalers Way

As per the bird records for the site location noted above, there has been regular presence of Osprey near Whalers Way and Cape Wiles. The last official record (Birdlife data) being in September 2014. Bird enthusiast associated with the project (Mike Damp) also recalls two nests close to the site have not been active for about 5 years. The nests have been checked on regular visits to the site. The two known abandoned nests are located at Cape Wiles and another between Cape Wiles (Nest site 1) and Cape Carnot (Nest site 2) (Figure 1). It has been suggested that installation of an Osprey viewing area and car park in the unmanaged Heritage Agreement area may have led the birds to abandon the nest (e.g. at Cape Wiles), given the regular disturbance from above, similar to reports in the latest Osprey survey (Detmar and Dennis 2018). In addition, the nest at Cape Wiles may have been subject to storm surge disturbance, given location, similar to other nests noted as damaged / abandoned in the recent Osprey survey (Detmar and Dennis 2018).

Figure 2 shows the location of the known, but abandoned nests in relation to the project site. Distances are as follows:

- The distance from launch Site B to Nest Site A (1) is approx. 4070 m
- The distance from launch Site B to Nest Site B (2) is approx. 2000 m
- The distance from Site A to Nest Site A (1) is approx. 4990 m
- The distance from Site A to Nest Site B (1) is approx. 2975 m

These distances to unoccupied /abandoned nests are all at or larger than the state-wide buffer (2000 m) that is recommended to be avoided during the core breeding period of active nests to avoid human induced disturbance impacts.

Figure 1: Location of known abandoned nests at Whalers Way, South Australia



Image provided by Southern Launch

Figure 2: Historic Osprey nests near Southern Launch Project Site

Image provided by Southern Launch

Recent surveys on 26/11/2020 and 8/12/2020 (Larry Bebbington) did not observe recent activity at the nesting sites. Bebbington L. during 2020 surveys observed no recent (past 3+ years) nest building activities or fresh chalk at the abandoned Osprey nest sites and concluded that following attempts to rebuild in 2017, the nests have been abandoned due to human disturbance (refer Figure 3, Figure 4, Figure 5).

Figure 3: Osprey Nest Cape Wiles Site 1 second stack (December 8, Photo Source Brenton Ellis)



Figure 4: Osprey Nest Cape Wiles Site 1 (December 8, Photo Source Brenton Ellis)



Figure 5: Osprey Nest Site 2 (December 8, Photo Source Brenton Ellis)



4.4.2 Port Lincoln Wharf and Thistle Island

There are regional examples of Osprey nests persisting with / habituating to noisy environments (e.g. vessels coming and going). As per a recent ABC news article and citizen interest there is a known active nest at the Port Lincoln Wharf, where three chicks have hatched this year. One of the chicks in this nest is being monitored in a long-term study (Birdlife Ian Falkenberg). This nest is on a barge in the busy marina, with the largest fishing fleet in the southern hemisphere a location prone to noise and regular disturbance. This nest is located ~ 27 km from Whalers Way project site. In comparison there are another one or two nests nearby, one on Thistle island (where another chick is being monitored in a long-term study), ~ 40km from the site; and one new nest recorded in the recent survey (remote area of Lincoln National Park, 2015). Based on the high level mapping in Detmar and Dennis 2018 it is assumed the new nest in the LNP that is ~ 17 km from the site, rather than Liguanea island which is 5 km south of pad A, acknowledging that details about known nests are not provided readily given threatened species status. It is thought that new nests such as this may be occupied by 'refugee' Ospreys that have abandoned nests elsewhere (Detmar and Dennis 2018).

Another ABC article reports that the remote Thistle Island Osprey nest, part of the long term study, is possibly over 200 years old (ABC May 2020).

4.4.3 Global nesting locations

Ospreys are known to nest on artificial structures, man-made towers, power poles and platforms. Numerous studies have demonstrated successful raising of young on such platforms, particularly near marinas, in aquaculture set ups.

Globally nests are known to occur in a range of noisy environments. The Center for Conservation Biology in America has a program called 'Osprey Watch' where large numbers of Osprey nests are regularly monitored and details are posted. Nesting structures range from dead trees, to artificial substrates such as light towers, cell phone towers, utility poles, and artificial nesting platforms.

4.5 Significant impact assessment

The AECOM (2020) preliminary significant impact assessment considered that no significant residual impact to the Eastern Osprey (as an EPBC listed Migratory species) was anticipated based on the following summary information:

- A known Osprey nest was located 2 km from the project area. This nest was considered inactive (anecdotally for 5 years), but it was noted that the species has been known to return to inactive nests (DAWE 2020 cited in AECOM 2020a). One individual was recorded flying over the project site (near Cape Carnot, 400 m from the project area) during the vegetation assessment. Based on this it was considered that at least one pair with an established territory may be impacted by the project
- Osprey habitat along the coastline was unlikely to be impacted by the project via vegetation clearance or operational rocket launches.
- Increase in invasive species was not expected and such species were not expected to be harmful to the species (e.g. foxes and cats as predators).
- Potential impacts from construction and operation would be managed via a Construction and Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP).

Additional information to supplement the significant impact assessment for this Migratory species, which also considers that significant impact to the species is unlikely, is as follows:

1. No pair with an established territory is currently known from the project area; two abandoned nests that are > 2 km from the project area are near the site. There are no recent records (BDBSA or Birdlife data) for these nest locations, nor are they mentioned /shown in Detmar and Dennis (2018). In addition, recent surveys November and December 2020 (Larry Bebbington) did not observe recent activity at the nesting sites. Bebbington L. during 2020 surveys observed no recent (past 3+ years) nest building activities or fresh chalk at the abandoned Osprey nest sites and concluded that following attempts to rebuild in 2017, the nests have been abandoned due to human disturbance. However it is acknowledged that coastline habitat is important for the species, there are adjacent areas of coastline habitat available and Osprey are present in the area, but not necessarily nesting close to the launch site. During the recent survey (December 2020) a pair of Osprey were observed whirling and tumbling 500 m 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 >5 km from the launch sites. The current coastline habitat (2 km from the project site) provides sub optimal habitat for potential Osprey given the cliff top tracks and viewing platform that are frequently used by the public at the unmanaged Heritage site. The project aims to reduce 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 return to the coastline and have the opportunity to rebuilt the existing nests that are currently abandoned.

2. It is acknowledged that foxes and cats could be harmful to Osprey if nests were in a location that was accessible, however given standard CEMP and OEMP controls, it is not expected that the project would increase the baseline status of invasive pest species. In reality, it is likely that a change of landuse that is well managed, with reduced public access and illegal dumping will benefit all fauna at the site that could be impacted by an increase in invasive pest levels.
3. In Australia the species occurs in coastal and estuarine northern temperate and subtropical regions, with the isolated SA population considered to be on the extreme southern edge of the species preferred bioclimatic range (Dennis and Clancy 2014). The current SA population is considered to be unstable with a number of nest relocations and 'refugee' pairs relocating to start new territories. Multiple contributing factors are likely to be influencing the instability in the current distribution, including human disturbance (Detmar and Dennis 2018). It is acknowledged that there is potential for at least one Osprey territory to overlap the project area, however given the lack of known active nests it is unlikely a core nest territory occurs within 2 km of the project area. The project is not considered to directly impact the habitat of local individuals of the species, but noise impacts are expected. According to Southern Launch / AECOM (2020b) the expected noise levels / impacts are expected to be as follows:
 - a. Construction level noise for approximately 8 months (peaking at 73-83 dB(A), 6 days a week between 7 am and 6 pm. These noise levels are equivalent to busy traffic or a vacuum cleaner. AECOM 2020b suggests that for the nearest sensitive human receivers (2.3 km away) the construction noise would be less than 51 dB(A), for the worst case scenario (maximum construction noise). Where there is continuous noise 20 dB above background noise (i.e. 50-60 db(A), there may be communication impacts to birds (e.g. within 2 km of the works), with the greatest impacts 10-20 meters from works. CEMP measures will be used to reduce impacts to fauna.
 - b. Operations (non launch) noise will peak at 63 dB for an estimated average of 4 hours per day 5 days a week (12% of the time). This calculation allows for movement of vehicles and use of air driven hand tools throughout the day. It should be noted that hand tools will be used inside the assembly building, which will reduce the noise impact. These noise levels are equivalent to just above the level of a clothes dryer / normal conversation. These noise levels are considered inaudible to the nearest sensitive human receivers 2.3 km from the site. Similarly, the predicted noise level of 62 dB(A) at 25 metres from the project area 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. Noting that during a southerly storm event or even a large southerly swell, the wave noise generated at the cliff interface would nullify any construction noise over 100 m away.

- c. Operations (launch) noise will peak for approximately 60 seconds, every 3 weeks (0.005% 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, up to 80m from the launch pad. It should be noted that this noise level is a worst case scenario and is expected to be generated by the largest vehicles (e.g. 100 tonne, that would rarely be used at the site). Southern Launch expects the majority of vehicles will generate much lower levels of noise. This noise will be mitigated by a water deluge and flame trench, which reduce the noise level by approximately 5-10 dB. 140 dB is equivalent to gunshot, fireworks or airplane takeoff at 25 meters. 130 dB is the hearing threshold of pain (human close proximity). AECOM 2020b noise modelling based on worse case scenarios, excluding mitigation measures suggest that noise levels from Launch site A would dissipate to 100 dB (nest site 2), 95 dB (nest sit 1 and northern end of Liguanea Island); noise levels from launch pad B would dissipated to 105 dB (nest site 2) and 98 db (nest site 1), < 95 dB (Liguanea Island). It is noted that this modelling has also not considered terrain / vegetation to buffer noise, which would also lower the impacts to surrounding fauna (i.e. residual noise impacts would be lower than predicted in initial noise modelling cited in AECOM 2020b).
- d. 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 will reduce the number of fauna in the immediate noise zone close to the launch pad. This measure would only be used randomly (not on a timer), from dawn to until launch on launch days.

In summary, whilst there is potential for at least one 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 km 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 km 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.

Construction and operation noise information provided by Southern Launch / AECOM 2020b. Noise level examples from common decibels chart.

5. White-bellied Sea-eagle

5.1 SA distribution / status

The White-bellied Sea Eagle (*Haliaeetus leucogaster*) is not listed under the EPBC Act, and is listed as Endangered under the SA *National Parks and Wildlife Act 1972*.

The most recent review of White-bellied Sea Eagle distribution in South Australia confirmed a total of 73 breeding pairs / occupied territories across a range of habitats; coastal, offshore island and inland river habitats (Dennis and Detmar, 2018). It was noted that there was a decline in previous territories since 2010. Studies of productivity of these eagles and others suggest that the decline is related to low fecundity (i.e. ability to produce offspring), high rates of nest failure and human-induced disturbance related to displacement of pairs. Disturbance during critical phases of breeding are known to result in nest failures and displacement to sub-optimal habitats. It is also suggested that seasonally applied breeding refuge zones could ensure maximum reproductive potential is achieved by the remaining breeding pairs (Dennis and Detmar, 2018).

Thirty three territories are known from the Western Eyre Peninsula region where the proposed Southern Launch project site occurs. In this region however, there are only seven mainland territories (sparsely distributed, including an active cliff top nest > 5 km from Launch Pad B) and twenty six are located on offshore islands.

5.2 Breeding

The White-bellied Sea Eagle forms long-term pair bonds and selected nesting locations over long time periods. Favoured nest locations are often used by successive generations Wiersma and Richardson 2009; Dennis, Fitzpatrick and Brittain 2012; Debus et al. 2014 cited in Dennis and Detmar, 2018). There are times within the breeding period that are more crucial than others (i.e. mid-May to mid-September as per literature from long-term studies and WBSE experts (Dennis et al. 2011a, Dennis et al. 2012, Dennis et al. 2015).

In terms of territory density there is variation and this may be declining. On St. Peters Island there were 4 territories with primary nests spaced an average of 2.4 km apart, whereas on the north coast of Kangaroo Island where there were 10 territories, primary nests were spaced an average on 9 km apart.

Nest sites include cliff-face ledges, shallow cave overhangs or on rock outcrops on steeply sloping terrain. On Kangaroo Island WBSE used an abandoned osprey nest (Dennis and Detmar, 2018). Sites with abundant food resources (e.g. fish, reptiles and birds such as seabirds, Cape Barren Geese, Shearwaters) are favoured for nesting in proximity.

5.3 Disturbance

Long-term studies of White-bellied Sea Eagles from Kangaroo Island that occupy 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. These results were similar to studies in NSW (Dennis and Detmar, 2018).

Sensitivities to these bird's disturbance are so well documented that there are long-established disturbance avoidance protocols (based on spatial and temporal) approach constraints that are applied to regular raptor surveys (Dennis and Detmar 2018). Similarly, weed and pest control programs and recreational management measures are in place on Kangaroo Island in conservation areas with known White-bellied Sea Eagle territories / nests (Dennis, Detmar and Patterson 2015)). Surveys are generally conducted in late-September and October when pairs are well settled into established patterns of providing food to the nest / young, searching for food and defending the nest. Similar to Osprey, abandoned or less favoured nests that are not occupied are examine for evidence of activity if birds are not present. The recent survey identified three abandoned nests on the Eyre

Peninsula; two in National Parks with high levels of disturbance and one occupied by a Wedge-tailed Eagle (Dennis and Detmar 2018).

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. Line of site disturbance or disturbance from above nest level or the strategic nest-guard roost site are thought to trigger early and strong reaction causing the eagles to loft and rise above the 'perceived threat', leaving the nest exposed for as long as the 'threat' remains (Romin and Muck2002; Dennis, Detmar and Patterson 2014 cited in Dennis and Detmar, 2012).

5.4 Known records / nests near proposed site

Whilst White-bellied Sea Eagles have regularly been reported in the Whalers Way region, and flying overhead (refer Table 2). -White Bellied Sea Eagles occupy a territory and nest on the offshore Liguanea Island and a recent territory and nest site has been established >5km to the east of the launch sites (Dennis & Detmar2018 unpublished). The exact location of the mainland clifftop nest site remains undisclosed due to potential disturbances. During site surveys on the 26 November and 8 December 2020 L. Bebbington recorded a pair of Sea Eagles 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 riding thermals to the south east of the island. As the eagles returned to Liguanea Island one of the birds observed a host of sea birds feeding on a large school of Pilchard approximately 1 km off the coast and went into a long dive which terminated in the kill of a gorged Short Tailed Shearwater on the surface. The Sea Eagle returned to Liguanea Island with the kill and was last observed flying to the southern end of the island. White Bellied Sea Eagles are regularly observed (Bebbington L. pers. com.) overflying the coastline at Whalers Way and well to the east and west of the site. Sea Eagles are also regularly observed well inland preying on juvenile Cape Barren Geese and feeding on sheep carcasses or bathing in farm dams (Bebbington L. pers. obs.).

Current disturbances to the recently established White Bellied Sea Eagle nest site at Whalers Way consist of infrequent interactions with amateur photographers who discovered the nest during active searches possibly in 2018. Searches on Facebook 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.

Table 2: BDBSA and Birdlife records of White-bellied Sea Eagles near Whalers Way peninsula

Year (s)	Number of records	Number of WBSE per record	Location / comments	Source
1967-1977	8	Not counted	Low spatial reliability (> 25 km from Whalers Way) / 1.8 km WSW of Lincoln National Park (LNP)	BDBSA
26/05/1980		Not counted	14.2 km SSW of Sleaford	BDBSA
27/12/1994		Not counted	1.8 km WSW of Lincoln National Park	BDBSA
28/09/1999	1	Not counted	3.2 km NNW of Lincoln National Park	Birdlife

20/03/2001	2	1	2.3 km NNW of Lincoln National Park and 4.8 km SSW of LNP.	BDBSA
22/03/2001	1	1	4.8 km SSW of Lincoln National Park	BDBSA
6/11/2001	1	2	4.8 km SSW of Lincoln National Park	BDBSA
13/12/2004	1	1	10.1 km SSE of Sleaford, Cape Wiles	BDBSA
18/08/2006	1	Not counted	2.6 km SSW of Tulka	Birdlife
8/12/2007	1	2	2.8 km SSW of Tulka	BDBSA
3/02/2008	1	1	5.1 km SSW of Lincoln National Park	BDBSA
28/01/2009, 2/03/2009, 21/05/2009	3	1	5.7 km ESE of Sleaford / 5.2 km SSE of Sleaford	BDBSA
11- 12/08/2009	2	Not counted	7 km ENE of Sleaford Mere, 2.8 km NNE of Tulka (Proper Bay)	Birdlife
24/09/2009	1	Not counted	3.8 km SW of High Sandhill (summit), Jussieu Bay north LNP	Birdlife
17/10/2009	1	Not counted	5.8 km SSW of Uley / Bicker Island	Birdlife
3/04/2010	1	Not counted	7.8 km SSE of Sleaford / Whalers Way	Birdlife
14/04/2010	1	1	7.5 km WSW of Lincoln National Park, Sleaford Bay Wanna	BDBSA
23/04/2011	1	Not counted	2.8 km NNE of Tulka / Proper Bay	Birdlife
14/08/2011	1	Not counted	7 km ENE of Sleaford / Sleaford Mere	Birdlife
6/04/2012	1	Not counted	2.8 km NNE of Tulka / Proper Bay	Birdlife
2/10/2013	1	Not counted	0.8 km NNW of Lincoln National Park	Birdlife
26/08/2018	1	Not counted	7.2 km SSE of Sleaford / Whalers Way	Birdlife
21/04/2019	2	Not counted	6 km WSW of Tulka / Sleaford Bay;	Birdlife
25/04/2019	1	subadult	6.6 km ESE of Sleaford (Bay)	Birdlife
27/04/2019	1	Not counted	3.1 km ESE of Sleaford / Westwood Park	Birdlife
11/05/2019	1	Adult pair	3.1 km ESE of Sleaford / Westwood Park (on the farm)	Birdlife
13/02/2020	1	1	2.3 km NNE of Tulka (LNP), coastal	BDBSA

5.5 Mitigation options for disturbance

For another project on Kangaroo Island there were recommendations to avoid disturbance include avoiding construction activities between May and December for a distance of 2 km along the coast and 1 km inland from a known WBSE nest. For activities undertaken outside this time then an exclusion zone was to be developed around any known WBSE nests in consultation with local wildlife specialists.

Similarly, Dennis et al. 2015 reports that on Kangaroo Island a local DEWNR (now DEW) protocol was developed in 2007 regarding staff and volunteers to adjust work programs to avoid all activity inside a 1000 m radius from a known cliff top nest from mid-May to December. In addition, public access to cliff top walking paths was also restricted.

For the current Whalers Way project WBSE have been observed flying overhead, however breeding territory and a cliff top nest is in proximity to the site and although proposed (land-based) development is well outside the 2 km non-disturbance buffer zone (buffer distance as suggested in Dennis et al. 2011b, Dennis 2012), the bay and surrounds likely forms part of the foraging zone of the species.

It is considered highly unlikely that proposed launch activities over 5 km away from the 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 cancel out any possible minimal noise generated at launch.

Key mitigation options for avoiding impacts to White-bellied Sea Eagles are:

- Adopting state-wide 2000 m disturbance buffers (based on recommended 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 1000m of a primary nest.
- Development of a species management plan for specific protection and management of breeding refuge habitat in South Australia
- Subsequent ongoing population monitoring in key habitats

6. Rocket Launch / Bird Interactions

The rocket launching project that is proposed in Whalers Way is not unique. There are similar projects around the world, in similar habitat, often having positive impacts on bird species as the projects contribute to local threatened species programs and manage regular human disturbance at the launch sites. Some examples are:

- Rocket Lab, New-Zealand-founded company launches small satellites to space at northern Hawke's Bay New Zealand. Mahia Peninsula is the location of their first launch site and noted as place of cultural and environmental importance. Rocket Lab are the 4th most frequent launched rocket in the world and regularly contribute to sustainable use of space and the land which they operate. The launch site has sent 55 satellites to space (14 missions). The company is fundraising with a limited edition patch, to provide money for the critically endangered Shore Plover that resides on small island near the site. The local Department of conservation welcome the initiative of this company. The launch vehicles used by Rocket Lab are similar in size to the majority of launch vehicles expected to be used at the Whalers Way site. (<http://www.voxy.co.nz/national/5/373502>).
- The Shore Plovers nest ~ 2 km from the rocket Lab launch site in New Zealand. Monitoring following rocket launches showed that the birds continued to roost and feed as normal following the launches. Rocket Launch also has contributed to invasive ant control to protect the Shore Plovers (<https://www.doc.govt.nz/news/media-releases/2018/rare-birds-and-rockets/>).
- America's Bald Eagles are known to nest in a famous pine tree at Kennedy Space Center. Birds have been occupying nests at this site since the 1970s in proximity to launches of very large rockets many times larger and louder than the current proposed project at Whalers Way. To put the size noise difference into perspective, most vehicles launched at Whalers Way will be between 15 and 40 tonne, with some vehicles up to 100 tonne and will generate between 120 and 140 dB of noise. The space shuttle is 2030 tonne and generates 198 dB of noise.
- French Guiana Space Centre operates three different launch vehicles in proximity to a rain forest of the French Guiana, which supports a range of diverse flora and fauna. The company has an environmental management plan which monitors and assesses environmental risks before each launch. One species that is monitored is the Scarlet Ibis which lives on the shoreline that is part of the site. Long term monitoring has not identified any dramatic impacts from the existing launch schedule (<http://www.spacesafetymagazine.com/spaceflight/launch/biodiversity-rocket-launches-cohabiting-guiana-space-centre/>)
- The Pacific Spaceport Complex – Alaska (PSCA), formerly known as the Kodiak Launch Complex (KLC), is a dual-use commercial and military spaceport for sub-orbital and orbital launch vehicles. The facility is on Kodiak Island in Alaska. The PSCA is similar to Southern Launch's site in that it is coastal has an island approx. 3km to the south which is under the flight path and hosts a diverse array of marine bird life. The site has operated since 1998 with no negative impact on local fauna.

7. Project Constraints summary

It is understood that DEW have concerns about the project. This technical memo has provided additional information to support the approval documents for this project. A summary of the concerns and response is provided in Table 3.

Table 3: DEW concerns and response

DEW concerns	Response
Public access to fauna	The project aims to reduce public access to fauna, particularly along the coast line reducing line of site disturbance if WBSE or Osprey nests develop / return to the coastline
Light spill impacts (national pollution guidelines, 2020 Version 1.0)	Out of scope for this memo, being addressed elsewhere
AECOM 2020a report only considers two species in detail, more information is required regarding other bird species and specific impacts associated with desertion of site, startle response.	More detailed information about the WBSE and Osprey provided here.
Coastal Raptors (Osprey and White-bellied Sea Eagles) – these species have be identified as occurring in the area but have not been assessed, these species are known to be sensitive to disturbance and are likely to be impacted by the proposal, therefore a detailed assessment should be undertaken by a suitably qualified coastal raptor expert and included in the report	This memo provides more detail and has been prepared by an associate ecologist with over 16 years consulting experience and a PhD, which is considered appropriate for EIS submission.
Suggested review of Caton et al 2011, Dennis and Clancy 2014, Detmar and Dennis 2018, Dennis and Detmar 2018.	Reviews (as appropriate) discussed in this memo.
Suggest likelihood of occurrence information was out of date or needs to be re-assessed.	Agreed and discussed in this memo.
Suggested more detail be provided regarding the Osprey nest near Cape Carnot (1km from the nearest launch site? – based on commentary in the initial submission p.52, 6.4.2) And that White-Bellied Sea Eagle be discussed as well.	Discussed in this memo and additional information provided by site visit (Larry Bebbington). The nearest nest site is Site 2 which is immediately west of Black Lookout which is 2 km from Pad B. There is no known nest at Cape Carnot.

7.1 Mitigation options for CEMP /OEMP

7.2 Opportunities

This project provides a range of opportunities to positively impact the local Osprey population.

Restricting public access as a result of change in land use would reduce the amount of human disturbance at the site. This could benefit the large raptors as well as other smaller sensitive birds that are known to occur the site (E.g. Western Whipbird, Southern Emu-wren). This would reduce general disturbance of habitat (e.g. impacts to vegetation and noise) as well as line of site disturbance along exposed cliff areas.

Environmental Management activities could encourage birds back to the western coastline of the peninsula (e.g. establishing strategically placed artificial elevated nesting platforms). Such platforms are regularly used in Queensland for both Osprey and Human safety, as such there are guides and manuals for building such platforms (e.g. DES 2016). These types of conservation initiatives are also recommended by Detmar and Dennis (2018) to assist with addressing the rapid decline in the SA population.

Monitoring of existing abandoned nests at Whalers Way for changes following landuse activities, restriction of human disturbance and response to small rocket launch may assist with enhancing local knowledge about the decline in the SA population of Osprey. Similarly, monitoring of White-bellied Sea Eagle presence and any interactions between the species, may also be useful.

Contributing to development of management plans, community awareness programs, guidelines for land-owner management for one or both species as per recommendations by Detmar and Dennis (2018) and Dennis and Detmar (2018).

Future consideration could be given to moving the coastal roads / tracks further inland would reduce the amount of coastal traffic known to disturb Ospreys, particularly during breeding season. It is noted that the existing location is a Heritage Agreement, where there is regular unmanaged human disturbance, recreation, vehicles, illegal dumping. Moving roads / tracks / access further inland would reduce the amount of disturbance, providing opportunities for Osprey and or White-bellied Sea Eagle to re-establish nests along the southern coastline of Whalers Way.

Finally, given the estimated launch trajectory, it is considered that the launches would not cause disturbances to raptors (or other fauna) on the coast or Liguanea Island. In addition, if mitigation measures are used to reduce the noise and propellant blast at the launch pads the Emu Wrens and Whipbird disturbances should be confined to a much smaller area (refer targeted assessments).

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