Kingston Pier Channel Construction Project

Public Environment Report

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

2 May 2023

311015-00061

Advisian
Worley Group

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PROJECT 311015-00061 - Kingston Pier Channel Construction Project - Public Environment Report

Rev	Description	Author	Review	Advisian approval	Revision date	Client approval	Approval date
C	Draft for DCCEEW adequacy review	K. Newton, C. Jones	B. Morgan	B. Morgan	22.11.22	-	-
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0	Final	C. Jones	K. Newton	B. Morgan	02.05.23	-	-

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Executive Summary

The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) (proponent) proposes to augment (deepen and widen) the existing channel bed in the harbour adjacent to Kingston Pier, Norfolk Island. The proposed action involves the transfer of dredge spoil from the channel dredging to an onshore disposal site at Old Cascade Quarry on the northern side of the island. The disturbance footprint at the dredge site (i.e. dredge footprint) is 0.5 hectares (ha) of the 5 ha work area, and the disturbance footprint at the quarry is 0.3 ha. The purpose of the proposed action is to improve vessel access and safety and ensure that the harbour meets required navigation standards and guidelines.

The proposed action would be located on land around Kingston Pier and in the water area and seabed in the channel adjacent to Kingston Pier. The land at Kingston Pier is located within the Kingston and Arthur's Vale Historic Area (KAVHA). KAVHA is listed on the UNESCO World Heritage List as one of the 11 places that make up the Australian Convict Sites World Heritage serial listing and is also listed on the National and Commonwealth Heritage Lists. The shipwreck site of HMS Sirius, located on the outer reef at Slaughter Bay, off the coast of Norfolk Island, is listed on the National Heritage and Commonwealth Heritage Lists.

The proposed action was referred under the *Environment Protection and Biodiversity Conservation Act* 1999 (the EPBC Act) to the Minister for the Environment on 17 February 2022 (EPBC 2021/9124). The delegate for the Minister for the Environment determined on 4 April 2022, that the action is a controlled action and approval is required as the action has the potential to have a significant impact on the following matters of national environmental significance (MNES) that are protected under Part 3 of the EPBC Act:

- The world heritage values of a declared World Heritage property
- The heritage values of a National Heritage place
- The environment of the Commonwealth marine area, or the environment as the proposal would take place in a Commonwealth marine area
- The environment because the proposal is a Commonwealth action.

Following the provision of referral information, the delegate of the Minister for the Environment determined, on 4 April 2022, that the proposed activity is to be assessed by a Public Environment Report (PER) (this document). Final guidelines for the PER were for the Kingston Pier Channel Construction Project, Norfolk Island (the Project) were received in May 2022. These are provided in **Appendix A**.

A Public Exhibition of the PER was held from 7 March 2023 to 3 April 2023. One submission was received from the general public on 25 March 2023 and the comments were reviewed and have been addressed by the proponent as part of finalising this PER.

Information about the proposed action and its relevant impacts are provided in this PER. This information will be used by Minister for the Environment and Water to make an informed decision on whether or not to approve, under Part 9 of the EPBC Act, the taking of the action for the purposes of each controlling provision.

Acronyms and Abbreviations

Acronym / Abbreviation	Definition
ARI	Average Recurrence Interval
AUCHD	Australasian Underwater Cultural Heritage Database
CEMP	Construction Environmental Management Plan
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
FY	Financial Year
GTP	Gross Territory Product
ICNG	Interim Construction Noise Guideline
KAVHA	Kingston and Arthur's Vale Historic Area
KAVHA AZMP	Kingston and Arthur's Vale Historic Area Archaeological Zoning and Management Plan
KAVHA CLMP	Kingston and Arthur's Vale Historic Area Cultural Landscape Management Plan
KAVHA HMP	Kingston and Arthur's Vale Historic Area Heritage Management Plan
KEF	Key Ecological Feature
KPUAMP	Kingston Pier Underwater Archaeological Management Plan
MNES	Matters of National Environmental Significance
MHWM	Mean High Water Mark
NEPM	National Environment Protection Measure
NAGD	National Assessment Guidelines for Dredging
NIRC	Norfolk Island Regional Council
NTU	Nephelometric Turbidity Unit
PER	Public Environment Report
Precinct H	Precinct H – Landing Place Ridge (known as Kingston Pier)
Project	Kingston Pier Channel Construction
PSC	Project Steering Committee

Acronym / Abbreviation	Definition
Sea Dumping Act	*Environment Protection (Sea Dumping) Act 1981*
SIMS	Sydney Institute of Marine Science
SWMS	Safe Work Method Statement
SWMP	Soil and Water Management Plan
UCH Act	Underwater Cultural Heritage Act 2018
UCL	Upper Confidence Limit

1 Introduction

1.1 Overview

The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) (proponent) proposes to augment (deepen and widen) the existing channel bed in the harbour adjacent to Kingston Pier, Norfolk Island. The proposed action involves the transfer of spoil from the channel dredging operation to an onshore disposal site at the Old Cascade Quarry on the northern side of the island. The disturbance footprint at the dredge site (i.e. dredge footprint) is 0.5 hectares (ha) of the total 5 ha work area, and the disturbance footprint at the quarry is 0.3 ha. The purpose of the proposed action is to improve vessel access and safety into the harbour and Kingston Pier and ensure that it meets required navigation standards and guidelines.

The proposed action would be located on land around Kingston Pier and in the water area and seabed in the channel adjacent to Kingston Pier. The land at Kingston Pier is located within the Kingston and Arthur's Vale Historic Area (KAVHA). KAVHA is listed on the UNESCO World Heritage List as one of the 11 places that make up the Australian Convict Sites World Heritage serial listing and is also listed on the National and Commonwealth Heritage Lists. The shipwreck site of HMS Sirius, located on the outer reef at Slaughter Bay off the coast of Norfolk Island, is listed on the National Heritage and Commonwealth Heritage Lists.

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1.2 Description of the Action

A detailed description of the proposed action as identified in Table 1-1 including its various elements is provided in the following sections.

Table 1-1 Details of the action

Item	Action Details
Title of the Action	Kingston Pier Channel Construction Project
Proponent/Address	*Department of Infrastructure, Transport, Regional Development, Communications and the Arts* GPO Box 594 Canberra, 2601 ACT, Australia
Coordinates	**Area 1** -29.058953254728,167.95282184428 -29.058144373648,167.95196890181 -29.058142029056,167.95195817298 -29.057241701762,167.95400201625 -29.057954461518,167.9548817808 -29.058953254728,167.95282184428 **Area 2** -29.022251805102,167.97389998382 -29.022281122693,167.97446861213 -29.022679841114,167.97512038892 -29.023144228863,167.97494336313 -29.023716501803,167.9743103618 -29.023601578393,167.97409310287 -29.022251805102,167.97389998382

1.2.1 Project Need and Objectives

Kingston Pier is located on the southern coast of Norfolk Island (Figure 1-1) and is one of only two locations on the Island enabling port operations, the other being Cascade Pier on the northern coast. It is used by various vessel operators such as commercial charters, fishing vessels and emergency responders. In addition, break-bulk cargo is transhipped to Kingston Pier from cargo ships moored offshore using local launches and lighters. The lighters are stored in nearby boat sheds. The cargo is lifted out of the lighters at Kingston Pier using either a shore-mounted crane or mobile crane.

Kingston Pier is also important to the Norfolk Island community for its cultural significance and its role in annual Anniversary Bounty Day Celebrations which commemorate the arrival of the Pitcairn Islanders on 8 June 1856. It is a key element of the KAVHA which is of both National and International heritage significance.

Kingston Pier was constructed from 1839 to 1847. It is currently comprised of external stonework, steel sheet piles, a concrete surface and rubble fill. The structure was repaired following damage sustained during World War II and refurbished in 2007 using modern materials.

The sheet pile wall system includes the combination of an old wall built in 1953 and a new wall built in 2006. There is uncertainty regarding the founding (toe) level of the old wall, however as-built toe level records of the new wall are available. Recent surveys undertaken in 2020 indicate lower seabed levels than the wall was designed for as well as evidence of loss of gravel fill from behind the new wall. The result of these findings indicates a significant reduction in pier capacity.

Road access to Kingston Pier is provided from Pier Street via the junction of Quality Row, Country Road and Middlegate Road. It is also accessible from Bay Street via Bounty Street.

Today, Kingston Pier is considered critical infrastructure for both minor freight operations and cruise ship passengers to access Norfolk Island. However, the existing entrance and interior channel dimensions of the harbour adjacent to Kingston Pier are inadequate for safe navigation during all tides, and do not meet required navigation standards and guidelines. In addition, the existing limited water depth adjacent to Kingston Pier at lower tides is a safety risk for users due to inadequate under-keel clearance. This has the effect of limiting the use of Kingston Pier by vessels.

As mentioned above the Project would involve augmenting the existing channel bed at Kingston Pier by increasing its depth and width, to improve vessel access and safety and ensure that it meets required navigation standards. In doing so, it would also support the potential for greater use of Kingston Pier by various vessel operators.

The key objectives for the Project include:

- Provide a deeper and wider approach channel for commercial and recreational vessels
- Increase the availability of Kingston Pier for berthing of vessels by providing a safer berthing approach
- Cause minimal impact to existing port operations and structures during construction
- Use local labour and resources where possible and appropriate
- Ensure the Project is sympathetic to and complies with the Kingston and Arthur's Vale Historic Area Heritage Management Plan (KAVHA HMP)
- Ensure the Project considers and minimises environmental, social and economic impacts
- Ensure community and stakeholders are communicated to in a timely manner and involved in key decisions made, such as selection of the preferred design channel
- Consider future allowance for larger vessels to enter the channel
- Deliver the project by late 2023 and within project budget.

Photographs of Kingston Pier, its context and setting are provided in Figure 1-2 to Figure 1-25.

Figure 1-1 Location map of Kingston Pier at Norfolk Island (Source: Google Earth 2020).

Figure 1-2 View looking east along Quality Row (Source: Advisian 2020).

Figure 1-3 View looking south to Pier Street (Source: Advisian 2020).

Figure 1-6 View looking east from Pier Street to the Royal Engineers Office and Boatsheds (Source: Advisian 2020).

Figure 1-4 View looking south along Pier Street (Source: Advisian 2020).

Figure 1-5 View looking south from Pier Street to the Settlement Guard House, Pier Store and Boatsheds (Source: Advisian 2020).

Figure 1-7 View looking south-west to the hardstand area at Kingston Pier (Source: Advisian 2020).

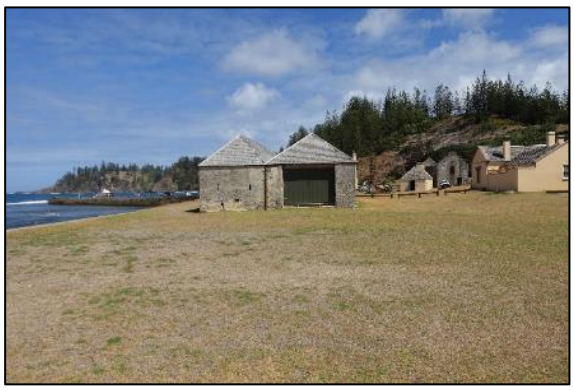


Figure 1-8 View looking west near the stone seawall to the Boatsheds and Kingston Pier

(Source: Advisian 2020).

Figure 1-9 View looking west at the stone seawall to the Boatsheds, Flaghouses and Kingston Pier

(Source: Advisian 2020).

Figure 1-10 View looking west from the foreshore to the Boatsheds and Kingston Pier

(Source: Advisian 2020).

Figure 1-12 View looking south at Kingston Pier

(Source; Advisian 2020).

Figure 1-11 View of the eastern side of Kingston Pier

(Source: Advisian 2020).

Figure 1-13 View of the western side of Kingston Pier

(Source: Advisian 2020).

Figure 1-14 View about halfway along the western side of Kingston Pier and the fisherman's crane

(Source: Advisian 2020).

Figure 1-15 View of the southern extent of the western side of Kingston Pier

(Source: Advisian 2020).

Figure 1-16 View of the shallow rock shelf adjacent to the southern extent of Kingston Pier

(Source: Advisian 2020).

Figure 1-17 View of the harbour adjacent to the western side of Kingston Pier

(Source: Advisian 2020).

Figure 1-18 View of the western side of Kingston Pier from the boat ramp

(Source: Advisian 2020).

Figure 1-19 Passenger Transfer Vessel carrying cruise ship passengers at Kingston Pier on 23 January 2020

(Source: DITRDC 2020).

Figure 1-20 View looking north at Kingston Pier

(Source: Advisian 2020).

Figure 1-21 View looking west from Kingston Pier to the Landing Place

(Source: Advisian 2020).

Figure 1-22 View looking north-west from near the boat ramp at Kingston Pier

(Source: Advisian 2020).

Figure 1-24 View looking south-east from Flagstaff Hill to Kingston Pier, Phillip and Nepean Islands

(Source: Advisian 2020).

Figure 1-23 View looking south from Flagstaff Hill to Kingston Pier and beyond

(Source: Advisian 2020).

Figure 1-25 View looking east from Flagstaff Hill to Slaughter and Emily Bays

(Source: Advisian 2020).

1.2.2 Project Location

Norfolk Island is located in the Pacific Ocean, approximately 1,600 kilometres (km) north-east of Sydney, 890 km north-east of Lord Howe Island and 1,100 km north-west of Auckland, New Zealand. It is approximately 8 km long and 5 km wide, with an area of 3,455 hectares (ha) (DITRDC, 2020). Kingston is the capital of Norfolk Island and is Australia's second oldest town behind Sydney. Kingston Pier (Figure 1-26a), located on the south side of the Island, is one of two waterway import/export and access locations on the island, the other being Cascade Pier. Break-bulk cargo is transhipped from cargo ships moored offshore using the launches and lighters. Cargo is lifted out of lighters at the pier using either a shore mounted crane or mobile crane. Limited water depth is available adjacent to Kingston Pier at lower tides and presents a safety risk for users due to inadequate under-keel clearance.

The Project is located on land around Kingston Pier and in the water area (including seabed) in the harbour adjacent to Kingston Pier and Slaughter Bay. The definition of *"land"* in the *Planning Act 2002 (NI)* means land above the mean high water mark (MHWM) and includes offshore stacks and water covering land above the MHWM. The land at Kingston Pier is owned and managed by the Australian government and is located within the Kingston and Arthur's Vale Historic Area (KAVHA). The waters around Norfolk Island are also considered Commonwealth waters under the jurisdiction of the Australian government and are located in the Norfolk Marine Park.

The land-based disposal site for spoil is located at the Old Cascade Quarry. The site is located on the northern coast of Norfolk Island (Figure 1-26b). The land at the onshore disposal site is privately owned.

Figure 1-26 Indicative Project location at Kingston Pier and Slaughter Bay (left) and the Old Cascade Quarry (right) (Source: Google Earth 2020).

1.2.3 Project Approval History

In 2009, an EPBC Act Referral (EPBC 2009/5183) was prepared under the provisions of the EPBC Act and submitted to the Department of the Environment, Water, Heritage and the Arts by The Administration of Norfolk Island. This EPBC Act Referral proposed the augmentation of the seabed adjacent to Kingston Pier as well as the construction of an associated temporary ramp to facilitate the works, extending from the shore along the working side of Kingston Pier. On 8 December 2009, the Department of the Environment, Water, Heritage and the Arts determined the proposed action was a

controlled action and would require assessment and approval under the EPBC Act before it could proceed. On 28 February 2014, the Department of the Environment (formally the Department of the Environment, Water, Heritage and the Arts) declared the proposed action had lapsed.

In 2016, WorleyParsons was commissioned by the then Department of Infrastructure and Regional Development to prepare a feasibility report exploring potential augmentation options at Kingston Pier. The findings and recommendations of the report have informed the Project design.

Stakeholder engagement undertaken to-date has confirmed that the Project is generally supported by stakeholders, subject to acceptable environmental outcomes.

As discussed in Section 1.1, following the provision of EPBC Act referral information, the delegate of the Minister for the Environment determined, on 4 April 2022, that the proposed action (EPBC 2021/9124) is to be assessed by a PER (this document). Final guidelines for the PER were received on 5 May 2022.

1.2.4 Project Background and Description

The Project involves deepening of the Kingston Pier Channel, installation of a navigation aid on the rock shelf, remedial work to the Kingston Pier Sheet Piling and environmental controls as required for the channel augmentation works. Project background and a detailed description of each component and proposed staging is provided below. Refer to drawings in **Appendix B**.

1.2.4.1 Kingston Pier Channel Design and Deepening

Channel Design

Advisian developed six channel design options for the Project. Options 1 – 4 were presented as part of the second round of the consultation process in May 2020 while Options 1A and 3A were developed as a result of the second round of consultation. The channel design options provide a suitable channel profile for vessels to safely access Kingston Pier without significantly impacting upon the existing built and natural environments. The options are summarised in Table 1-2 below. The long sections of the channel design options are shown on Figure 1-27.

Table 1-2 Dimensions of the six channel design options developed.

Option	Design Vessel	Entrance channel width	Interior channel width	Channel depth	Material Volume
Option 1	Current vessel fleet	20m	18m	-2.7m MSL	2,500m^3
Option 2	Current vessel fleet	26.5m	24m	-2.7m MSL	4,000m^3
Option 3	Future vessel fleet	20m	27m	-3.2m MSL	4,400m^3
Option 4	Future vessel fleet	32.5m	36m	-3.2m MSL	8,200m^3
Option 1A	Current vessel fleet	20m	22.5m	-2.7m MSL	~2,750m^3
Option 3A	Current vessel fleet	20m	22.5m	-2.7m to -3.2m MSL	~5,000m^3

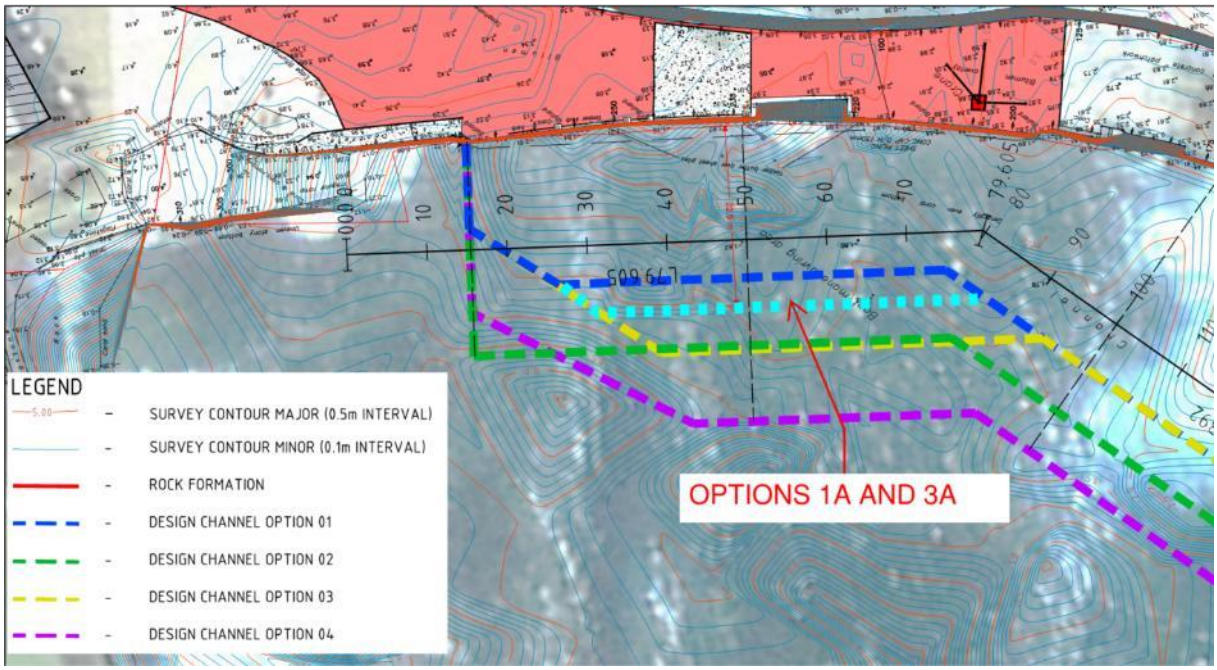


Figure 1-27 Long-sections of the channel design options 1 – 4 including 1A and 3A.

Options 1A and 3A only vary from Options 1 and 3 respectively between approximate chainages CH 25 to CH 95. A cross section at Chainage CH 50 in Figure 1-28 and the plans presented in Figure 1-29 and Figure 1-30 highlight the variances.

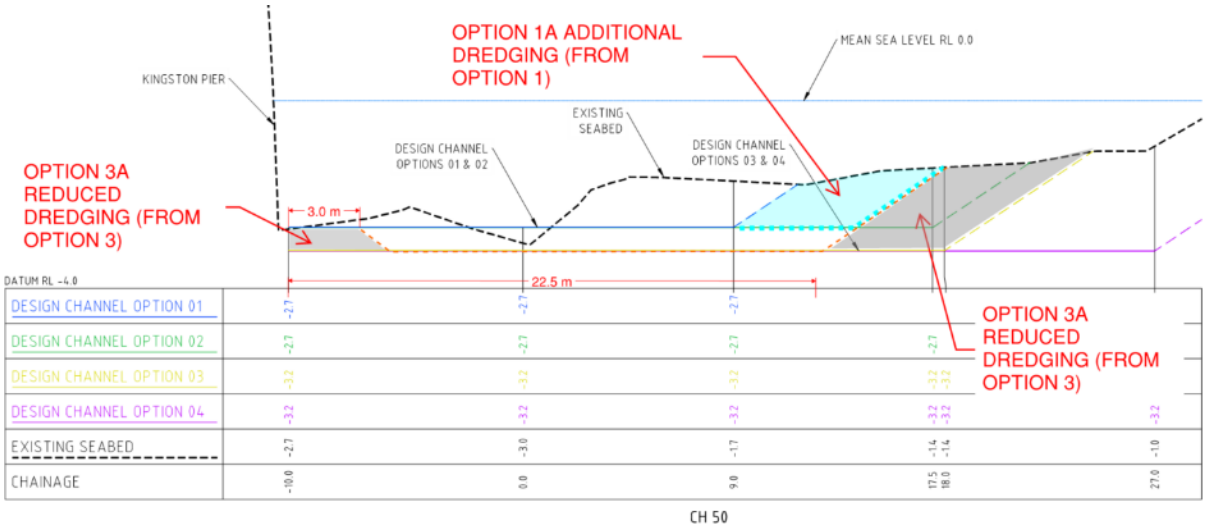


Figure 1-28 Channel design at Chainage 50 for all six options.

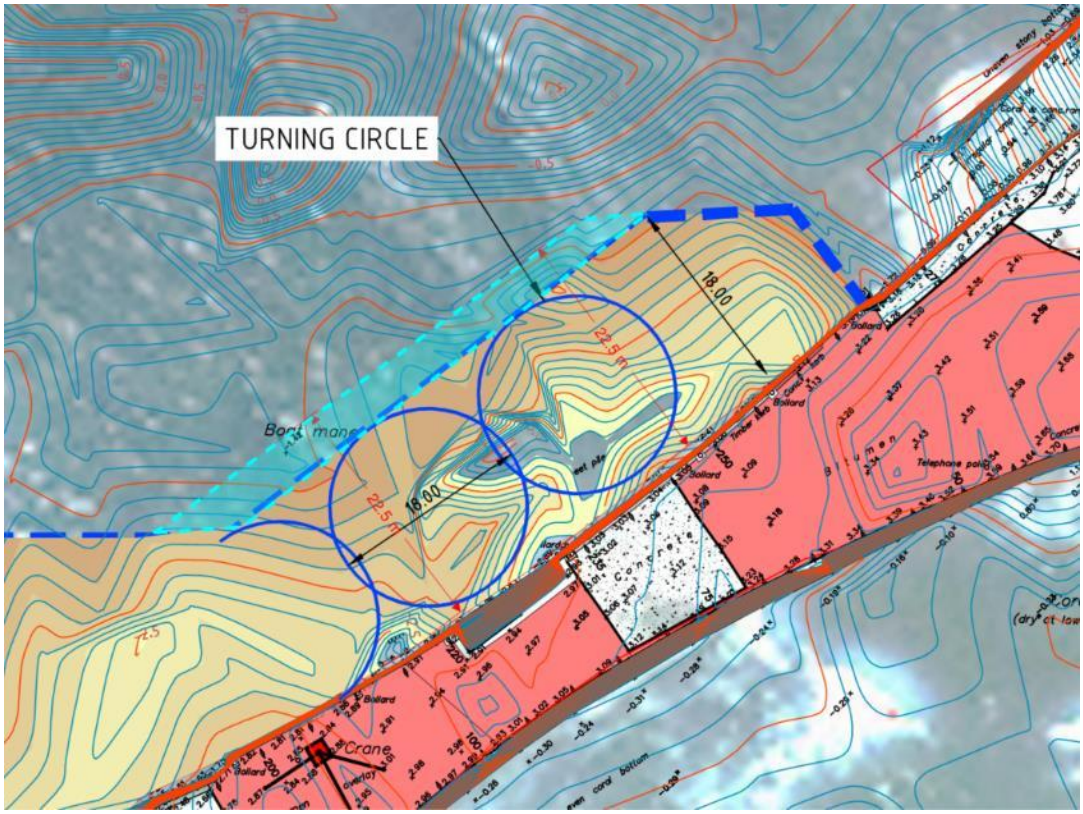


Figure 1-29 Option 1a additional channel width (cyan shading) compared to Option 1 (dark blue dashed line).

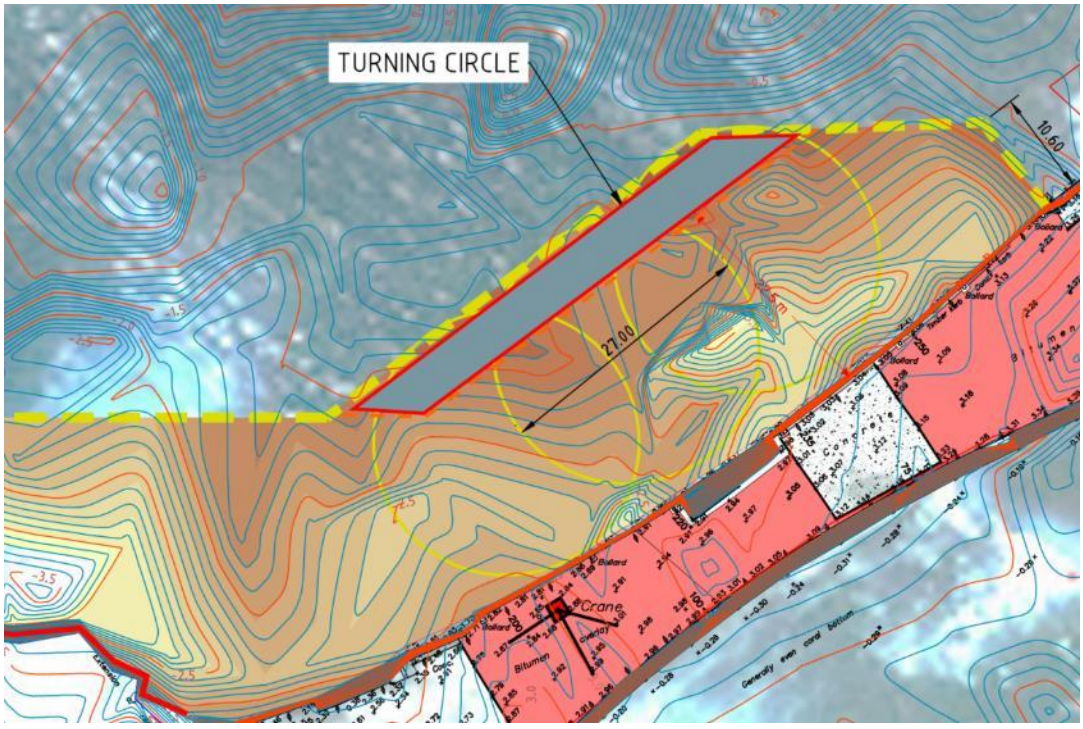


Figure 1-30 Option 3a reduced channel width (grey shading with red outline) compared to Option 3 (yellow dashed line).

All the design options were assessed in Table 1-3 for how they performed against the project objectives and other project considerations.

Table 1-3 Multicriteria assessment of the design channel options.

Criteria	Option 1	Option 2	Option 3	Option 4	Option 1a	Option 3a
Channel is suitable for current vessel fleet	✔	✔✔	✔	✔✔	✔	✔
Channel is suitable for potential future vessel fleet (larger vessels)	✗	✗	✔	✔✔	✗	✗[1]
Impact on the wave behaviour in the harbour	✔	✗	✔✔	✗✗	✔	✔✔
Impact on the structural integrity of the sheet piles and pier	✔	✔	✗	✗	✔	✔[2]
Minimal disturbance to marine environment	✔✔	✗	✔	✗✗	✔✔	✔
Minimal disturbance to maritime archaeological potential	✔✔	✗	✔	✗✗	✔✔	✔
Cost effectiveness of mobilising offshore equipment	✗✗	✔	✔	✔✔	✗✗	✔✔
Excavated volume	2,500 m^3	4,000 m^3	4,400 m^3	8,200 m^3	2,750 m^3	5,000 m^3
Cost (excluding recording, storage and management of maritime artefacts)	$4.3M	$5.0M	$5.3M	$6.9M	$4.4M	$5.1M

✔✔ Option provides the great benefits compared to the other options.

✔ Option provides some perceived benefits compared to the other options.

- Option provides a neutral benefit and impact compared to the other options.

✗ Option has some perceived impacts compared to the other options.

✗✗ Option has adverse impacts compared to the other options.

1 Opportunity for channel to be deepened for larger vessels with on-island equipment in the future
2 Would require strengthening of sheet piling if the channel is deepened in the future

Option 3A was seen to provide a balance between the additional benefits of a deeper and wider channel, and the environmental impact and structural risk to the pier. Option 3A was preferred for the following reasons:

- Provides adequate manoeuvrability around the berth area for one or more vessels to operate
- Provides a reduction in wave energy at the berth
- Limits the potential risk of undermining the existing sheet-piles
- Limits the impact on the environment and maritime archaeological potential
- Provides the opportunity in future to deepen the channel with minimal additional work
- Facilitates the material disposal design, approval and works
- Is aligned with the Port Management Strategy.

Figure 1-31 Preferred channel design alignment and volume cut.

The Project Steering Committee (PSC) supported and endorsed Option 3A on 13 July 2020 as the preferred channel option due to the following reasons:

- It is unlikely for DITRDC to receive the opportunity or authority to augment the channel in the near future, and therefore an option to future-proof the channel should be undertaken if possible
- Fishing vessels, passenger transfer vessels and cargo transfer vessels may become larger in future and therefore a future-proofed channel design will be required if Kingston Pier intends to continue fulfilling its function
- The efforts and resources required for planning and delivery of the channel deepening works justifies more being done if possible.

Therefore, Option 3A (Table 1-4) was selected as the most preferred channel design and progressed to 100% Design. Following subsequent investigation of the stability of the pier, it was agreed to deepen the channel to the ultimate design level of -3.2m MSL.

Table 1-4 Preferred channel design dimensions.

Channel	Design Vessel	Entrance channel width	Interior channel width	Channel depth	Material Volume
Option 3A	Current vessel fleet	20m	22.5m	-3.2m MSL	~5,000m^3

Deepening Strategy

A Deepening Strategy was prepared to outline the construction approach and details of the Project. The strategy was developed in accordance with the design requirements outlined in the Basis of Design, environmental requirements documented in the Environmental Assessment, operational constraints of the Kingston Pier channel, and engineering best practice to deliver a cost-effective solution. Furthermore, the strategy has been developed with the philosophy of "working with nature" that conserves the significance of the area's natural and cultural heritage values as best as possible.

The augmentation footprint is limited to the area harbored by Kingston Pier, the western rock revetment, the reef rock-shelf and Flagstaff Hill (Figure 1-32). The main features of the augmentation footprint are defined in Figure 1-32 and as follows.

Inner Channel

The Inner Channel stretches from the landward end of the pier near the boat ramp to the seaward end of the pier. The channel is mostly 22.5m wide at the toe and widens towards the end of the pier, and batter slopes of 1V:1.5H in rock are generally proposed. The design channel depth is R.L. -3.2 m MSL. Note that the channel is at depth along the bench landward of the access stairs.

Outer Channel

The Outer Channel stretches from the northern side of the rock shelf near the end of the pier, around the western side of rock shelf, and just offshore of the rock shelf. The channel width north of the rock shelf is 20m wide, then widens as it moves around and offshore of the rock shelf up to 40m. The top of the channel batter is also offset at least 2m from the toe of the rock shelf. Batter slopes of 1V:1.5H in rock are proposed. The design channel depth is R.L -3.2 m MSL where the full channel width is required to be deepened north of the rock shelf, and generally only the eastern side of the channel is required to be deepened as it moves around and offshore of the rock shelf

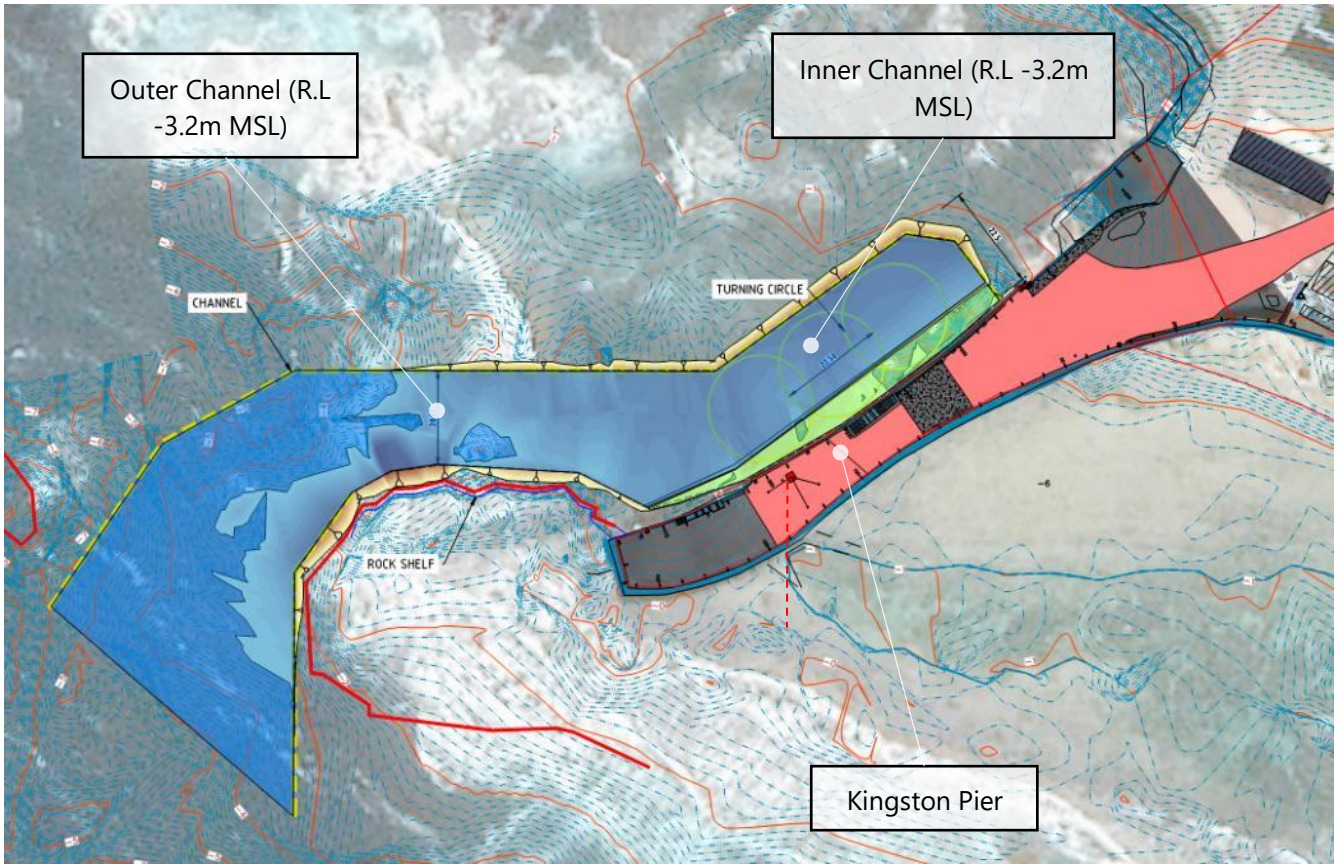


Figure 1-32 Channel design features showing extent of inner and outer channel.

Dredging Quantities

A summary of an estimate of the in-situ quantities of the different types of materials to be removed is shown in Table 1-5 below.

Table 1-5 Volume breakdown of material types.

Material Type	Quantities
Sediment	375 m^3
Calcarenite	1,600 m^3
Tuff (with occasional basalt floaters)	1,945 m^3
Total volume at design level (without deepening tolerance)	3,920 m^3
Total volume with 300 mm deepening tolerance	5,045 m^3

The deepening strategy was prepared based on available geotechnical and bathymetric information and the equipment and the equipment considered appropriate to remove, handle and dispose of the different types of material within the augmentation footprint. The deepening methodology and staging within the strategy has been developed to satisfy requirements for deepening in an area with significant maritime archaeological significance and significant marine ecological values.

Mobilisation

Plant and equipment required for the works would likely be mobilised from either the east coast of Australia or New Zealand. The equipment would include:

- A venturi suction pipe – for removal of the marine sediment layer
- Perforated sediment boxes to dewater sediment
- Pneumatic drill and water pick – for hand removal of calcarenite material Archaeology sieve station set-up
- Appropriately sized backhoe
- Jack-up barge
- Rock-breaker attachment
- A hopper or flat barge and skip bins
- A tugboat
- Portable utilities (generators and water tanks).

For mobilisation, a jack-up barge would be towed from Australia or New Zealand by a tug. Located on the jack-up barge would be the excavator with attachments and small dumb barges (unpowered construction platform), punts (boat with a flat-bottomed hull) and skip bins. If there is not enough room on the jack-up barge deck to deliver everything in one trip, then a second trip with another tug and a dumb barge may be required.

Site Establishment

Site establishment would involve set up of the construction ancillary facilities which includes use of the nearby sheds on the pier for storage of plant and equipment. Temporary portable utilities including water tanks or a generator would be set up. A sieve station would be set up near the boat ramp for screening of archaeological artefacts from the sediment layer (Figure 1-33).

Figure 1-33 Contractor's site establishment.

Removal of the Sediment Layer

The sediment layer within the Project area envelope covers an area of around 4,000 m^2, with an average. The marine sediment layer within the augmentation footprint covers an area of around 3,750 m^2, with an average thickness of 0.1 m this would equate to 375 m^3 volume that is required to removed.

A certain portion of the sediment layer would be targeted for screening for maritime artefacts. This would involve being removed by divers using a hand-held venturi suction pipe, which would transfer material into a perforated sediment box sitting on the seabed. Once the sediment box is filled, it would be lifted onto the pier with a crane. The sediment box would be transferred to the sieve station where workers would sieve through the sediment material for marine artefacts. The extent of screening would be informed by the Kingston Pier Underwater Archaeological Management Plan (KPUAMP).

The area that is not required to be screened for maritime artefacts would be removed via a backhoe mounted on a jack-up barge. The sediment would then be transferred to Old Cascade Quarry and placed in stockpiles for remediation of the Old Cascade Quarry.

It is estimated the duration of the removal of the sediment layer would be two weeks, excluding weather delays and mobilisation and demobilisation time.

Removal of the Calcarenite Layer

There is approximately 1,600 m^3 of calcarenite material to be removed within the Project envelope. The calcarenite region lies around 4 m away from the pier beyond the existing channel that was deepened with a dragline in the 1980s.

Certain areas would be targeted by divers inspecting the cracks and gullies of the calcarenite rock for maritime potential, particularly shipwreck artefacts or evidence of early settlement. Where needed, hand-tools such as pneumatic drills or water picks would be used to carefully remove calcarenite for archaeological screening. The extent of screening would be informed by the KPUAMP.

The area that is not required to be screened for maritime artefacts would be removed by a backhoe mounted on a jack-up barge. The material would be lifted onto skip bins on the jack-up barge. Once the skip bins are filled, they would be lifted onto the pier by a crane. The material would be transported to Old Cascade Quarry via trucks and placed in stockpiles for remediation of the Old Cascade Quarry.

It is estimated that the material could be removed, sieved, handled and stockpiled at an average production rate of around 1000 m^3 per week and the duration of the removal of the calcarenite layer would be 1.6 weeks, excluding weather delays and mobilisation and demobilisation time.

Removal of the Tuff Layer

For the full augmentation footprint, the tuff layer is assumed to either underlie the sediment and calcarenite layers, and in some cases present exposed on the seabed. Approximately 2,000 m^3 of tuff material would be removed to achieve the design depths of the channel. Up to an additional 1,000 m^3 tuff could be removed as a result of the 300 mm vertical deepening tolerance.

The tuff layer is unlikely to contain maritime archaeological potential and therefore is not currently proposed to be screened for maritime artefacts. The tuff material would be removed by a backhoe mounted on a jack-up barge. The material would be lifted onto skip bins on the jack-up barge. Once the skip bins are filled, they would be lifted onto the pier by a crane. The material would be transported to Old Cascade Quarry via trucks and placed in stockpiles for remediation of the Old Cascade Quarry.

Basalt formations may be found within the tuff layer, which would be harder rock that would require a rock-breaker attachment to break up the basalt prior to removing with the backhoe.

It is estimated that the material could be removed, handled and stockpiled at an average production rate of around 1,000 m^3 per week and the duration of the removal of the tuff layer would be up to 3 weeks, excluding weather delays and mobilisation and demobilisation time.

Onshore Handling and Disposal

The Old Cascade Quarry has been nominated as the appropriate location for onshore disposal of the spoil. This area has been selected on the basis that NIRC intends to restore the Old Cascade Quarry back to a state that would be suitable for cattle grazing and the placed material would contribute to this future remediation project.

The spoil would be hauled to Old Cascade Quarry via trucks and placed in an appropriate sorting area where a portion of the spoil would be screened for archaeological artefacts. Large calcarenite fragments would be sorted and stored at Old Cascade Quarry where it would be drawn upon for various restoration projects on Norfolk Island.

The spoil has been assumed to bulk out by 10% once onshore, resulting in a volume of up to 5,500 m^3 and would have more than adequate space for stockpiling in the quarry. The quarry has adequate capacity to receive this volume of material subject to the fill profile.

The spoil has been tested for acid sulfate soils and contaminants and has been assessed as suitable for beneficial reuse. Indicative location for placement of the spoil is shown in Figure 1-34.

Figure 1-34 Old Cascade Quarry placement location.

1.2.4.2 Navigation Aid

Navigation aids, in the form of channel markers, for the Kingston Pier channel were considered to be beneficial by some stakeholders for the safe navigation of vessels to and from the pier. The Project considered three locations for placement of navigation aids (Figure 1-35).

- Location A – located on the edge of the rock shelf (see point "A" on figure)
- Location B – located on the edge of the channel (see point "B" on figure)
- Location C – located on the bombora west of the reef rock shelf (see point "C" on figure).

Figure 1-35 Proposed navigation marker locations A, B and C.

Upon undertaking the stakeholder consultation at the 30% and 80% Design phase, most stakeholders agreed that a permanent navigation marker at Location A would be suitable, but not suitable at Locations B or C.

Therefore, it is proposed that a navigation marker be permanently installed at Location A only. The form of the navigation marker would be a steel pile as small as possible to maintain minimal impact to the visual landscape of Kingston Pier, but still able to withstand wave loads. The navigation marker used would be a West Cardinal Mark type, which would indicate the direction of safety would be west of the reef and rock shelf. The marker would not be lit and would be characterised by two cones pointing towards each other and a black horizontal band on a yellow painted pile (Figure 1-36 and Figure 1-37).

The navigation marker would be bolted to the rock shelf at low tide and extend 1.5 metres above highest astronomical tide (HAT).

Figure 1-36 West Cardinal Mark.

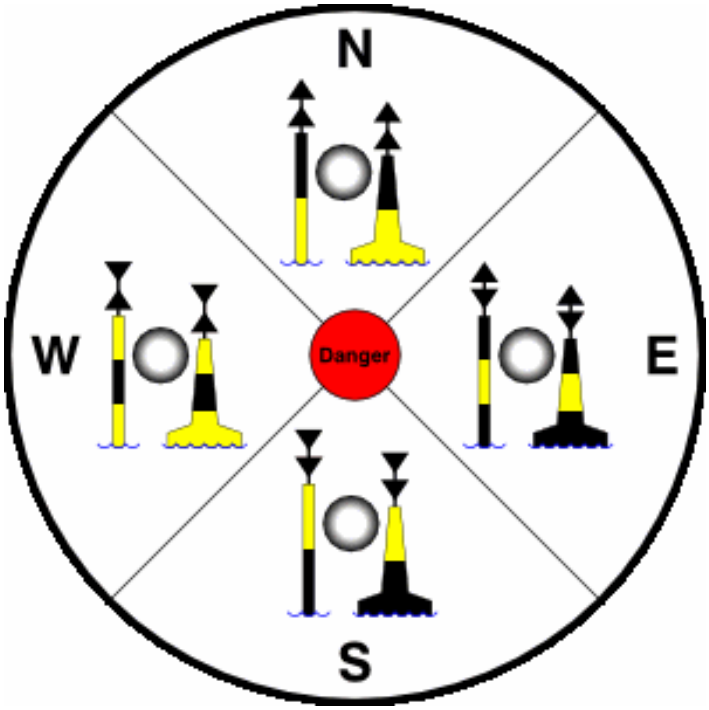


Figure 1-37 Diagram of cardinal marks.

1.2.4.3 Kingston Pier Sheet Pile Wall Remediation

Kingston Pier was constructed from 1839 to 1847. It is currently comprised of external stonework, steel sheet piles, a concrete surface and rubble fill. The structure was repaired following damage sustained during World War II and refurbished in 2007 using modern materials.

A structural assessment of the Kingston Pier sheet piles and recent 2020 hydrographic survey and 2021 detailed investigations using downhole magnetic gradiometer method and parallel seismic method has confirmed that the recent sheet-pile wall is undermined at certain sections or had reduced embedment than at construction, and therefore is at risk of structural issues which may be further exacerbated by the proposed channel deepening. Remedial options have been developed to ensure the sheet pile wall is not significantly undermined, and the risk of damage to the Kingston Pier structure is adequately mitigated.

Eight concept designs were developed based on outcomes from the various site investigations. Options were refined following a value engineering and multicriteria assessment with Option 6 selected as preferred.

Option 6 comprises filling the void between the old raked sheet piles and newer sheet piles with a grout and capping to prevent any leakage of the grout during the construction. The clutches of the sheets would be welded together near the seabed to ensure a greater connection between the sheets and also limit any loss of grout in the void infilling. A suitable grout to flow between the rubble currently filling the void would need to be selected. The option includes the installation of a new steel waler welded to the outside of the sheet piles to connect each pan for a greater distribution of load. The waler would be encased in a stiff concrete shrouding that would not extend past the fender line to allow for safe navigation and berthing of vessels. This encasing would act as a capping to the undermined shallow sheets. A trench would also be filled with concrete at the toe of the current wall with a berm at the channel dredge design level. A typical sectional drawing is shown in Figure 1-38.

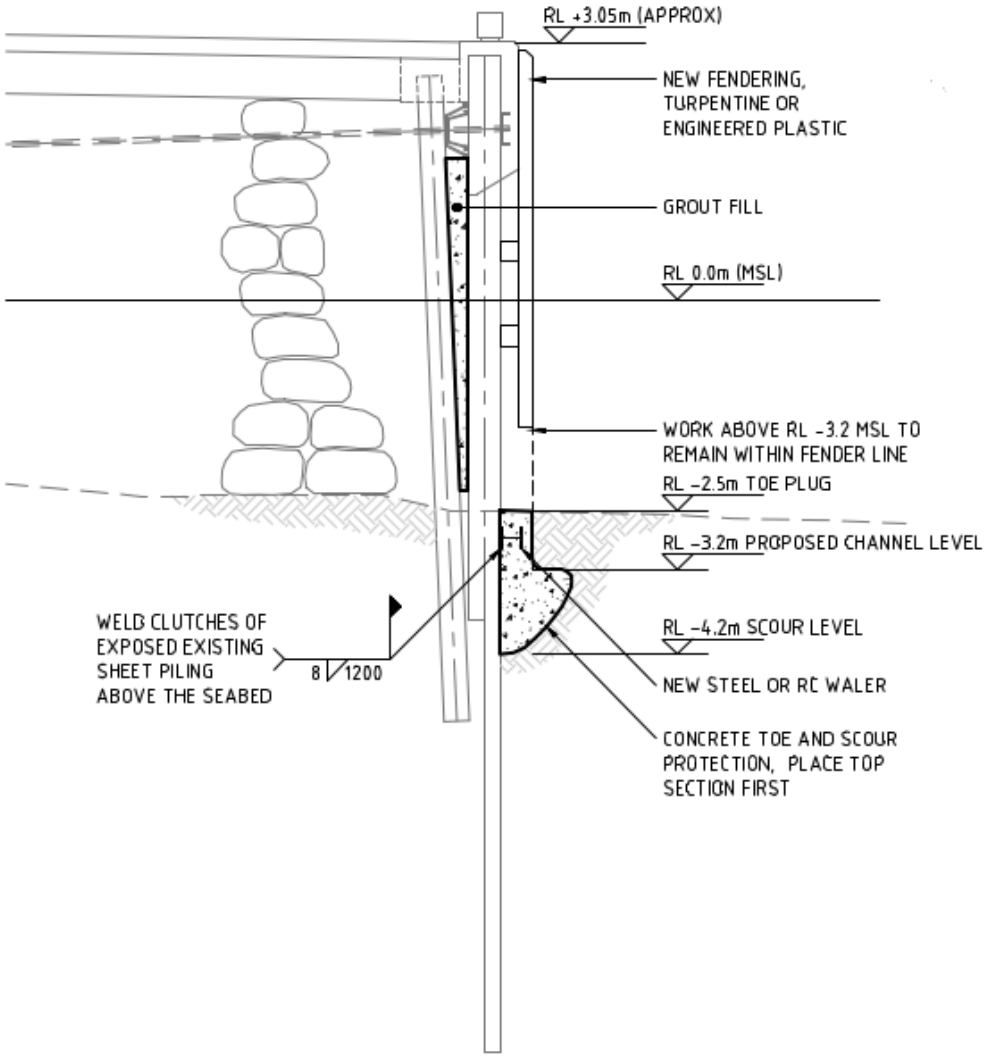


Figure 1-38 Option 6 Sketch.

The sheet pile wall remediation steps are as follows:

- Repair exposed sheet pile toes with steel patch
- Grout-fill existing gravel-filled cavity between sheet pile walls, this requires a performance based solution to be put forward in an ITP for approval by the Superintendent
- Install mass concrete toe beam
- Weld sheet pile clutches above seabed
- Remove and replace existing hard fendering.

1.3 Feasible Alternatives

The only alternative to the Project (the 'Do Nothing' Scenario) is described in Section 1.3.1 to demonstrate why the Project is the 'preferred' solution; this being the best and most feasible approach to improve access and safety for vessels at Kingston Pier at all tides and in accordance with required navigation standards. Due to the location and nature of the existing Kingston Pier channel, there are no alternatives to constructing this Project elsewhere.

As described, overarching Project objectives reflect the requirements to ensure that environmental, heritage social and economic impacts are minimised which directly relate to four MNES protected by controlling provisions of Part 3 of the EPBC Act that are the subject of the PER. A description of the related options considered for Project elements are described in Sections 1.3.2 to 1.3.6.

1.3.1 The 'Do Nothing' Scenario

Channel Construction and Spoil Disposal

This scenario assumes that there is no augmentation of the existing channel bed at Kingston Pier nor the undertaking of any other proposed activities. Under this scenario, the existing channel bed would continue to pose an ongoing safety risk for various vessel operators due to inadequate under-keel clearance. As described previously, this would limit the use of Kingston Pier by vessels during all tides, particularly as critical infrastructure for minor freight operations and cruise ship passengers to access Norfolk Island. Consequently, this would not provide increased opportunities for tourism as well as community and economic development on Norfolk Island.

Kingston Pier Stabilisation

Where no action is taken in stabilising the pier, the capacity of the pier would remain limited. This would result in ongoing limitations to heavy lifting, which would restrict sea transfer of goods in loading and unloading. There are also potential safety issues associated with ongoing degradation of the pier resulting in further reduction in stability. The worst-case scenario is that the pier would eventually fail and no longer be operable which would. This would adversely impact the sea transfer of goods and tourism growth for the Island.

1.3.2 Channel Deepening Options

As detailed in Section 1.2.4, alternative options have been considered and assessed with the presented option provided within this PER, being selected as the preferred option. In summary, Option 3A was seen to provide a balance between the additional benefits of a deeper and wider channel, and the environmental impact and structural risk to the pier.

1.3.3 Construction Methodology Options

A number of construction methodology options were considered for augmentation of the existing channel bed at Kingston Pier. The options are summarised below. The recommended construction option consists of a combination of these options.

Augmentation from Kingston Pier

This option would involve using a 40-50 tonne excavator with a long-reach arm extending approximately 20 m into the harbour adjacent to Kingston Pier. However, at this extension the excavator would not have enough power to augment hard seabed material such as calcarenite. This option would need to be supplemented with water-based plant.

Drilling and Blasting

This option was not considered further due to the potential for damage to Kingston Pier and given the sensitivities of the site being located in the Norfolk Marine Park.

Augmentation using Hand-Tools

This option would involve using hand drills, hydraulic jack hammers and/or underwater saws to augment seabed material. The seabed adjacent to Kingston Pier may need to be initially cut with a saw prior to any augmentation works with larger plant such as a backhoe. This would minimise the risk of potential damage to the foundations of Kingston Pier where existing rock may otherwise be ripped from underneath the existing steel sheet pile wall. Augmentation of the existing channel bed using only hand-tools would introduce safety risks for underwater personnel especially during rough wave conditions and the operation of larger plant.

Venturi Suction Pipe

This option would involve using a venturi suction pipe to remove seabed material from the existing channel bed as well as from reef crevices. However, the suction pipe would not be used to remove tuff rock and calcarenite material due to inadequate ability to breakdown rock and frequent blockages.

Backhoe on a Floating Barge

This option would involve using a backhoe-mounted floating barge to augment the existing channel bed in benign wave conditions. Additional anchors would be required to secure the floating barge during rough wave conditions in the harbour adjacent to Kingston Pier. The continuous motion of the floating barge would impact on the efficiency of augmentation works. A tug would be required during construction to move the floating barge to a safer water-based location during rough wave conditions.

Backhoe on a Jack-Up Barge

This option involves using a backhoe from a jack-up barge which would be able to better withstand a range of wave conditions compared to the floating barge. The barge can be 'jacked-up' above sea level, particularly when wave conditions are greater than the operational limit for the backhoe or to secure the barge and plant in-situ overnight. A tug would be required during construction to reposition the barge to access the full extent of the existing channel bed. The legs of the jack-up barge would penetrate the seabed located within the channel.

Rock Breaker Attachment

This option involves using a rock breaker attachment or similar, on the backhoe, as a contingency to breakup hard seabed material such as basalt core stones or inclusions.

Drum Cutter Attachment

This option involves fitting the backhoe with a drum cutter, such as a German-built Erkat, rather than a rock breaker attachment to breakup hard seabed material. Drum-cutting is faster and more effective than the rock breaker. However, would create greater suspended solids.

Cutter Suction Dredge

This option involves using a cutter suction dredge transported from mainland Australia or New Zealand for cutting hard seabed material prior to pumping from the seabed. It would be secured using spuds lowered into the seabed. This option was not considered further due to the existing wave conditions at Kingston Pier, the limited available area for dewatering pumped seabed material and the scale of augmentation works.

Walking Excavator

A walking excavator is an all-terrain excavator used in difficult to access areas such as steep inclines and uneven terrains. This option was not considered further due to the existing wave conditions at Kingston Pier and the uneven seabed surface.

Temporary Construction Platform

This option would involve the construction of a temporary rock working platform extending from the shore along the working side of Kingston Pier. An excavator located on the platform would augment the existing channel bed from the most seaward location of the channel. As the excavator moves closer to the shore, the platform would be progressively dismantled. This option was not considered further due to potential impacts on marine ecology, non-Aboriginal heritage and maritime archaeology as well as the availability of suitable material to construct the platform.

1.3.4 Water-Based Disposal of Spoil

The water-based disposal of spoil was initially considered as an option. However, water-based disposal was discounted for the following reasons:

- There are no currently registered water-based disposal sites located in the waters around Norfolk Island. It is considered that the application for a water-based disposal site would involve a lengthy approval and permitting process
- Spoil is required to be transferred onto land to be screened for archaeological artefacts. The material would then need to be moved onto a barge and transported to the water-based disposal location. It is considered that this process would be costly and time consuming
- Water-based disposal was not considered to be a sustainable nor effective reuse of the material.

1.3.5 Land-Based Disposal of Spoil

Calcarenite may be reused for non-structural purposes such as fill or as a subbase for footpaths if it is crushed and cleaned. The most appropriate beneficial reuse for calcarenite and tuff material would be as non-structural fill unless it is cement stabilised. These materials may potentially be reused for raising of the Cascade Pier aprons (subject to design), rehabilitation of the Old Cascade Quarry or as landscape mounding.

Three options were considered for the land-based disposal of spoil as shown in Figure 1-39.

Figure 1-39 Location of options for land-based disposal of spoil (Source: Google Earth 2020).

The three options for land-based disposal are summarised below.

Restoration of the School Playing Fields

This option involves the reuse of spoil as non-structural fill, which would be beneficial for restoration works at the school playing fields. This may be in the form of landscape mounding. These fields are located north of the existing school playing fields and north-east of the Norfolk Island Central School buildings.

The local community generally has unfavourable views towards using this location as a convenient disposal option for projects. Therefore, stockpiling at this location was not recommended.

Raising of the Cascade Pier Aprons

This option involves the beneficial reuse of spoil as non-structural fill in works at Cascade Pier to raise the existing aprons. A temporary stockpile would be required until construction works commence at Cascade Pier. The stockpile may be located at the Old Cascade Quarry.

There is a high likelihood that these works would require structural fill. The spoil does not meet this requirement. Therefore, this option has been discounted in preference of the Old Cascade Quarry.

Old Cascade Quarry

This option involves the use of the Old Cascade Quarry as the land-based disposal site for spoil as part of future rehabilitation works at the Old Cascade Quarry.

The Old Cascade Quarry is located in the vicinity of Cascade Reserve. It is situated east of Cascade Pier and immediately adjacent to Cascade Cliff (Figure 1-34). According to the Cascade Reserve Plan of Management, Cascade Cliff in its natural state was originally a significant feature of Cascade Reserve. It was completely reshaped in 1999-2000 by major engineering work which involved horizontal benching of Cascade Cliff to improve safety and prevent further rockfalls onto Cascade Road and Cascade Pier (Norfolk Island Parks and Forestry Service 2003). At present, Cascade Cliff resembles an engineered landscape of vertical faces separated by horizontal benches, with some vegetation. It is noted that during the life of the Plan of Management, the boundary of Cascade Reserve would be adjusted to remove Cascade Cliff. The end-date for the life of the Plan of Management is not known. Finally, the Old Cascade Quarry is not described in the Plan of Management.

Considering the Old Cascade Quarry is proposed to be rehabilitated in the future as per the NIRC's objectives, land-based disposal of spoil at the Old Cascade Quarry would contribute to a future beneficial reuse. As a result, this option was most preferred.

1.3.6 Kingston Pier Stabilisation

A discussion on the options is presented in Section 1.2.4.3.

The only variation of options that would be possible for the proposed remediation works would be the selection of scour protection at the toe of the wall. A concrete toe could provide the scour protection, or alternatively a scour mattress or additional rock could be used. There is limited rock available on the island so this would be difficult to source and there are risks in introducing foreign material to the island.

An alternative option for the overall repair strategy could be the design of a new pier structure, extending from the current footprint in each direction, however this scale of project is not warranted at this stage of the pier's life.

2 Matters of National Environmental Significance

2.1 Description of the Environment

Norfolk Island lies within the Temperate East Marine Region. This marine region is comprised of Commonwealth waters extending from the southern boundary of the Great Barrier Reef Marine Park to Bermagui in New South Wales. This also includes the waters surrounding Lord Howe Island and Norfolk Island. The region covers an approximately 1.47 million km^2 of temperate and subtropical waters. The region extends from shallow waters on the continental shelf, 3 nautical miles (5.5 km) from shore to the deep ocean environments at the edge of Australia's exclusive economic zone, 200 nautical miles from shore (Director of National Parks 2018).

Kingston Pier is a historic stone pier approximately 150 m long, located on the southern coast of Norfolk Island in Sydney Bay. Kingston Pier has been in use for over 150 years as a cargo transfer facility and is considered an irreplaceable part of the Norfolk Island infrastructure. It is used by various vessel operators such as commercial charters, fishing vessels and emergency responders. In addition, break-bulk cargo is transhipped to Kingston Pier from cargo ships moored offshore using local launches and lighters. The lighters are stored in nearby boat sheds. The cargo is lifted out of the lighters at Kingston Pier using either a shore-mounted crane or mobile crane.

The Pier has the following characteristics:

- Constructed of locally sourced calcarenite stone
- The eastern face is battered
- The western face is near vertical and includes two sets of steps to facilitate transfer of personnel to and from boats
- Situated along the western edge of an existing reef
- Damage occurred due to a severe storm event (reportedly in 1897) and excessive use by heavy equipment during World War II
- Repaired in 1953, which included installation of steel sheet piles and a concrete capping beam
- Refurbished in 2007 with additional sheet-piling
- Is considered to be of high cultural and heritage significance.

Nearby sensitive receivers include the Pier Store (Museum) and Royal Engineers Office (Museum shop and information) which are located within the KAVHA to the north-east of the site (Figure 2-1). In addition, the Boatsheds are existing maritime facilities which are located near the site. There are no residential properties or industrial areas that are located in proximity to the site. In addition, the Kingston Common Reserve is located in the vicinity of Kingston Pier to the north, east and west and allows for public activities which contribute to the visitor experience within the KAVHA. It also contains historic buildings and structures which are involved in commercial uses and tourism.

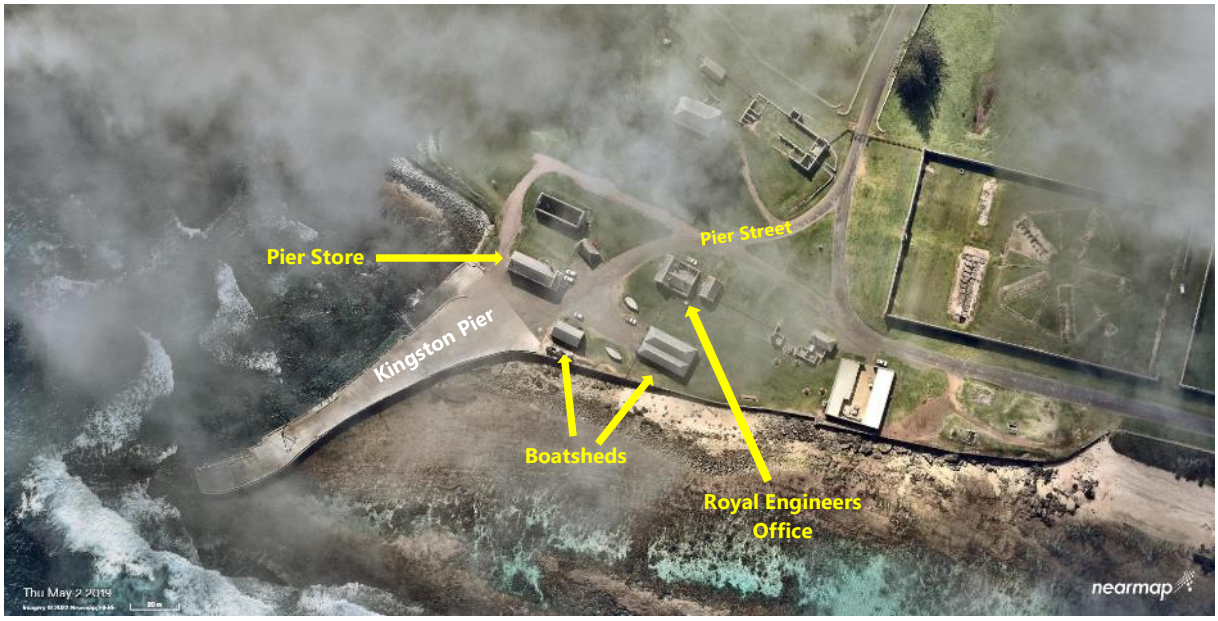


Figure 2-1 Nearby sensitive receivers to Kingston Pier (Source: Nearmap 2022).

The facilities currently available at Kingston Pier are summarised in Table 2-1.

Table 2-1 Summary of facilities at Kingston Pier.

Facilities	Availability
Commercial fishing – unloading and berthing	Yes.
Charter vessels – unloading and berthing	Yes.
Recreational and visitors berthing	Yes.
Fuel, water, electricity and lighting	Electricity and lighting only.
Boat ramp and car park	Yes.
Public toilets	Yes. Near the Royal Engineers Office.
Retail food and beverage	Small kiosk in the vicinity.

The Kingston Pier is located seaward of a shallow rock shelf that is exposed at lower tide levels and provides some sheltering of waves for vessels in the lee. The existing entrance channel is over rocky reef with sea bed levels ranging from around -2.4 m to -3.4 m CD offshore and adjacent to the rock shelf. Landward of the rock shelf and next to the pier seabed levels are around -0.7 m to -1.5 m CD.

The unique temperate environment Norfolk Island is situated in makes for habitats which are ideal for a variety of marina fauna and flora. These unique organisms include 230 species of algae, 57 species of coral, 400 species of molluscs, 254 species of fish, numerous mammals and 236 species of marine benthic algae. These species are further described in Section 2.4.1.

2.2 World Heritage Values

2.2.1 Description of KAVHA

KAVHA is listed on the UNESCO World Heritage List as one of the 11 places that make up the 'Australian Convict Sites' World Heritage serial listing inscribed 31 July 2010.

A description of the KAVHA heritage elements, historical context and archaeological potential (land) and Kingston Pier is provided below.

KAVHA Heritage Elements

The KAVHA is located on the southern side of Norfolk Island, covering an area of around 250 hectares. The KAVHA site has been divided into 14 precincts for management purposes. The Project is located adjacent to Precinct H (Figure 2-2). There are 57 significant elements within Precinct H. In accordance with the KAVHA Heritage Management Plan (HMP) (Jean Rice Architect, Context and GML Heritage, 2016), the post-1825 elements of Precinct H are briefly described below:

- **Kingston Pier –** constructed (1839-47) using stone, rubble fill and local materials. It was refurbished in 2007 using modern materials, steel sheet piles and a concrete surface. One of two sets of stone stairs remains.
- **The Seawalls –** made of stone and located east of Kingston Pier along the whole foreshore. In 1943, the wall was breached during the salvage of *Ronaki* IX-94 which was wrecked on the reef. Kingston Pier and the seawalls are considered to be among the earliest remaining large-scale engineering works in Australia.
- **Boatsheds & Workshops –** the single boatshed (1828-9) and double boatshed (1841) were constructed using local calcarenite.
- **The Pier Store and Crankmill –** the Pier Store (1825) and is currently used as a museum. It has been used for milling and a guardroom. The verandah was added in 1841. The Crankmill was constructed in 1827-38 and originally housed a hand-powered mill for grinding grain. It was subsequently used by a whaling company as a boatshed. It is now a ruin.
- **The Settlement Guard House –** constructed (1826) on the foundations of a First (Colonial) Settlement 1788 – 1814 building. The building was a guard house until 1841 and later altered to a boatshed. It was reconstructed in 1977-1979.
- **Hospital and Surgeon's Quarters –** constructed (1827) for civil officers using prefabricated timber components. It was used as a residence after 1856. Past excavations revealed remains which are stored in the museum. It is now used by the Norfolk Island Lions Club.
- **Royal Engineer's Office and Stables –** constructed from stone (1848) with a hall and two front rooms. The stables block, portico and additional rooms were soon added. In c.1897, internal modifications were undertaken. It has been used by the museum as a café. The stables block was reconstructed as a public amenities building containing male and female toilets.
- **Quarters for the Lower Ranks –** archaeological remains of quarters built along the foreshore. A single remaining cottage (1850-3) is now the restoration office.

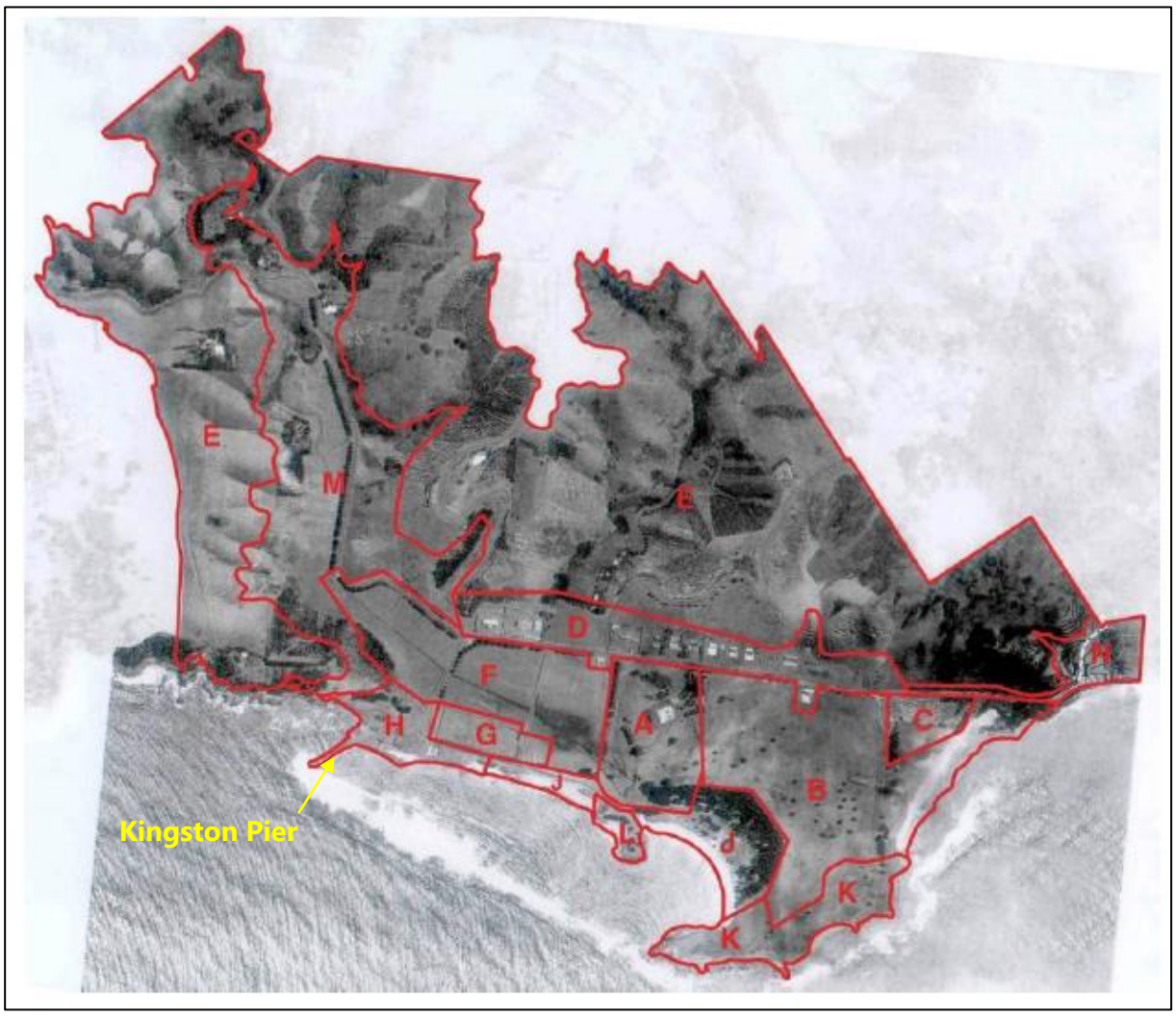


Figure 2-2 The KAVHA precincts (Source: Jean Rice Architect, Context and GML Heritage 2016).

KAVHA Historical Context

The site is located adjacent to the KAVHA which is of World and National heritage significance. The following brief historical context of the KAVHA has been informed by a review of the KAVHA HMP. The KAVHA comprises four historical periods which are briefly described below:

- **Polynesian Settlement:** Norfolk Island was occupied by Polynesians prior to European settlement. Past archaeological investigations have uncovered numerous artefacts and remains on Norfolk Island. Investigations at Emily Bay site in 1995-7 suggests a single phase of occupation between c.1150 and c.1450AD. The Norfolk Island Museum contains a collection of Polynesian artefacts recovered from the KAVHA.
- **First (Colonial) Settlement 1788 – 1814:** On 10 October 1774, Captain James Cook sighted Norfolk Island and then claimed it for the British Crown. The HMS *Supply* with Lieutenant Philip Gidley King arrived on Norfolk Island on 2 March 1788. By 1790, buildings and structures were constructed, and the land cultivated. The settlement's only links from Norfolk Island were HMS *Supply* and *HMS Sirius*. On 19 March 1790, *HMS Sirius* was wrecked on the reef east of

Kingston Pier. The crew and passengers were forced to remain whilst King left on HMS *Supply*. The settlers survived on sparse rations and by eating ground nesting birds and their eggs. Former convicts and the military were granted land for private use and villages were formed as well as roads, town structures and facilities. The settlement was called Sydney. In 1803, it was recognised that Norfolk Island could not operate independently of Port Jackson and in 1810, orders were issued to close the settlement. By 1814, the remnants of the Norfolk Island community sailed for Sydney. Norfolk Island remained unoccupied for the following 11 years.

- **Second (Penal) Settlement 1825 – 1855:** In 1822, Norfolk Island was recommended to be re-occupied on the principles of a penitentiary. On 6 June 1825, a party of convicts landed on Norfolk Island. By 1833 there were 600 prisoners and 130 troops on Norfolk Island and convicts were instructed to work in building and agriculture. A series of Commandants over the following eight years saw the construction of the structures including the Prisoners' Barracks, the Old Military Barracks and the Pier Store. By 1834, the settlement was known as Kingston. In 1838, the Royal Engineer, Lieutenant Lugard arrived at Norfolk Island and surveyed the settlement and later designed a number of buildings. He proposed improvements at the Landing Place and construction of Kingston Pier commended in 1839 and other building programs continued into the 1840s. In 1847, the penal settlement on Norfolk Island was to be abolished. From a total of 1820 convicts on Norfolk Island in December 1846, there were only 119 in October 1854.
- **Third (Pitcairn) Settlement 1856 – Present:** In 1852, the Pitcairn Islanders had outgrown the small Pitcairn Island and were to be relocated to Norfolk Island (over 6,000 kilometres to the west) following closure of the penal settlement. The Pitcairners sailed to Norfolk Island on the *Morayshire*, landing at Kingston on 8 June 1856. By 1857, the Pitcairners were in possession of the existing buildings at Kingston but maintained only those that they needed. Each household head was also allocated a 50-acre lot away from Kingston. Until 1900, few significant physical changes occurred in Kingston. Some of the existing buildings were modified as needed for use and additions were also made to some houses. The Administration of Norfolk Island was transferred to the Governor of New South Wales, effective on 1 January 1901. The *Norfolk Island Act* of 1913 established Norfolk Island as a territory under the Commonwealth of Australia. During the 1920s, a number of buildings and structures were renovated for use by the Administration of Norfolk Island as both offices and residences. The tourism trade also led to the construction of a guest house called Dewville to the east of the Quality Row houses and the creation of the golf course. During World War II, Kingston Pier was the main landing site for personnel and equipment associated with the construction of the airfield. The tourism trade increased following World War II. In the 1950s, a number of buildings were repaired, and some ruins were removed. In 1962, the Commonwealth Department of Housing initiated a restoration program which continued into the 1970s.

Archaeological Potential – Land

The Project has the potential to impact underwater cultural archaeology associated with known shipwrecks including the *HMS Sirius* which is culturally significant to the KAVHA.

The KAVHA Archaeological Zoning and Management Plan (Extent Heritage 2019) identifies potential archaeological remains within Precinct H (Figure 2-3). The boundary of Precinct H is based on 19th century maps and does not account for the shoreline receding at the Landing Place.

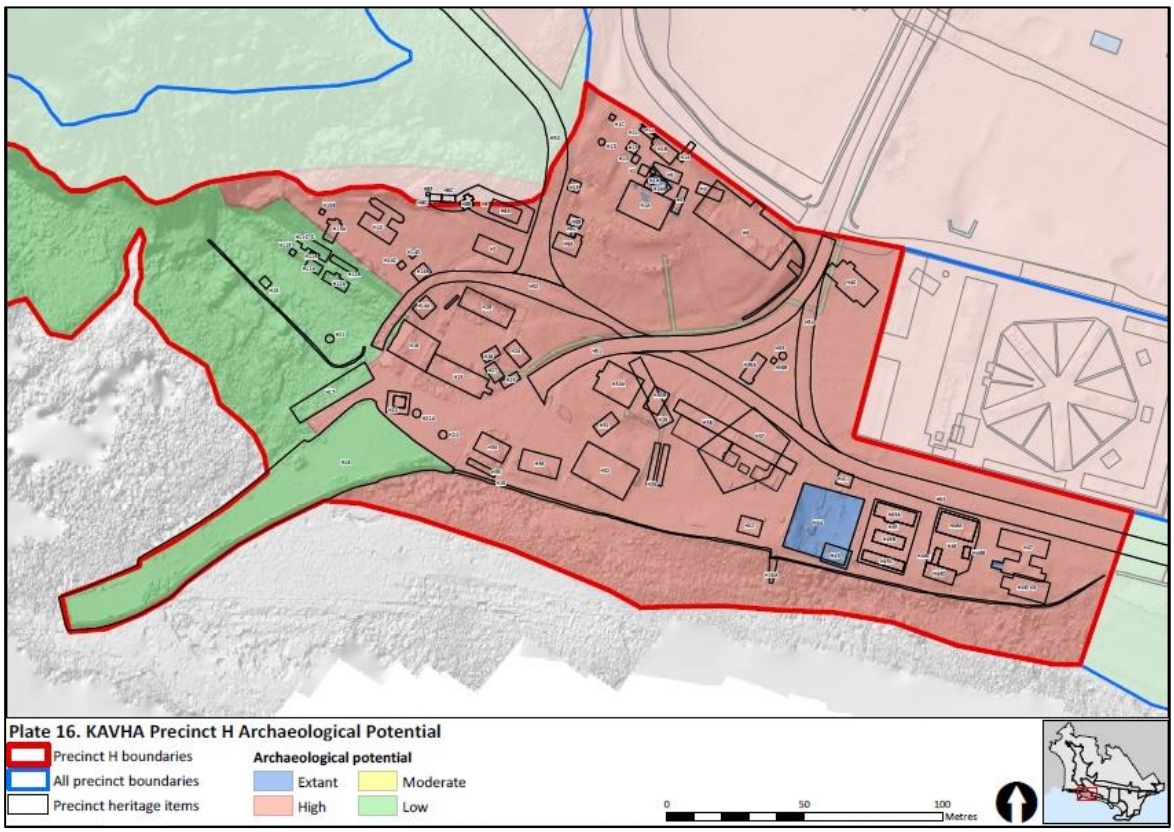


Figure 2-3 Precinct H archaeological potential (Source: Extent Heritage 2019).

The Statement of Archaeological Significance for the archaeological resource within the KAVHA, including remains recovered from archaeological deposits within the KAVHA that appear to be associated with a vessel, is provided below (Extent Heritage 2019):

> *"KAVHA is a rare surviving settlement that provides tangible evidence of a range of different forms of human occupation extending over a period of almost one thousand years. The archaeological remains have significant potential to contribute to understanding of the site's continuous development during each period of occupation.*
>
> *The values detailed in the statement of significance cover a wide range of existing and potential resources. These may vary in their ability to contribute to the core reasons for conserving and interpreting the site.*
>
> *The core values for the site are those associated with Polynesian settlement (rare, potentially a high degree of integrity, high research value). The First (Colonial) Settlement (rare, relatively undisturbed, key part of the broader operation of the British penal system, high research value). The Second (Penal) Settlement (the ultimate expression of Britain's global system of penal discipline, high research value). The Third (Pitcairn) Settlement (the operation of a culturally distinct Polynesia/European community living within a broader European context, high research value)."*

Kingston Pier Condition, Uses and Values

Previous refurbishment of Kingston Pier was undertaken in 2007. Early refusal was encountered during the installation of some of the steel sheet piles on the western side of Kingston Pier. This introduces the potential for undermining of the existing steel sheet pile wall by the proposed augmentation works. A recent hydrographic survey and underwater visual assessment by divers showed that this undermining was already occurring, with evidence of loose gravel fill escaping from between the old and existing steel sheet pile wall. Refer to Section 1.2.4.3 for further details on existing condition.

Eric Martin and Associates (2018) describe the current use of Kingston Pier as follows:

> "*Kingston Pier is a vital part of the supply chain to and from the Island, and plays in important role in maintaining the Island's economy. It is actively used, along with Cascade Pier, for the loading and unloading of cargo. Cargo ships generally have to anchor in the bay, and the loading and unloading of cargo, including food supplies, fuel, passenger vehicles and machinery is labour-intensive and requires the use of smaller boats and cranes. While Cascade Pier provides an alternate access point, both piers are needed to maximize opportunities for the transfer of cargo and cruise ship passengers to and from the Island in different weather conditions. Both piers are also used by smaller fishing and recreational boats*."

Key social, economic and cultural values associated with the Project at Kingston Pier relate to the port's role as critical infrastructure for both minor freight operations and transfer of cruise ship passengers, for various vessel operators such as commercial charter, fishing vessels and emergency responders and for other public users who use Kingston Pier for fishing and other recreation activities. Kingston Pier is culturally significant to the Norfolk Island community and the KAVHA. Community events are important to maintaining connections with the past and include on Bounty Day the re-enactment of the landing of the arrival of Pitcairners on Norfolk Island as well as general family and leisure activities at Kingston (Jean Rice Architect, Context and GML Heritage 2016).

2.2.2 KAVHA World Heritage Values

The following brief synthesis relates to the 'Australian Convict Sites' serial listing as described by UNESCO (2022):

> "*The property consists of 11 complementary sites. It constitutes an outstanding and large-scale example of the forced migration of convicts, who were condemned to transportation to distant colonies of the British Empire; the same method was also used by other colonial states.*
>
> *The sites illustrate the different types of convict settlement organised to serve the colonial development project by means of buildings, ports, infrastructure, the extraction of resources, etc. They illustrate the living conditions of the convicts, who were condemned to transportation far from their homes, deprived of freedom, and subjected to forced labour.*
>
> *This transportation and associated forced labour was implemented on a large scale, both for criminals and for people convicted for relatively minor offences, as well as for expressing certain opinions or being political opponents. The penalty of transportation to Australia also applied to women and children from the age of nine. The convict stations are testimony to a legal form of punishment that dominated in the 18th and 19th centuries in the large European colonial states, at the same time as and after the abolition of slavery.*

The property shows the various forms that the convict settlements took, closely reflecting the discussions and beliefs about the punishment of crime in 18th and 19th century Europe, both in terms of its exemplarity and the harshness of the punishment used as a deterrent, and of the aim of social rehabilitation through labour and discipline. They influenced the emergence of a penal model in Europe and America.

Within the colonial system established in Australia, the convict settlements simultaneously led to the Aboriginal population being forced back into the less fertile hinterland, and to the creation of a significant source of population of European origin."

The listing meets two criteria for outstanding universal value (UNESCO 2022) as follows:

"Criterion (iv): The Australian convict sites constitute an outstanding example of the way in which conventional forced labour and national prison systems were transformed, in major European nations in the 18th and 19th centuries, into a system of deportation and forced labour forming part of the British Empire's vast colonial project. They illustrate the variety of the creation of penal colonies to serve the many material needs created by the development of a new territory. They bear witness to a penitentiary system which had many objectives, ranging from severe punishment used as a deterrent to forced labour for men, women and children, and the rehabilitation of the convicts through labour and discipline.

Criterion (vi): The transportation of criminals, delinquents, and political prisoners to colonial lands by the great nation states between the 18th and 20th centuries is an important aspect of human history, especially with regard to its penal, political and colonial dimensions. The Australian convict settlements provide a particularly complete example of this history and the associated symbolic values derived from discussions in modern and contemporary European society. They illustrate an active phase in the occupation of colonial lands to the detriment of the Aboriginal peoples, and the process of creating a colonial population of European origin through the dialectic of punishment and transportation followed by forced labour and social rehabilitation to the eventual social integration of convicts as settlers."

The HMP notes that Kingston Pier and the harbour in particular illustrates criterion (iv) by maintaining its function as a port from the convict period.

The key significance values of the archaeological resource within the KAVHA and the location of the Project, excluding *HMS Sirius*, are summarised in Table 2-2.

Table 2-2 Significance of the archaeological resource (Source: Cosmos Archaeology 2020a).

Occupation Phase	Occurrence	Condition	Historical Relevance	Research Value	Resource	Key Value
Polynesian Settlement c.1150 – c.1450AD	Rare	Potentially a high degree of integrity	Tracing Polynesian settlement across the Pacific	High	All physical evidence	Critical
First (Colonial) Settlement 1788 – 1814	Rare	Relatively undisturbed	Key part of the broader operation of the British penal system	High	All physical evidence	Critical
Second (Penal) Settlement 1825 – 1855	Rare	Relatively undisturbed	The ultimate expression of Britain's global system of penal discipline	High	All physical evidence	Critical
Third (Pitcairn) Settlement 1856 – 1897	Rare	Not assessed	The operation of a culturally distinct Polynesia/European community living within a broader European context	High	All physical evidence	Critical
Third (Pitcairn) Settlement 1898 – present	Common	Not assessed		Limited	Evidence relating to WWII defence works, tourism, use of earlier structures and modifications	Secondary

In addition to Table 2-2, the archaeological remains of *HMS Sirius* are considered to be of critical significance value in accordance with the following excerpt from the Commonwealth Heritage List:

> "*The archaeological investigations of the shipwreck site of HMS Sirius have demonstrated its significant archaeological potential for research into the cultural heritage of the early European settlement of Australia. The remaining fabric of HMS Sirius and associated artefact assemblages represents a "time capsule" of cultural life from the period leading up to its shipwreck in 1790.*"

2.3 National Heritage Values

2.3.1 Description of KAVHA and HMS Sirius

KAVHA was registered on the National Heritage List on 1 August 2007. The curtilage is shown in Figure 2-4. A description of the KAVHA heritage elements, historical context and archaeological potential (land) and Kingston Pier is provided earlier in Section 2.2.1.

The *HMS Sirius* Shipwreck site is located east of Kingston Pier in the vicinity of the Project. The wreck site was listed on the National Heritage List on 25 October 2011. The curtilage is shown in Figure 2-5. A description of the shipwreck and archaeological potential (water) is provided below.

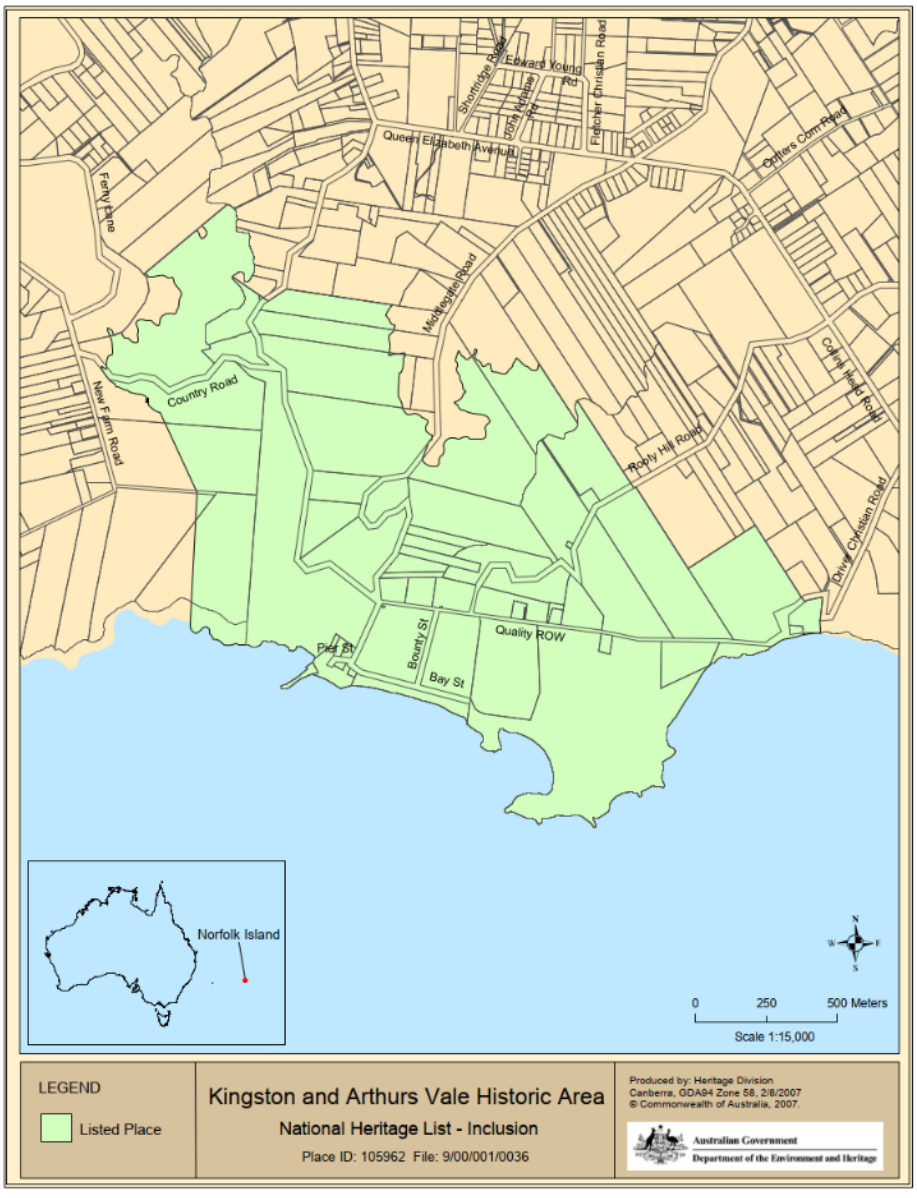


Figure 2-4 The curtilage of the KAVHA on the National Heritage List (Source: Department of the Environment and Heritage 2007).

Figure 2-5 Boundary of the primary site associated with HMS Sirius as listed in the National Heritage Listing Gazettal (Source: Cosmos Archaeology 2020a).

HMS Sirius

In March 1790, *HMS Sirius* and *HMS Supply* were sent to Norfolk with a contingent of supplies, convicts and marines to relieve overcrowding at Sydney Cove. On 19 March 1790, *HMS Sirius* and *HMS Supply* sailed close to shore to unload supplies. A strong western current pushed both vessels towards Point Ross, forcing them to make sail and attempt to leave the bay. *HMS Supply* was successful but *HMS Sirius* was not.

Archival sources as described by Cosmos Archaeology (2020a) indicated that in its final resting position the *HMS Sirius* wreck lay very close to the edge of the high reef platform. It is believed likely that the gully between the outer reef and the high inshore reef platform is the likely place where *HMS Sirius* broke up. Salvage continued for another fortnight but by June 1790, the vessel was found to be completely holed both fore and aft along both sides. In January 1791, Captain John Hunter salvaged the remaining guns from the wreck, complete with their carriages. Further small items were recovered from the wreck site in December 1791, but in January 1792, the wreck finally disintegrated. Philip Gidley King proclaimed that everything possible had been saved. Items have been removed from the

wreck site since it sank in 1792. The location of the site has never been lost, showing on survey charts since the vessel was wrecked.

The wreck site of *HMS Sirius* represents a tangible link to the most significant vessel associated with the early migration of Europeans to Australia (Cosmos Archaeology 2020a). Cosmos Archaeology undertook an inspection of the wreck site of *HMS Sirius* and associated debris field in November 2020. This inspection included the primary shipwreck site and the other identified archaeological deposits associated with *HMS Sirius* in Slaughter Bay.

The wreck of *HMS Sirius* is over 230 years old and the surviving wreck features are in remarkably good condition despite the site resting in a highly exposed position under the surf zone in an area prone to violent storms and weather. The inspection found a large number of loose artefacts still rest in the shallow area of Site 1 including shingle ballast, at least one possible copper alloy wall fitting, ammunition, coaks, tacks, broken ceramic and glass. A previously unrecorded anchor was located on the site near the eastern ballast pigs and two loose anchor flukes were recorded.

As a result of the 2020 inspection, the 1989 site plan was updated by Cosmos Archaeology (2020b) to incorporate these changes as shown in Figure 2-6. It has also been digitised and made into a layer within the new site plan, thus keeping the history in one location.

Figure 2-6 Updated HMS Sirius site plan (Source: Cosmos Archaeology 2020b).

Project Archaeological Potential – Water

The area around Kingston Pier has been subject to past underwater cultural heritage investigations. The most comprehensive were a series of surveys conducted between 1983 and 2002 into *HMS Sirius*. Six archaeological sites were identified in Sydney Bay (Figure 2-7) including the primary wreck site (Site 1) and the final wreck site (Site 2). Site 5 was identified and surveyed in 1985 and is located nearest the Project. Material from *HMS Sirius* was found including a spectacle plate bearing the name *Berwick* which was the previous name of *HMS Sirius*. It is likely that this piece of material drifted to its final location supported by the timbers of the rudder. Therefore, other material relating to *HMS Sirius* is likely to have been deposited at Site 5. However, the bulk of the vessel material was consistent with a sailing vessel from the second period of the 19th century. It was assumed to be from *Mary Hamilton* which contradicts historical records that the vessel was beached alongside Kingston Pier.

Figure 2-7 HMS Sirius six archaeological sites (yellow) located in the vicinity of the Project (purple) (Source: Cosmos Archaeology, 2020).

In 2005, a marine flora and fauna survey (Marges 2005) in the vicinity of Kingston Pier was undertaken as part of the 2007 refurbishment of Kingston Pier. The survey also examined for potential archaeological remains. However, none were observed, nor during any other previous visits to the area over the preceding 20 years. In addition, a 2016 seabed survey (Waterway Constructions 2016) of the existing channel bed undertaken to determine the nature and condition of the seabed did not identify any archaeological remains.

A non-disturbance archaeological dive inspection (Cosmos Archaeology 2020a) was undertaken for the Project from 26 – 27 February 2020 to:

- Locate any underwater cultural heritage artefacts on the western side of Kingston Pier for shipwreck artefacts such as timbers, ship fittings, personal items and potential discards
- Survey the topology of the seabed to determine the archaeological potential for remaining underwater cultural heritage resources at the location of the Project.

The inspection comprised four transect searches from Kingston Pier into the adjacent harbour (Figure 2-8), and two swim searches including at Site 5 (Figure 2-9). No significant underwater cultural heritage were identified with various modern materials found. However, it was assessed that culturally significant artefacts could be concentrated and buried within gullies, gutters, cracks and fissures within the calcarenite and possibly volcanic tuff substrate that would be removed by the proposed works and as such a test excavation was recommended (Cosmos Archaeology 2020a).

Figure 2-8 Location of four transects from Kingston Pier (Source: Cosmos Archaeology 2020a).

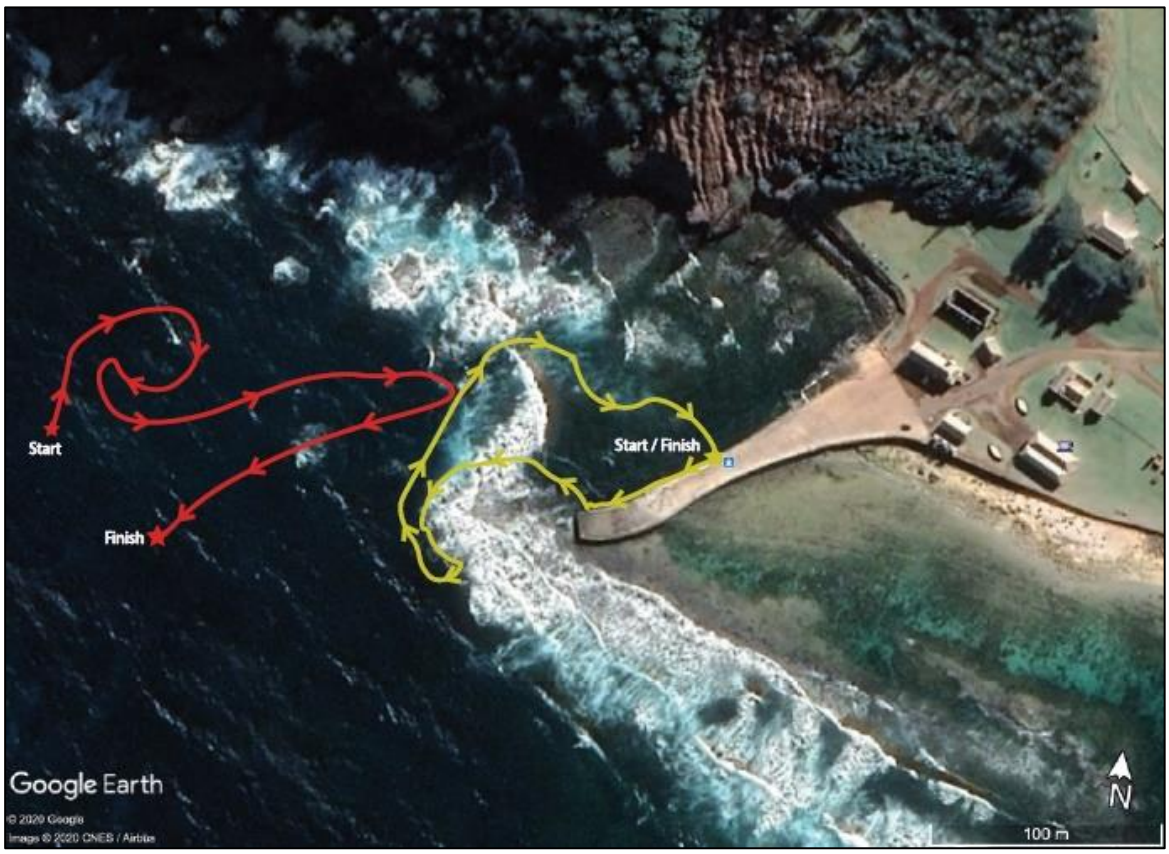


Figure 2-9 Approximate location of two swim searches (Source: Cosmos Archaeology 2020a).

An underwater archaeological test excavation investigation was undertaken in November 2020 adjacent to Kingston Pier (Cosmos Archaeology 2021). The purpose of the test excavation was to obtain a better understanding of the extent, frequency, variety, condition and significance of the underwater cultural resource. A detailed report of the test excavation investigations can be found in **Appendix C**.

Four trenches were excavated over seven days (Figure 2-10), recovering 1,442 artefacts with an overwhelming majority being from the 20th and 21st Century. Twenty-three artefacts were assessed as being potentially 19th century or earlier. These artefacts are in the possession of KAVHA, the remainder (1,399 artefacts) were discarded after cataloguing.

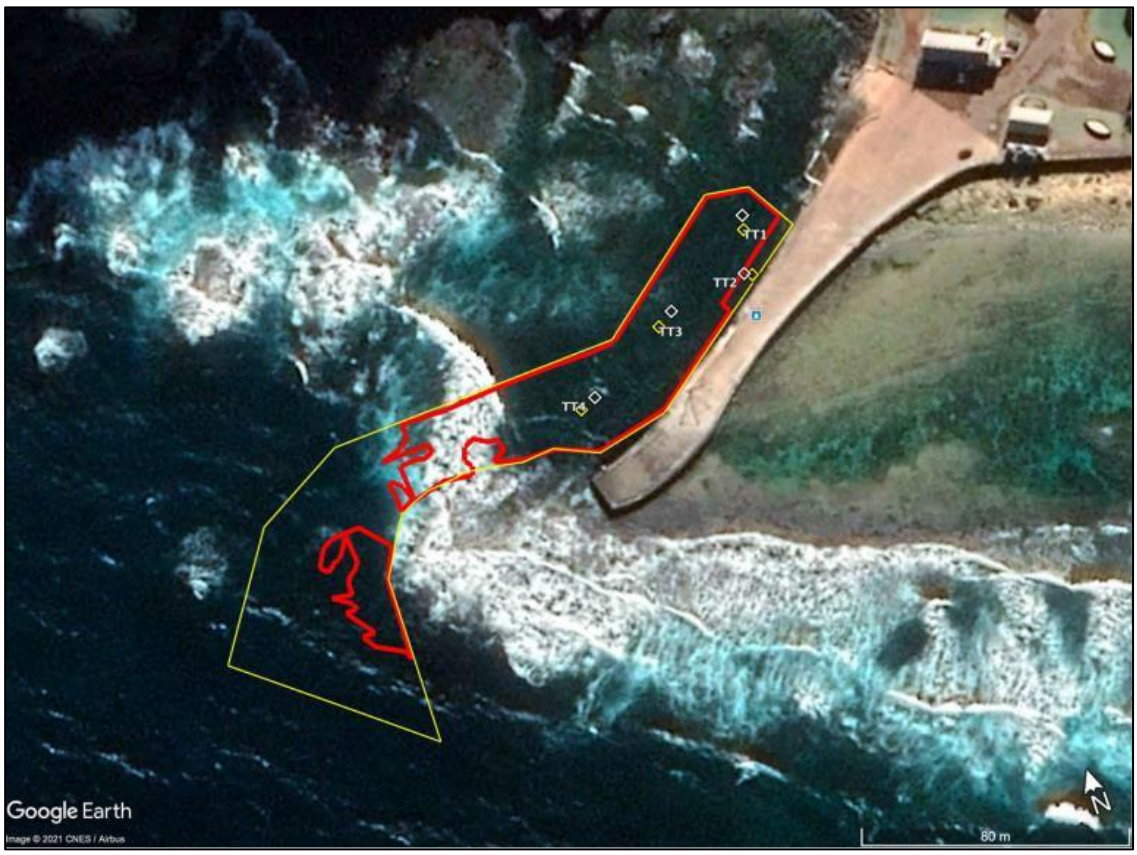


Figure 2-10 Final positions of the test trenches (in yellow diamonds) with red outline of the proposed augmentation works (Source: Cosmos Archaeology 2021).

The test excavation found that there is very little likelihood of substantial archaeological deposits associated with activities and events pre-dating 1898 to be present in the vicinity of Test Trench (TT) 1, 2 and 3. However, there is still the possibility for the presence, in very low frequencies, of culturally significant artefacts in these zones.

The seabed around TT4, where there is calcarenite reef and boulders has a very high likelihood for the presence of localised archaeological deposits containing culturally significant artefacts associated with shipwrecks and activities related to the Pier and the Landing Place.

As such, the following cultural sensitivity zones have been established in the proposed channel, as shown in Figure 2-11:

- Sector A – Low cultural sensitivity (light blue)
- Sector B – High cultural sensitivity (dark blue)
- Sector C – Medium cultural sensitivity (green).

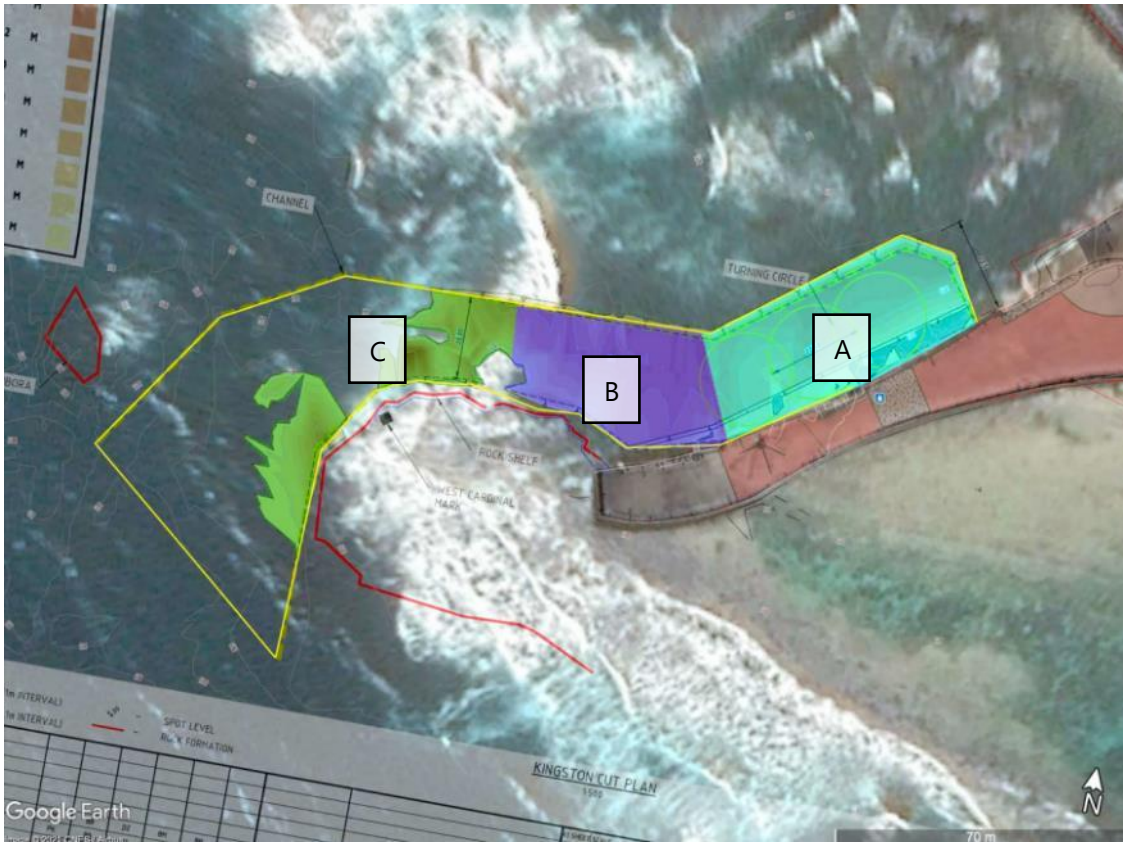


Figure 2-11 Preferred channel design overlaid with locations of cultural sensitivity.

It is noted that although no test excavation took place within the Sector C it has been conservatively assessed to be of medium cultural heritage sensitivity because of the known wreck events that have taken place in the area (Cosmos Archaeology 2021). The findings of the test excavation also provide some indication as to the quantity of artefacts that may be present within Sectors A and B.

2.3.2 KAVHA National Heritage values

The Summary Statement of Significance for KAVHA from the Australian Heritage Database is provided below. A copy of the inventory sheet including the place's full official values is provided in **Appendix D**.

> *"KAVHA on Norfolk Island is associated with three distinct (European) settlement periods: the convict era referred to as the First and Second Settlements from 1788-1814 and from 1825-1855 respectively; and the Pitcairn period from 1856 to the present, referred to as the Third Settlement. KAVHA is also important for its association with pre-European Polynesian occupation.*
>
> *KAVHA is an outstanding convict settlement that spans the era of convict transportation to Eastern Australia between 1788 and 1855. It is a place which has the capacity to demonstrate differing penal systems, changes in penal philosophy and the principal characteristics of a long standing penal settlement.*

Norfolk Island was proclaimed a British possession on 6 March 1788, six weeks after the arrival of the First Fleet at Port Jackson. The settlement faced starvation and the decision in 1790 to send a third of the population to Norfolk Island ensured the survival of the settlement and therefore played an important role in the development of the colony of New South Wales. KAVHA is significant for its association with Lieutenant Philip Gidley King who was responsible for establishing the First Settlement on KAVHA. There are significant archaeological remains of buildings and activities associated with the First Settlement.

KAVHA was reopened as a penal colony in 1825 in response to the need by the British Government to reinforce the idea that transportation was a punishment to be feared. The Second Settlement operated until 1855 and an outstanding collection of Georgian buildings, extensive archaeological remains, engineering works and landscaping are still in evidence from that time. The planning and operation of a nineteenth century penal settlement is clearly discernible.

During the Second Settlement, KAVHA gained a reputation as 'hell in paradise' for its brutal and sadistic treatment of inmates. It is an outstanding example of the severe punishment of convicts. Its reputation spread beyond the colonies to Britain and fuelled the anti-transportation debate. It is however also the site of experiments in convict reformation and recognised for its association with Alexander Maconochie, who formulated and applied most of the principles of modern penology while on Norfolk Island.

KAVHA is highly valued for its aesthetic qualities with the place and its setting being unimpacted by subsequent development. It is an evocative and picturesque historical landscape where the domestic scale and agricultural character of the setting is in marked contrast to the horror of the past signified by the convict ruins.

KAVHA is also valued for its Third Settlement period, as a distinctive place where a Polynesian/European community has lived and practised their cultural traditions since 1856. It is significant for its ongoing associations with Pitcairn Islanders.

The rich and varied of history of KAVHA contributes to its potential to yield important information about the living and working conditions of convicts. The place also has the potential to yield significant information on pre-European Polynesian culture, exploration and settlement patterns."

2.3.3 HMS Sirius National Heritage values

The Summary Statement of Significance for the *HMS Sirius* Shipwreck from the Australian Heritage Database is provided below. A copy of the inventory sheet including the place's full official values is provided in **Appendix E**.

"*The archaeological remains of HMS Sirius represent a tangible link to the most significant vessel associated with early migration of European people to Australia. HMS Sirius was guardian of the first fleet during its epic voyage to Australia between 1787 and 1788, which brought the convicts, soldiers and sailors who became Australia's first permanent European settlers. HMS Sirius was also the mainstay of early colonial defence in New South Wales and the primary supply and communication link with Great Britain during the first two years of the settlement*.

The careers of the first three governors' of the colony of New South Wales, Arthur Phillip (1788-1792), John Hunter (1795-1800) and Philip Gidley King (1800-1806) are closely associated with the history of HMS Sirius as all three sailed as senior officers on board HMS Sirius during the voyage of the first fleet to New South Wales. Hunter was also Captain of HMS Sirius during its last ill-fated voyage in 1790, when it was totally wrecked at Norfolk Island.

The loss of HMS Sirius at Norfolk Island on 19 March 1790 was a disaster to the fledgling colony during a period of crisis, when the settlement at Port Jackson was in danger of collapse and abandonment. It can be argued that the adaptability, ingenuity and grim determination to survive, demonstrated by the colonists at Port Jackson and Norfolk Island following this disaster, became an enduring trait of the Australian people.

The archaeological investigations of the shipwreck site of HMS Sirius have demonstrated its significant archaeological potential for research into the cultural heritage of the early European settlement of Australia. The remaining fabric of HMS Sirius and associated artefact assemblages represents a "time capsule" of cultural life from the period leading up to its shipwreck in 1790.

The important role played by HMS Sirius in the European phase of Australian settlement is widely recognised within the Australian community and is especially significant to the descendants of the first European settlers or "first fleeters" as they are often described. This importance was highlighted with the selection of HMS Sirius as a significant archaeological project to celebrate the Australian bicentennial in 1988.

The history and archaeological remains of the HMS Sirius are also highly valued by the people of Norfolk Island as the vessel represents a significant phase in the peopling of the Island and its development as a place of secondary punishment of convicts transported to Australia."

Cosmos Archaeology (2020a) note the following regarding the current values:

"*The National Heritage values are still relevant, in the main, to the current condition of HMS Sirius and the collection. However, during the development of the Heritage Management Plan there is an opportunity to revisit these values. One case in point is the significant relationship between the KAVHA and HMS Sirius that should be included in the updated heritage values. The threat to the site of sea urchin activity also needs to be addressed before the National Heritage values are significantly eroded*."

2.4 Commonwealth Marine Environment

The Norfolk Marine Park is an Australian marine park and is managed under the Temperate East Marine Parks Network. It was proclaimed under the EPBC Act on 14 December 2013. The long, narrow, steep-sided undersea of Norfolk Ridge runs through the marine park, which acts as a line of oceanic stepping stones, connecting deep water marine species from New Zealand to New Caledonia and supports diverse temperate and tropical marine life (Australian Marine Parks 2023).

The Norfolk Island Marine Park begins approximately 1,400 km offshore and covers 188,444 km^2 with depths of up to 5,000 m. The marine park comprises a number of zones, including a National Park, Multiple Use and Special Purposes zone. The Special Purpose Zone is located directed around Norfolk Island (Figure 2-12) and allows for both conservation and sustainable use in a highly valued natural area (Australian Marine Parks 2023).

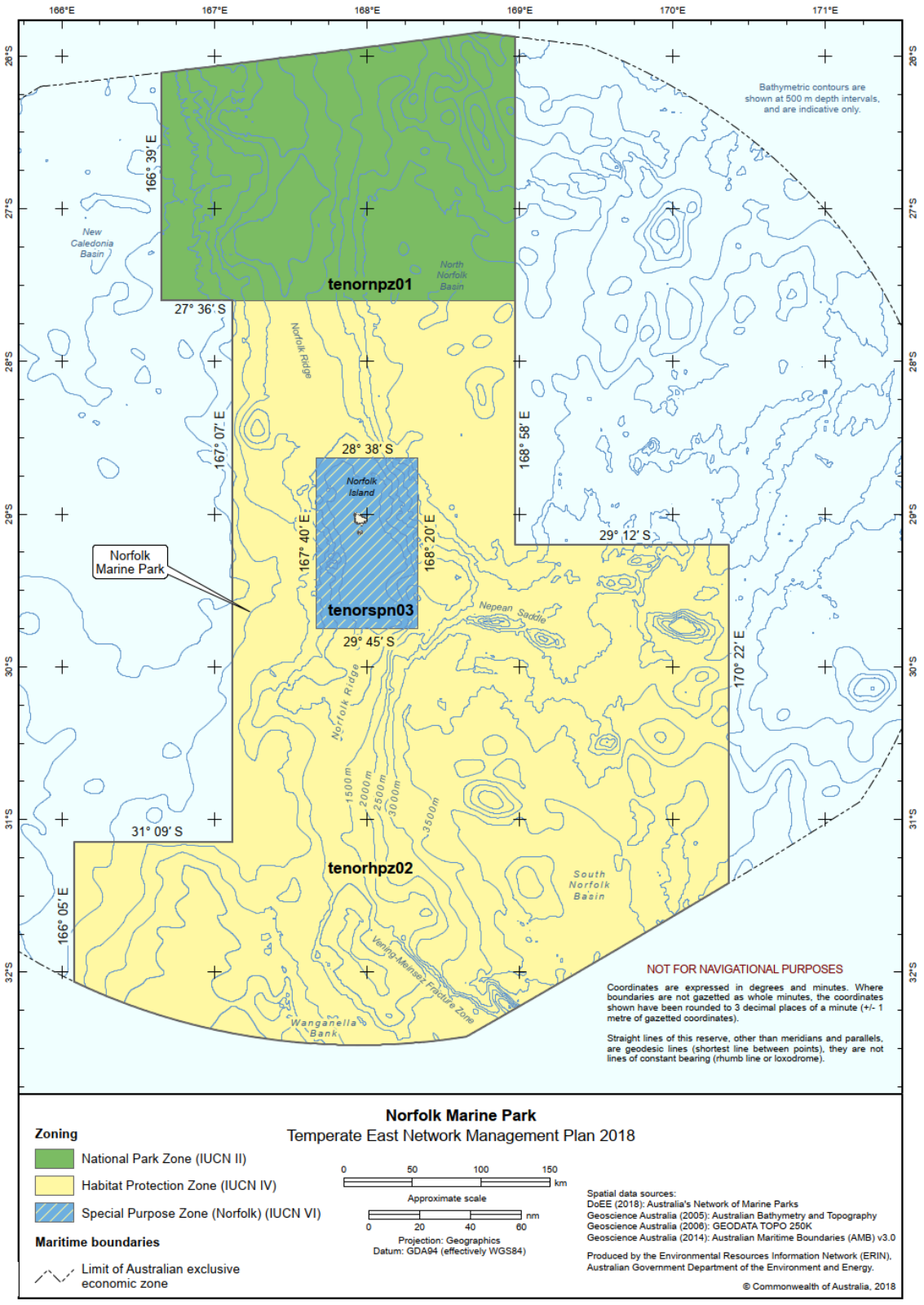


Figure 2-12 Norfolk Marine Park Map (Source: Commonwealth of Australia 2018).

2.4.1 Ecosystems and their Constituent Parts

A summary of the ecosystems and their constituent parts (including marine flora and fauna) is provided below. For further detail, refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

Norfolk Island has a unique assemblage of marine species. While most groups have not been comprehensively documented, around 230 species of algae, 57 species of corals, 400 species of molluscs (including 160 species of opistobranchs), 254 species of fish and several mammals have been identified to date (Parks Australia 2020). There are also a number of endemic species, and a large number of subtropical and Tasman Sea endemics such as the Norfolk Island blenny (*Parablennius serratolineatus*) and the Black-mouthed tun snail (*Tonna melanostoma*). These are described below and in the Aquatic and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

The conservation values of the Temperate East Marine Region in which Norfolk Island occurs include:

- Biodiversity – supporting high levels of species richness and diversity
- Key Ecological Features including:
    - Tasman Front and eddy field – a ridge that separates the warm, nutrient-poor waters of the Coral Sea from the cold, nutrient-rich waters of the Tasman Sea, providing increased nutrients and plankton aggregations, and enhanced productivity that attracts mobile species such as turtles, cetaceans, tuna and billfish.
    - Norfolk Ridge – a steep-sided, narrow and elongated feature approx. 1000 km long and 70 km wide. The pinnacles and seamounts of the Norfolk Ridge support relatively productive and diverse benthic habitats and are thought to act as stepping stones for faunal dispersal, connective deep-water fauna from New Caledonia to New Zealand.
- Protected species – species listed under the EPBC Act are listed as either threatened species, migratory species, and cetaceans and marine species. Species groups identified as conservation values include:
    - Bony fishes (10 species)
    - Cetaceans (9 species)
    - Marine reptiles (24 species)
    - Seabirds (34 species)
    - Sharks (6 species).
- Biologically Important Areas – for the conservation of protected species where individuals display biologically important behaviours
- Protected places including the Norfolk Marine Park.

2.4.1.1 Marine Flora

There are 236 species of marine benthic algae described in *Marine Benthic Algae of Norfolk Island, South Pacific*, with 41 species of Chlorophyta, 41 of Phaeophyta and the remaining 154 of Rhodophyta (Millar 1999 as cited in Advisian 2021a). Apart from several undescribed taxa, none are endemic to Norfolk Island. A considerable number of the species at Norfolk Island are shared with the Great Barrier Reef and the NSW coast as well as Lord Howe Island.

It is considered that marine algae dominate much of the substrate around the high-energy area of Kingston Pier. The intertidal zone of the harbour adjacent to Kingston Pier is dominated by green and red algae, with dominant species including the sea lettuce '*Ulva ulva*', *Enteramorpha* species and the grape weed *Caulerpa racemose*, known locally as 'dead man's fingers'. Other species of algae found around the Pier included *Ventricaria ventricosa* and *Caulperpa racemosa* (Marges, 2005). The algae within the area around Kingston is heavily relied upon by lagoon and other fishes as an important food source. Communities of marine algae are also found at Slaughter Bay and nearby Ball Bay.

2.4.1.2 Marine Fauna

Marine Fishes

Bony Fish

Tropical and subtropical fish species dominate the fauna of Norfolk Island, with fish fauna appearing to have originated largely by larval dispersal from Australia and the Coral Sea (Francis 1993).

The following bony fishes are known to occur in the Temperate East Marine Region and are listed under the EPBC Act:

- Eastern gemfish — eastern Australian population (*Rexea solandri*) – Conservation dependent
- Orange Roughy (*Hoplostethus atlanticus*) – Conservation dependent
- Black cod (*Epinephelus daemelii*) – Vulnerable.

The Black cod (*E. daemelii*) was listed in the EPBC Act Protected Matters Search for the Project.

A recent biodiversity survey completed by Edgar et al. (2017) identified 90 fish species from Norfolk Island. Abundance was highest for the Smoky Puller, *Chromis fumea* and Lea's Cardinalfish *Taeniamia leai*. Twenty cryptic fish species were also recorded from Norfolk Island during the survey, of which blennies and cardinalfish were the most abundant (Edgar et al., 2017). Local anecdotal reports indicate that there are new species of fish being regularly recorded in reef areas of Norfolk Island with 11 new species in January 2023 including the endemic Norfolk Island blenny (*Parablennius serratolineatus*) (Prior 2023).

The recent Reef Life Project (Heather et al. 2022) reported that a total of 111 fish taxa were recorded on surveys from 2009 to 2021, including 85 in the latest set of 32 surveys in 2021. The fish community within the lagoon was distinctively different from those surveyed at the other three localities in 2009 and 2021. A distinct and significant shift in the fish community structure occurred between 2009 and 2021 overall, but the lagoon fish community remained unique from all other sites, characterised by more tropical species associated with coral reefs (Heather et al. 2022). Fish biomass also differed significantly between sites in each of the four localities, and changes in fish biomass between 2009 and 2021 were dependent upon the locality. Fish biomass at the Phillip Island sites declined by 78% between 2009 and 2013, and despite a slight increase again between 2013 and 2021, remained 64% less in 2021 than in original RLS surveys in 2009.

The reduction in fish biomass at the Phillip Island sites appeared to be the result of relatively higher abundances of Galapagos sharks (*Carcharhinus galapagensis*) and schooling sea chubs (Kyphosus spp.) in 2009 surveys. Fish biomass was 58% lower in the Lagoon in 2021 compared to 2009, although this was not significantly significant according to Heather et al. (2022). No significant change in fish

biomass was observed at the North-west and South sites between the years 2009 and 2021. High biomass in the South sites in 2021 was largely driven by schools of the Onespot puller (*Chromis hypsilepis*) and the Yellowspotted sawtail (*Prionurus maculatus*). Species richness varied significantly between site localities, but no significant change was observed from 2009 to 2021 (Heather et al. 2022). The relative biomass of trophic groups varied through the years, with trends for decreased biomass of higher carnivores and invertivores, and increased biomass of herbivores and planktivores. None of these changes were statistically significant, however, with large variation in biomass of trophic groups between sites suggesting that the functional structure of Norfolk Island communities is quite variable through space and time. The fish taxa with the greatest biomass in each of the areas in the Norfolk Marine Park surveyed are shown in Figure 2-13.

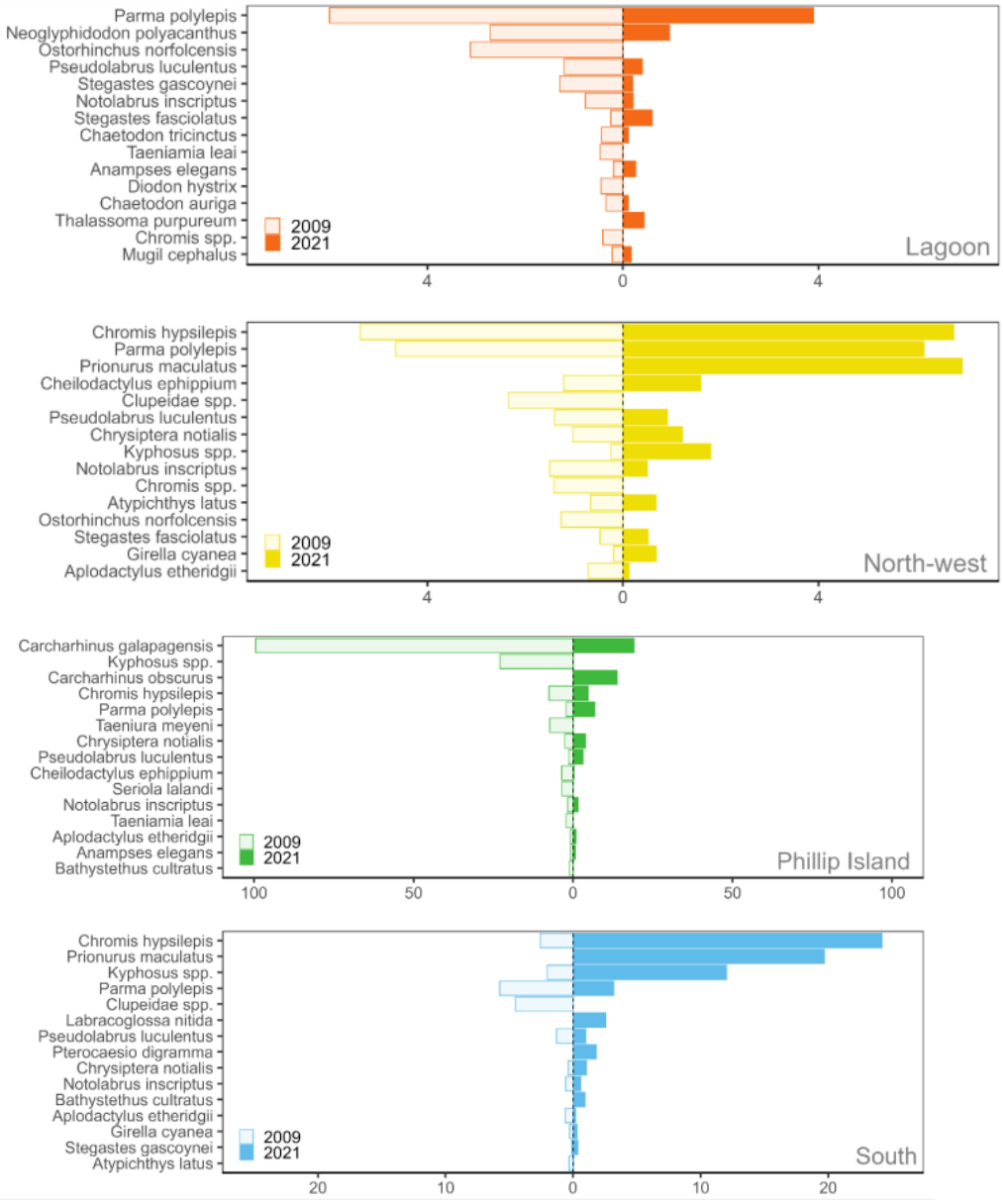


Figure 2-13 Fish taxa with the greatest biomass surveyed in the Reef Life Surveys (x axis = biomass) (Source: Heather et al. 2022).

Sharks

Important breeding, feeding and aggregation areas for sharks are found throughout the Temperate East Marine Region, including areas around Norfolk Island. The following sharks are known to occur in the Temperate East Marine Region and are listed under the EPBC Act:

- Grey nurse shark - east coast population (*Carcharias taurus*) – Critically endangered
- Longfin mako shark (*Isurus paucus*) – Migratory
- Porbeagle (*Lamna nasus*) – Migratory
- Shortfin mako shark (*Isurus oxyrinchus*) – Migratory
- Whale shark (*Rhincodon typus*) – Vulnerable, migratory
- White shark (*C. carcharias*) – Vulnerable, migratory
- Green sawfish (*Pristis zijsron*) – Vulnerable
- School shark (*Galeorhinus galeus*) – Conservation dependent.

The White shark (*C. carcharias*) was listed in the EPBC Act Protected Matters Search for the Project.

Shark species identified in studies of fish species of Norfolk Island and surrounds are listed below (Francis 1993, Heather et al. 2022).

- Galapagos shark (*Carcharhinus galapagensis*)
- Dusky shark (*Carcharhinus obscurus*)
- Grey reef shark (*Carcharhinus amblyrhynchos*)
- Smooth hammerhead shark (*Pshyrna zygaena*)
- Tiger shark (*Galeocerdo cuvier*)
- White shark (*Carcharodon carcharias*).

Rays

Rays in the Temperate East Marine Region are of great ecological importance due to their position at the top of the food chain (Keable 2007). There are no ray species in the Temperate East Marine Region listed under the EPBC Act nor were any listed in the EPBC Act Protected Matters Search.

Ray species identified in a study of fish species of Norfolk Island and surrounds are provided below (Francis 1993).

- Abbott's moray (*Gymnothorax eurostus*)
- Grey moray (*Gymnothorax nubilus*)
- Griffin's moray (*Gymnothorax obesus*)
- Lipspot moray (*Gymnothorax chilospilus*)

- Lord Howe Island moray (*Gymnothorax annasona*)
- Lowfin moray (*Gymnothorax porphyreus*)
- Mosaic moray (*Enchelycore ramosus*)
- New Zealand eagle ray (*Myliobatis tenuicaudatus*)
- Round ribbontail ray / bullray (*Taeniura meyeni*)
- Stingaree (*Urolophus sp*).

Syngnathids

All species of Syngnathids (seahorses, seadragons, pipefishes and pipehorses) are listed and protected under the EPBC Act. Booth's pipefish (which is known from Norfolk Island) was listed in the EPBC Act Protected Matters Search for the Project (as a Listed Marine species and "species or species habitat may occur within area".

There are also a number of listed syngnathid species known to occur in the greater Temperate East Marine Region. However, it is not clear whether these species inhabit areas immediately surrounding Norfolk Island. None of these species were listed in the Protected Matters Search.

Marine Mammals

Whales

The following 29 whale species are known to occur in the Temperate East Marine Region and are listed under the EPBC Act:

- Andrew's beaked whale (*Mesoplodon bowdoini*) – Cetacean
- Antarctic minke whale (*Balaenoptera bonaerensis*) – Migratory, cetacean
- Arnoux's beaked whale (*Berardius arnuxii*) – Cetacean
- Blainville's beaked whale (*Mesoplodon densirostris*) – Cetacean
- Blue whale (*Balaenoptera musculus*) – Endangered, migratory, cetacean
- Bryde's whale (*Balaenoptera edeni*) – Migratory, cetacean
- Cuvier's beaked whale (*Ziphius cavirostris*) – Cetacean
- Dwarf minke whale (*Balaenoptera acutorostrata*) – Cetacean
- Dwarf sperm whale (*Kogia simus*) – Cetacean
- False killer whale (*Pseudorca crassidens*) – Cetacean
- Fin whale (*Balaenoptera physalus*) – Vulnerable, migratory, cetacean
- Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*) – Cetacean
- Gray's beaked whale (*Mesoplodon grayi*) – Cetacean

- Hector's beaked whale (*Mesoplodon hectori*) – Cetacean
- Humpback whale (*Megaptera novaeangliae*) – Vulnerable, migratory, cetacean
- Killer whale (*Orcinus orca*) - Migratory, cetacean
- Long-finned pilot whale (*Globicephala melas*) – Cetacean
- Melon-headed whale (*Peponocephala electra*) – Cetacean
- Pygmy killer whale (*Feresa attenuata*) – Cetacean
- Pygmy right whale (*Caperea marginata*) – Migratory, cetacean
- Pygmy sperm whale (*Kogia breviceps*) – Cetacean
- Sei whale (*Balaenoptera borealis*) – Vulnerable, migratory, cetacean
- Shepherd's beaked whale (*Tasmacetus shepherdi*) – Cetacean
- Short-finned pilot whale (*Globicephala macrorhynchus*) – Cetacean
- Southern bottlenose whale (*Hyperoodon planifrons*) – Cetacean
- Southern right whale (*Eubalaena australis*) – Endangered, migratory, cetacean
- Sperm whale (*Physeter macrocephalus*) – Migratory, cetacean
- Strap-toothed beaked whale (*Mesoplodon layardii*) – Cetacean
- True's beaked whale (*Mesoplodon mirus*) – Cetacean.

Table 2-3 provides the whale species identified in the EPBC Act Protected Matters Search undertaken for the Project, including the conservation status and likelihood of occurrence in the study area (as determined by the database search).

Table 2-3 Whale species listed under the EPBC Act Protected Matters Search for the study area.

Antarctic minke whale (*Balaenoptera bonaerensis*) - Cetacean, Migratory, Species or species habitat likely to occur within area	Long-finned pilot whale (*Globicephala melas*) - Cetacean, Species or species habitat may occur within area
Blainville's beaked whale (*Mesoplodon densirostris*) - Cetacean, Species or species habitat may occur within area	Melon-headed whale (*Peponocephala electra*) - Cetacean, Species or species habitat may occur within area
Blue whale (*Balaenoptera musculus*) - Endangered, Cetacean, Migratory, Species or species habitat may occur within area	Minke whale (Balaenoptera acutorostrata) - Cetacean, Species or species habitat may occur within area

Bryde's whale (*Balaenoptera edeni*) - Cetacean, Migratory, Species or species habitat likely to occur within area	Pygmy killer whale (*Feresa attenuata*) - Cetacean, Species or species habitat may occur within area
Cuvier's beaked whale (*Ziphius cavirostris*) - Cetacean, Species or species habitat may occur within area	Pygmy sperm whale (*Kogia breviceps*) - Cetacean, Species or species habitat may occur within area
Dwarf sperm whale (*Kogia sima*) - Cetacean, Species or species habitat may occur within area	Sei whale (*Balaenoptera borealis*) - Vulnerable, Cetacean, Migratory, Species or species habitat likely to occur within area
Fin whale (*Balaenoptera physalus*) - Vulnerable, Cetacean, Migratory, Species or species habitat likely to occur within area	Short-finned pilot whale (*Globicephala macrorhynchus*) - Cetacean, Species or species habitat may occur within area
Gray's beaked whale (*Mesoplodon grayi*) - Cetacean, Species or species habitat may occur within area	Southern right whale (*Eubalaena australis*) - Endangered, Cetacean, Migratory, Species or species habitat may occur within area
Humpback whale (*Megaptera novaeangliae*) - Cetacean, Migratory, Species or species habitat may occur within area	Sperm whale (*Physter macrocephalus*) - Cetacean, Migratory, Species or species habitat may occur within area
Killer whale (*Orcinus orca*) - Cetacean, Migratory, Species or species habitat may occur within area	Strap-toothed beaked whale (*Mesoplodon layardii*) - Cetacean, Species or species habitat may occur within area

Dolphins

The following 12 dolphin species are known to occur in the Temperate East Marine Region and are listed under the EPBC Act:

- Bottlenose dolphin (*Tursiops truncatus*) – Cetacean
- Common dolphin (*Delphinus delphis*) – Cetacean
- Fraser's dolphin (*Lagenodelphis hosei*) – Cetacean
- Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) – Cetacean
- Indo-Pacific humpback dolphin (*Sousa chinensis*) – Migratory, cetacean
- Pantropical spotted dolphin (*Stenella attenuata*) – Cetacean
- Risso's dolphin (*Grampus griseus*) – Cetacean
- Rough-toothed dolphin (*Steno bredanensis*) – Cetacean

- Southern right whale dolphin (*Lissodelphis peronii*) – Cetacean
- Spinner dolphin (*Stenella longirostris*) – Cetacean
- Striped dolphin (*Stenella coeruleoalba*) – Cetacean
- Dusky dolphin (*Lagenorhynchus obscurus*) – Cetacean, migratory (may infrequently occur).

Of these species, eight were listed in the EPBC Act Protected Matters Search for the Project which have the potential to occur within the study area (i.e. within 10 km of the site), including:

- Bottlenose dolphin (*Tursiops truncates s. str.*) - Cetacean, Species or species habitat may occur within area
- Common dolphin (*Delphinus* delphis) - Cetacean, Species or species habitat may occur within area
- Fraser's dolphin (*Lagenodelphis hosei*) - Cetacean, Species or species habitat may occur within area
- Long-snouted spinner dolphin (*Stenella longirostris*) - Cetacean, Species or species habitat may occur within area
- Pantropical spotted dolphin (*Stenella attenuate*) - Cetacean, Species or species habitat may occur within area
- Risso's dolphin (*Grampus griseus*) - Cetacean, Species or species habitat may occur within area
- Rough-toothed dolphin (*Steno bredanensis*) - Cetacean, Species or species habitat may occur within area
- Striped dolphin (*Stenella coeruleoalba*) - Cetacean, Species or species habitat may occur within area.

Seals and Sea Lions

Two species of seals and sea lions are likely to be encountered in the Temperate East Marine Region and are listed under the EPBC Act. They are the Australian fur seal (*Arctocephalus pusillus doriferus*) and New Zealand fur seal (*Arctocephalus forsteri*).

These species were not listed in the Protected Matters Search for the Project and are not expected to occur at the location of the Project except on very rare occasions.

Marine Reptiles

Turtles and Sea Snakes

The following 25 marine reptile species are known to occur in the Temperate East Marine Region and are listed under the EPBC Act:

- Green turtle (*Chelonia mydas*) – Vulnerable, migratory, marine
- Hawksbill turtle (*Eretmochelys imbricata*) – Vulnerable, migratory, marine

- Leatherback turtle (*Dermochelys coriacea*) – Endangered, migratory, marine
- Loggerhead turtle (*Caretta caretta*) – Endangered, migratory, marine
- Beaked seasnake (*Enhydrina schistosa*) – Marine
- Black-ringed seasnake (*Hydrelaps darwiniensis*) – Marine
- Blue-lipped sea krait (*Laticauda laticaudata*) – Marine
- Colubrine sea krait (*Laticauda colubrine*) – Marine
- Dubois' seasnake (*Aipysurus duboisii*) – Marine
- Elegant seasnake (*Hydrophis elegans*) – Marine
- Horned seasnake (*Acalyptophis peronii*) – Marine
- Laboute's seasnake (*Hydrophis laboutei*) – Marine
- Little file snake (*Acrochordus granulatus*) – Marine
- Marbled or spine-tailed seasnake (*Aipysurus eydouxii*) – Marine
- Olive seasnake (*Aipysurus laevis*) – Marine
- Olive-headed seasnake (*Hydrophis major*) – Marine
- Plain-banded seasnake (*Hydrophis vorisi*) – Marine
- Small-headed seasnake (*Hydrophis mcdowelli*) – Marine
- Spectacled seasnake (*Hydrophis kingii*) – Marine
- Spotted seasnake (*Hydrophis ornatus*) – Marine
- Stokes' seasnake (*Astrotia stokesii*) – Marine
- Turtle-headed seasnake (*Emydocephalus annulatus*) – Marine
- White-bellied mangrove snake (*Fordonia leucobalia*) – Marine
- Yellow seasnake (*Hydrophis spiralis*) – Marine
- Yellow-bellied seasnake (*Pelamis platurus*) – Marine.

Of these species, five (all of which are turtles) were listed in the EPBC Act Protected Matters Search including the Flatback turtle (*Natator depressus*) which is not listed above:

- Loggerhead turtle (*Caretta caretta*) - Endangered, Marine, Migratory, Species or species habitat likely to occur within area
- Green turtle (*Chelonia mydas*) - Vulnerable, Marine, Migratory, Species or species habitat likely to occur within area

- Leatherback turtle (*Dermochelys coriacea*) - Endangered, Marine, Migratory, Species or species habitat likely to occur within area
- Hawksbill turtle (*Eretmochelys imbricata*) - Vulnerable, Marine, Migratory, Species or species habitat likely to occur within area
- Flatback turtle (*Natator depressus*) - Vulnerable, Marine, Migratory, Species or species habitat likely to occur within area.

The Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy, 2017) recognises Norfolk Island as a known foraging area for Green and Hawksbill turtles from unknown stocks, and that Leatherback, Flatback and Loggerhead turtles likely occur in the area. Whilst being typically mobile species, anecdotal information indicates that at least four Green turtles regularly frequent the lagoons and two turtles are observed as mostly permanent residents in the Emily Bay and channel area (Prior 2023).

Marine Invertebrates

Sessile Invertebrates

The following sessile invertebrates were reported by Aurecon Australia (2011) as occurring in nearby Ball Bay based on a field survey and a desktop investigation of Christian and Marges (1995) and Coleman (1991):

- Two-colour ascidian - *Lissoclinum bistriatum*
- Dividing sponge - *Tethya fissurata*
- Jewel anemone - *Corynactis australis*
- Waratah anemone - *Actinia tenebrosa*
- Bubble tip anemone - *Entacmacea quadricolour*.

Mobile Invertebrates

The recent Reef Life Surveys (Heather et al. 2022) reported that Norfolk Island reefs tend to have relatively few large mobile invertebrates compared with mainland Australian locations at similar latitudes. A total of 47 mobile macroinvertebrate taxa were recorded across all surveys from 2009 to 2021, including 27 recorded during the latest round of 32 surveys in 2021. Macroinvertebrate communities were generally much more similar across localities than the fish communities were. Although the Lagoon macroinvertebrate community structure was slightly different to that at sites in other localities in 2009, this changed by 2021; macroinvertebrates at Slaughter Bay in the Lagoon became more similar to sites in the North-west than to the other two Lagoon sites, and their 2009 composition (Heather et al. 2022).

Macroinvertebrate density was an order of magnitude lower at Lagoon sites than those outside the lagoon. Sites within the Lagoon, North-west and South localities tended to decrease in macroinvertebrate densities, whilst sites around Phillip Island tended to increase in density, however none of these changes were statistically significant. Macroinvertebrate densities across all sites were very heavily dominated by sea urchins, mostly *Heliocidaris tuberculata*, *Centrostephanus rodgersii*, and *Tripneustes gratilla*. Invertebrate species richness varied significantly between localities, with the fewest

species per transect recorded in the Lagoon. Invertebrate species richness was also marginally lower in 2021 compared to 2009 (marginal statistical significance; p = 0.051), by an average of one fewer species per survey in 2021. The mean densities of the 15 most abundant macroinvertebrate species in each locality for 2009 and 2021 are shown in Figure 2-14.

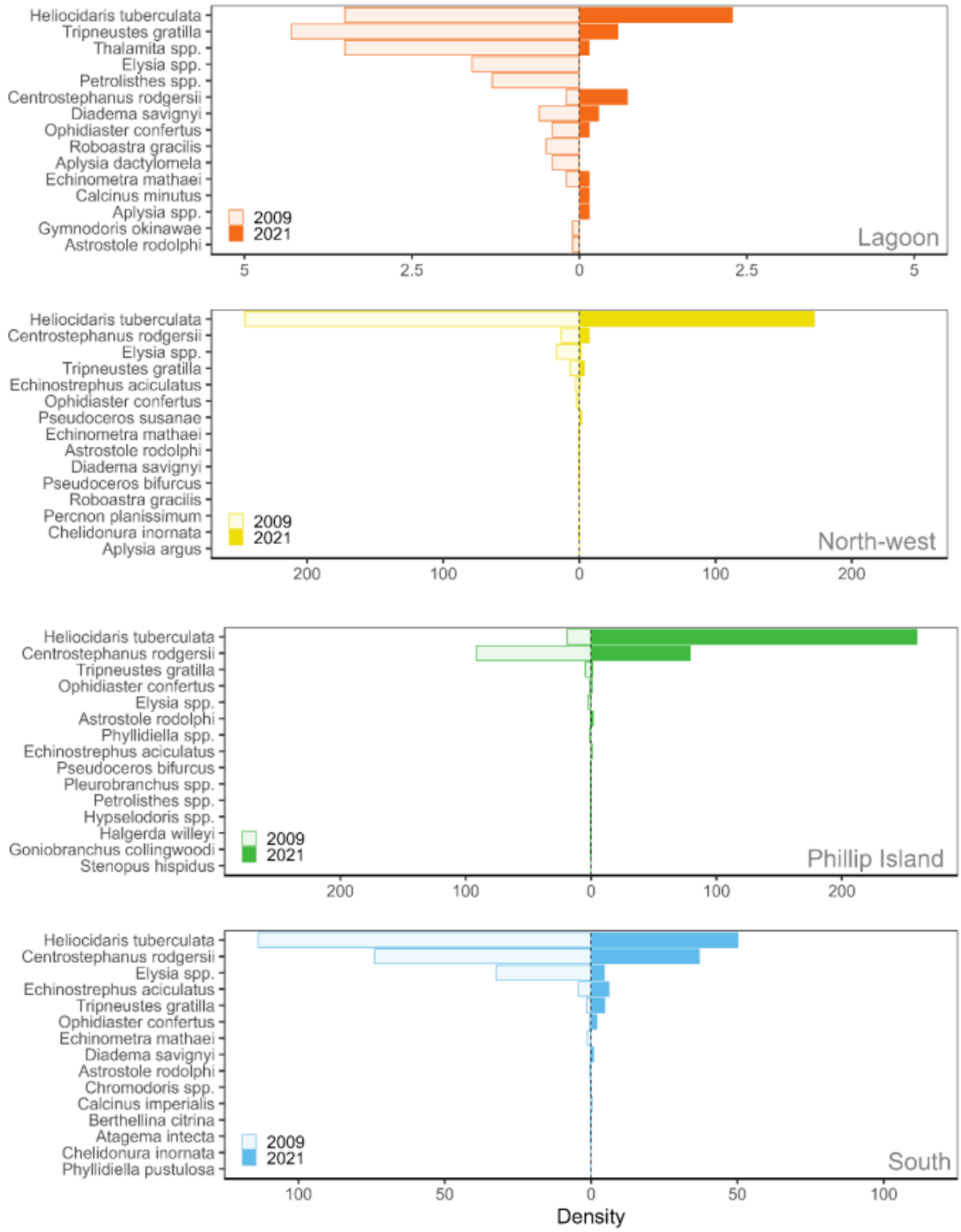


Figure 2-14 Mean densities of the 15 most abundant macroinvertebrate species in each locality for 2009 and 2021 (Source: Heather et al. 2022).

The following mobile invertebrate species (Table 2-4) were reported by Aurecon Australia (2011) as occurring in Ball Bay based on a field survey and desktop investigation.

Table 2-4 Mobile invertebrate species recorded by Aurecon (2011) in Bell Bay.

Striped sea urchin - *Tripneustes gratilla*	Little sea hare - *Aplysia parvula*
Tuberculate sea urchin - *Heliocidares tuberculata*	Brazier's sea hare - *Dolabrifera brazieri*
Mathae's sea urchin, Rock-boring urchin - *Echinometra mathaei*	Milk-spot cowry - *Cypraea vitellus*
Gracious sea urchin - *Tripneustes gratilla*	False ear shell - *Gena sp.*
Impatient sea cucumber - *Holothuria impatiens*	*Nerita albicilla*
Little sea star - *Patiriella exigua*	Orange worm shell - *Vermetus sp.*
White sea star - *Asterina alba*	Guam bubble shell - *Micromelo guamensis*
Dentate brittle star - *Ophiocoma dentate*	Bristle worm - *Eurythoe complanata*
Six-armed brittle star - *Ophiocomella sexradius*	Margined flatworm - *Callioplana marginata*
Forskal's side gilled slug - *Pleurobranchus forskali*	Waratah anemone - *Actinia tenebrosa*
Variegated shore crab - *Leptograpsus variegates*	Bubble tip anemone - *Entacmacea quadricolour*
Little ghost crab - *Ocypode cordimana*	Hi Hi - *Nerita albicilla*
Peduncle hermit crab - *Dardanus pedunculatus*	Brazier's sea hare - *Dolabrifera brazieri*
Elegant xanthid crab - *Xanthias elegans*	Impatient sea cucumber - *Holothuria impatiens*
Red bait crab - *Plagusia chabrus*	

In relation to the lagoons, Australian Marine Parks (2023) determined for echinoderm species that:

> *"Due to the ongoing issue of storm and groundwater pollution entering the lagoon at Emily and Slaughter Bay, and the important role of herbivorous fish and echinoderms in controlling algal growth, a complete no-take area has been established in this area, in support of local custom.*
>
> *In recognition of the role that Cemetery Bay plays as a source of echinoderms to the lagoon, Cemetery Bay will be a no-take area for these species.*

From 15 February 2023, until further notice, Emily and Slaughter Bays will be a complete no-take area. Cemetery Bay will be a no-take area for echinoderms (sea cucumbers, sea urchins, starfish, brittle stars, sand dollars and crinoids). Fishing for kingfish and other finfish species is still allowed at Cemetery Bay."

Corals and Coral Structures

The shallow reefs of the Norfolk Marine Park have developed on the southern margin of coral reef formation, supporting a mix of tropical, temperate and endemic flora and fauna. Reef communities are further structured by gradients in wave exposure around the coastline of Norfolk Island and nearby islands and emergent rocks. Large prevailing swells, winds from multiple directions, and few enclosed bays, allow moderate to strongly wave exposed reef habitats to predominate, with only a small lagoon in the south supporting a sheltered shallow coral reef habitat. The isolation of Norfolk Marine Park reefs from other reefs has also contributed to the presence of regional endemic species, and a high abundance in some species that are rare or unusual elsewhere (de Forges et al. 2000 in Heather et al. 2022). Further, there are estimates by Professor Andrew Baird that potentially up to 30% of Norfolk Island coral species are as yet undescribed, and some of these may be endemic (Prior 2023).

The most accessible reefs within the Norfolk Island coral reef ecosystem include the Emily Bay and Slaughter Bay lagoonal reef, and neighbouring Cemetery Bay lagoonal reef. These reefs adjoin the Kingston lowland catchment and world heritage listed Kingston and Arthur's vale historic sites. The Slaughter Bay reef is most proximate to the proposed works area, located on the eastern side of Kingston Pier. Emily Bay and Slaughter Bay together form a ~0.18 km^2 intertidal lagoon (SIMS 2021).

Coral reefs are inherently sensitive, in addition, the Slaughter Bay and Emily Bay coral reefs are currently under particular stress as a result of an extensive coral bleaching event in 2020 (caused by unusually high sea surface temperatures) within the lagoonal reef, inshore pollution and declining water quality associated with high rainfall events and land-based run-off, and a subsequent coral disease outbreak on the reef. Each of these documented events (bleaching, land-based pollution, disease outbreaks) are known to be associated with declining coral reef health and phase-shifts from coral to algal dominated coral reef systems (SIMS 2021).

The Norfolk Island Natural Resource Management Plan (Parsons Brinkerhoff 2009) provides the following important observations regarding the corals of Norfolk Island:

"The inshore waters of Norfolk, Phillip and Nepean Islands support one of the southern-most coral assemblages in the world. The coral reef ecosystem at Norfolk is one of the few known examples of a transitional algae and coral assemblage (an unusual mix of tropical and temperate marine fauna and flora due to the alternating influence of warm and cool currents at the Islands) (Kuster 2001). The reefs are not actively accreting and are, therefore, not true coral reefs. The reefs occur as a thin veneer over the rock substrate and their rates of growth are slow in subtropical waters, therefore they are growing at around the same pace as their erosion and physical destruction (Kuster 2001 and Zann et al. 2001)".

"A survey on the reefs in 1999 found that the inshore benthic communities are dominated by relatively few species of subtropical hard corals co-existing with a high diversity of algae. The 57 species of scleractinian corals, in 27 genera in 11 families, comprises a unique association of tropical and temperate species of global biodiversity value. While species diversity on Norfolk was moderately high, six species accounted for almost half the coral coverage. These are mainly specialised subtropical species. The majority of the other species are uncommon to rare (Zann et

al. 2001). These coral communities form part of a chain of reefs that may be essential in maintaining a supply of larvae dispersed from source reefs to the west, probably Lord Howe Island, Elizabeth and Middleton Reefs. The low diversity of coral species combined with marginal temperatures for coral growth at high latitudes indicates that the coral communities are vulnerable to disturbance (Kuster 2001)."

Few systematic surveys, and no long-term monitoring of biodiversity, has occurred for the shallow water reef habitats around Norfolk Island, although a number of biodiversity discovery and inventory studies have been undertaken (Francis 1991, Randall and Francis 1993, Francis 1993 and Veron 1986). Reef Life Survey biodiversity assessments of shallow reefs were undertaken in 2009 and 2021, with a limited subset of sites resurveyed in 2013. The Sydney Institute of Marine Science (SIMS) also surveyed coral health in the lagoon in 2020 (Ainsworth et al. 2021). The SIMS study described impacts of a coral bleaching event in 2020, but previous bleaching events also likely occurred in 2005, 2011 and 2017 (based on satellite derived data; Ainsworth et al. 2021), with impacts on biodiversity largely unknown and unquantified (Heather et al. 2022).

Surveys of shallow reef biodiversity were undertaken in the Norfolk Marine Park in 2009, 2013 and 2021 by a team of skilled divers participating in the Reef Life Survey program (www.reeflifesurvey.com) and from the University of Tasmania. The full report can be found at https://reeflifesurvey.com/wp-content/uploads/2022/07/Norfolk-Island-Biodiversity-report-2021_FINAL_160522.pdf. A total of 74 transects were surveyed for reef fishes, mobile invertebrates and benthic cover at 16 sites in 2009 (n = 31 transects), 2013 (n = 11), and 2021 (n = 32) (Heather et al. 2022). Benthic cover changed little through time in most locations around the island, but a shift from turfs to macroalgae and a slight increase in coral cover were observed at the lagoon sites.

A total of 45 species and morphologically distinct groups of coral taxa were identified from photoquadrats from surveys spanning 2009 to 2021 (Figure 2-15). Benthic community structure significantly changed from 2009 to 2021, especially within the lagoon, which shifted to become more similar to the habitats recorded outside of the lagoon between 2009 and 2021.

Results of the Reef Life Surveys at Emily Bay and Slaughter Bay suggested that the bleaching and rainfall events in 2020 (Ainsworth et al. 2021) did not result in significant coral mortality (reduced coral cover), at least based on comparison of values in March 2021 to observations from 2009 (a period which also spans other potential bleaching events in 2011 and 2017). A recent study by SIMS showed coral disease to be increasing in the lagoon over the same time period (Ainsworth et al. 2021), and while coral disease was not recorded by the current study, no potential impact of this increase in disease on the total cover of living corals was observed. Changes in the cover of individual coral taxa in the lagoon more likely relate to fine-scale patchiness of coral composition, transect placement, and the dynamic nature of sand movement, than to impacts of bleaching events or disease outbreaks (Heather et al. 2022).

Figure 2-15 Top 15 Live hard coral taxa by site locality (x-axis = coral cover) (Source: Heather et al. 2022).

The following coral species were reported by Aurecon Australia (2011) as occurring in nearby Ball Bay on a reef growing on a rocky outcrop towards the north eastern headland. This reef has extensive hard coral cover (based on a desktop investigation of Christian and Marges 1995 and Coleman 1991).

- Cauliflower coral - *Pocillopora damicornis*

- Lord Howe Coral - *Acanthastrea lordhowensis*
- Brush coral - *Acropora hyacinthus*
- Lichen coral - Porites lichen
- Lesser star coral - *Goniastrea australensis*
- Uniform coral - *Montipora aequituberculata*
- *Platygyra favia acropora*
- Montipora sp.
- Porites sp.
- Acropora sp.
- Sarcophyton.

Multi-species synchronous coral spawning is known to occur on Norfolk Island reefs from December to February where spawning typically occurs 8 to 10 days after full moons in December, January and February, similar to nearby Lord Howe Island (Baird et al. 2023). These dates are based on anecdotal evidence from local reports including when surface slicks indicative of coral spawning was observed on three occasions on 27 December 2021, 28 January 2022 and 26 February 2022, between 8 and 11 days after the respective full moons as reported in the journal article by Baird et al. (2023). No dedicated studies have been undertaken to determine the full duration of the coral spawning season in Norfolk Island including information on which species and what proportion of colonies are spawning on each occasion.

Marine and Migratory Birds

Migratory and marine birds are protected under the EPBC Act. In total, 53 listed seabird species are known to occur in the Temperate East Marine Region. Of these species, 31 marine birds and 19 migratory birds were listed in the Protected Matters Search (totalling 32 species, some with overlapping status) (Table 2-5).

Table 2-5 Marine and migratory bird species listed under the EPBC Act Protected Matters Search for the study area.

Common Sandpiper - *Actitis hypoleucos*	Eastern Curlew - *Numenius madagascariensis*
Common Noddy - *Anous stolidus*	Red-tailed Tropicbird - *Phaethon rubricauda*
Sharp-tailed Sandpiper - *Calidris acuminata*	Grey Noddy - *Procelsterna cerulea*
Red Knot - *Calidris canutus*	White-necked Petrel - *Pterodroma cervicalis*
Pectoral Sandpiper - *Calidris melanotos*	Black-winged Petrel - *Pterodroma nigripennis*
Antipodean Albatross - *Diomedea antipodensis*	Providence Petrel - *Pterodroma solandri*

Southern Royal Albatross - *Diomedea epomophora*	Little Shearwater - *Puffinus assimilis*
Wandering Albatross - *Diomedea exulans*	Fleshy-footed Shearwater - *Puffinus carneipes*
Gibson's Albatross - *Diomedea gibsoni*	Sooty Shearwater - *Puffinus griseus*
Northern Royal Albatross - *Diomedea sanfordi*	Wedge-tailed Shearwater - *Puffinus pacificus*
Lesser Frigatebird - *Fregata ariel*	Masked Booby - *Sula dactylatra*
Great Frigatebird - *Fregata minor*	Chatham Albatross - *Thalassarche eremita*
Bar-tailed Godwit - *Limosa lapponica*	Campbell Albatross, Campbell Black-browed Albatross - *Thalassarche impavida*
Southern Giant Petrel - *Macronectes giganteus*	Black-browed Albatross - *Thalassarche melanophris*
Northern Giant Petrel - *Macronectes halli*	Salvin's Albatross - *Thalassarche salvini*
Australasian Gannet - *Morus serrator*	White-capped Albatross - *Thalassarche steadi*

2.4.1.3 Aquatic (Marine) Ecology Field Survey (Advisian 2020)

An aquatic (marine) ecology survey was undertaken from 18–20 February 2020. Intertidal and inshore subtidal marine habitats adjacent to and nearby Kingston Pier were assessed using a combination of snorkel and diver-based surveys with a primary focus on Kingston Pier harbour and Slaughter Bay. The survey used non-destructive techniques and relied on photographic and visual assessment. No ecological samples were collected. The general survey area is shown in Figure 2-16.

The foreshore and intertidal assessment were undertaken via site walkover and snorkelling, with photographs taken of the various habitats present and any fauna sighted. Key intertidal habitats inspected included rocky and/or sandy beach areas and intertidal rocky platforms. Inshore subtidal habitat was surveyed by diver inspection, supplemented with underwater photography of common species and habitat. Key subtidal habitats inspected were primarily sandy seabed and subtidal rocky reef. Subtidal rocky reef to the west of Kingston Pier was primarily macroalgal dominated, whereas reef to the east and inside the lagoon at Slaughter Bay was predominantly coral.

Figure 2-16 Aquatic (marine) ecology general survey areas at Kingston Pier harbour and Slaughter Bay Lagoon (Source: Nearmap 2020).

Kingston Pier and Harbour Intertidal Habitat

Intertidal habitats adjacent to Kingston Pier were dominated by the artificial substrate of Kingston Pier and the existing rock revetment. Intertidal rock was generally devoid of marine flora or fauna except for small invertebrates such as crabs and limpets.

Kingston Pier Harbour – Shallow Subtidal Habitat in Existing Channel

The shallow subtidal habitat adjacent to Kingston Pier can be broadly divided into two distinct zones:

1. The existing channel that has been subject to previous disturbance and augmentation (modified)
2. The surrounding seabed (unmodified).

The seabed within the existing channel is primarily coarse sand and rubble overlying layers of rock. There is very little benthic fauna present on the areas of sand and a medium to moderate cover of macroalgae on the areas of rock. A variety of brown macroalgae and small encrusting and turfing species of red, green and brown algae varieties were also present.

Kingston Pier Harbour – Transitional Zone Between Existing Channel and Natural Reef

The intermediate transitional zone is the area between the existing channel and the natural seabed where there is some evidence of disturbance from previous augmentation. The existing channel is relatively narrow, with outcrops of rock and ledges surrounding the area of seabed that has been deepened previously. The cover of macroalgae over these areas is much higher compared to the existing channel and there are more crevices and structure to the reef that is likely to provide niche habitat for a range of cryptic species including fish and invertebrates. There are also some smaller corals present, but they are generally uncommon. The corals present are low in percentage cover and are generally represented by a handful of taxa, primarily Acroporids.

Kingston Pier Harbour – Natural Subtidal Reef Beyond the Transitional Zone

Beyond the transitional zone, the seabed grades into high rugosity, subtidal rocky reef where a higher diversity of macroalgae and corals are dominant. Larger and more well-established corals are present including Acropora spp., *Acanthastrea lordhowensis*, *Pocillopora damicornis*, Porites spp. and *Goniostrea australiensis*. Other invertebrates that were common include the white spined urchin *Tripneustes gratilla*, the tuberculate urchin, *Heliocidaris tuberculata* and the black spined urchin, *Centrostephanus rodgersii*. Bryozoans were also present, possibly the species *Cornuticella taurina*.

The percentage cover of macroalgae was also much higher with very little bare rock or sand visible. A patchy but moderate cover of the green alga, *Caulerpa racemosa* and the brown alga, Dictyota sp. was present together with a suite of other turfing and coralline species.

A variety of fish species were also present during the subtidal survey to the west of Kingston Pier including a school of trevally, *Pseudocaranx sp dentex* and smaller cryptic species. The Galapagos shark, *Carcharhinus galapagensis*, was an opportunistic visitor to Kingston Pier, following boat charters into port and feeding on discarded fish catch.

The Bombora (Rocky Outcrop) outside Kingston Pier Harbour

At the time of inspection of the bombora, no fish or other pelagic species were noted. The substrate was dominated by a high percentage cover of macroalgae with minimal coral cover. Very little bare rock or sand was visible.

Slaughter Bay Intertidal Habitat

Intertidal habitats next to Kingston Pier predominantly consisted of bare rock with small rock pools that grade into a submerged rock platform. The rock was devoid of any fauna but covered in a filamentous algae. Rock pools nearer the seawall were generally populated with small cryptic species of fish and invertebrates including small crabs and crustaceans. Molluscs were less common although the small black gastropod, *Nerita albicilla* was locally abundant.

Further east, the rock platforms became interspersed with sandy sections before opening up to a continuous stretch of sandy beach past the end of the seawall providing general public access to Slaughter Bay.

Slaughter Bay Shallow Subtidal Habitat

The lagoon at Slaughter Bay is shallow (2.5 m deep) and has a soft sandy bottom with scattered shells and coral rubble and is dominated by the algae species Sargassum, Caulerpa, Cutleria, Helminthocladia, Galaxaura, Liagora and members of the Dictyotales. On the outer reef edge there exists a community of Codium, Caulerpa, Valonia, Dasycladus, and more Dictyotales. The reef top has substantial mats of Hormosira, particularly in winter months (Millar 1999 as cited in Advisian 2021a). Coral species noted were *Pocillopora damicornis*, *Goniostrea australiensis*, Porites sp. and some larger acroporids, most likely *Acropora glauca* and *Acropora hyacinthus*.

The most common fish observed in the lagoon were the Banded Scalyfin, *Parma polylepis*, the Blackspot Sergeant, *Abudefduf sordidus*, Green Moon Wrasse, *Thalassoma lutescens*, Citron butterflyfish, *Chaetodon citrinellus* and the Black Rock Cod, *Epinephelus daemelii*.

The most common of the invertebrate species within the lagoon were the sea-urchins which included the white spined urchin, *Tripneustes gratilla*, the black spined urchin, *Centrostephanus rodgersii* and the tuberculate urchin, *Heliocidaris tuberculata*. The holothurian, *Holothuria whitmaei* was also common over areas of sandy seabed.

Full survey results and photographs of subtidal and intertidal habitats at a range of locations are provided in the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

2.4.2 People and Communities

The natural values of the Norfolk Marine Park, including Kingston Harbour and nearby Slaughter Bay and Emily Bay, provide opportunities for passive and active recreation for the people and communities of Norfolk Island, as well as visitors to the island. Beach pursuits, snorkeling and swimming occur, and non-powered watercraft use the areas within in Slaughter Bay and Emily Bay. Commercial and recreational fishing occurs within the Norfolk Marine Park, with commercial fishing boats utilising Kingston Pier to enter and exit the water and offload their catch. The Kingston Pier also provides the access point for visiting cruise ship passengers brought ashore on small vessels. Visitors to Norfolk Island come to enjoy its largely untouched marine environment.

2.4.3 Bathymetrical Characteristics

Seabed levels have been sourced from a combination of a hydrographic survey undertaken by Don Taylor on 1 December 2006 and a hydrographic survey undertaken by the Royal Australian Navy on 28 October 2015. The Don Taylor survey informs the levels of the seabed within nearby proximity of the channel and the levels of the rock-shelf. The Royal Australian Navy survey informed the offshore levels of the harbour.

The Kingston Pier is located seaward of a shallow rock shelf that is exposed at lower tide levels and provides some sheltering of waves for vessels in the existing channel. The existing entrance channel is located over rocky reef with seabed levels ranging from approximately -2.4 to -3.4 m MSL offshore and adjacent to the shallow rock shelf. Landward of the shallow rock shelf and adjacent to Kingston Pier, seabed levels are approximately -0.7 to -1.5 m MSL.

The bathymetric characteristics of the proposed action area are shown in Figure 2-17.

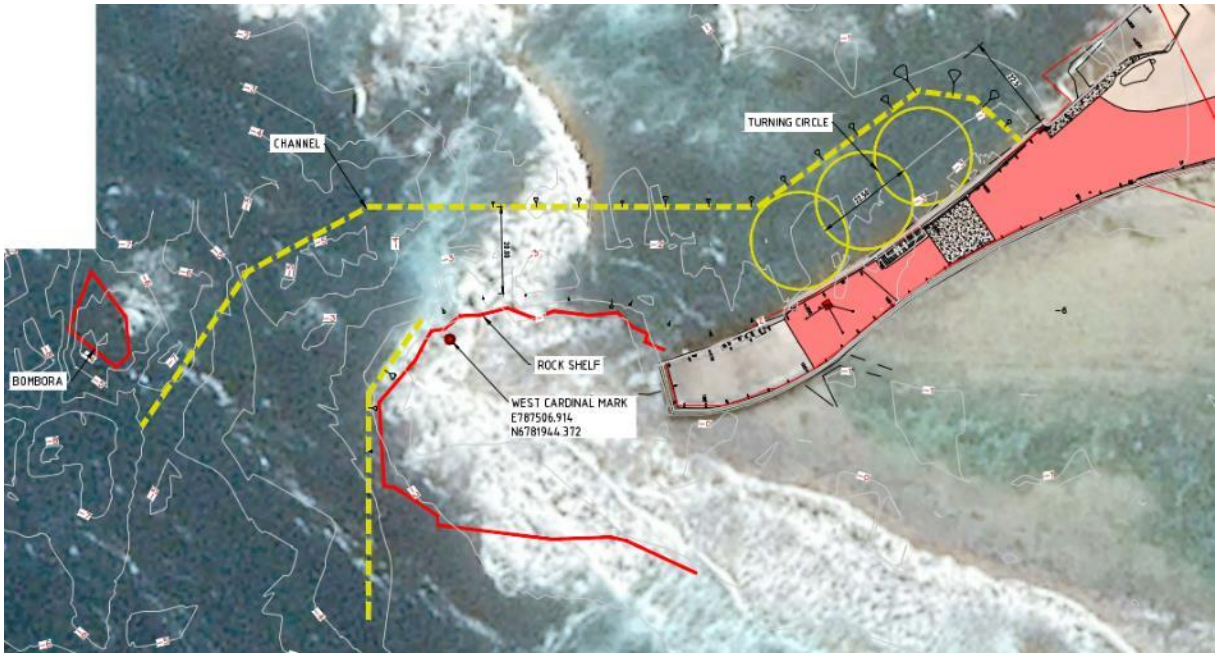


Figure 2-17 Bathymetry of the proposed action area within Kingston Harbour.

2.4.4 Natural and Physical Resources, Qualities and Characteristics within the Special Purpose Zone

The waters around Norfolk Island are classified as Special Purpose Zone (Norfolk) (IUCN VI), in which the objective is:

> *"to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species, while applying special purpose management arrangements for specific activities."*

The resources, qualities and characteristics of the zone are reflected in the identified values, which are described in Schedule 2 of the Management Plan and broadly outlined below:

- *Natural values* – examples of ecosystems representative of the Norfolk Island Province, unique reef fish assemblages, coral reefs in Emily Bay and Slaughter Bay, Key Ecological Features (KEFs) and species listed under the EPBC Act
- *Cultural values* – representing a unique community and culture on Norfolk Island involving Polynesian peoples, Pitcairn Islanders and Indigenous Australians
- *Heritage values* – KAVHA, Nepean Island Reserve and Phillip Island heritage sites and historic shipwrecks including *HMS Sirius*
- *Social and economic values* – fishing in the Norfolk Island Inshore Fishery area located in Special Purpose Zone (Norfolk) (IUCN VI). Activities such as boating, shipping, tourism and recreation in the coastal waters surrounding Norfolk Island including the coral lagoon of Emily Bay.

The Norfolk Marine Park is significant because it contains habitats, species and ecological communities associated with the Norfolk Island Province. It includes two key ecological features: Norfolk Ridge, and the Tasman Front and eddy field, both valued for high productivity, aggregations of marine life, biodiversity and endemism.

2.4.5 Social, Economic and Cultural Values

The marine environment around Norfolk Island has long held significance among Norfolk Islanders. A unique community and culture has developed by those who have visited and settled the island over time including the settlers from Pitcairn Island, who constituted the third settlement phase of the island's history. Their descendants, who comprise the majority of Norfolk Island's population, still speak the Pitcairn language. Boating, fishing, shipping, tourism and recreation are important activities in the Marine Park. This includes the sheltered coral lagoon of Emily Bay which is a valuable community asset used for swimming, snorkeling and tourism. These activities contribute to the socioeconomic and cultural wellbeing of the island community.

2.4.6 Heritage Values

The KAVHA and *HMS Sirius* are key heritage values of the Norfolk Marine Park as a Commonwealth marine area. The World and National heritage values is described in Sections 2.2 and 2.3. KAVHA demonstrates significant associations between the built and natural environment and Norfolk Island residents. It is a place of ongoing uses including continuity of the working port at Kingston Pier as well as areas for recreation, social and cultural events, and museums. Kingston Pier is of social significance to the Norfolk Island community.

The Norfolk Marine Park contains at least 15 known historic shipwrecks located near Kingston Pier as identified in Table 2-6. The wreck of HMS Sirius, one of the first fleet flagships which floundered in 1790. HMS Sirius was the flagship of the First Fleet, which set out from Portsmouth, England, in 1787 to establish the first European colony in New South Wales, Australia. In 1790, the ship was wrecked on the reef, south east of Kingston Pier, in Slaughter Bay, Norfolk Island. Further details on underwater heritage is provided in Section 2.3.1.

Table 2-6 Known historic shipwrecks located near Kingston (Cosmos Archaeology 2020).

Name	Where Lost	When
Not known – small boat	Kingston	1788
Not known – cutter from *HMS Sirius*	Kingston	1790
HMS Sirius	Kingston	1790
Not known – whaleboat	Offshore, approximately one mile	1826
Friendship	Kingston, near Kingston Pier	1835
Not known – small boat	Kingston	1840

Name	Where Lost	When
Bittern	Kingston and possibly Beefsteak Point	1863
Mary Hamilton	Kingston, near Landing Place	1873
Oscar Robinson	Emily Bay	1898
Not known – whaleboat	Kingston, off the reef point	1907
Wanderlust	Emily Bay	1914
Warragal	Offshore, between Norfolk and Phillip Islands	1918
Not known – whaleboat	Not known, but probably at Kingston or Cascade Piers	1922
Ronaki IX-94	Kingston, on reef east of Kingston Pier	1943
Jan	Emily Bay	1948
Iris	Beefsteak Point, west of Kingston Pier	1962

2.5 Commonwealth Agency

The proposed action is to be taken by a Commonwealth agency involving both Commonwealth land and private land as described below. This section has considered the relevant requirements of the *Significant Impact Guidelines 1.2 Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth Agencies* (Department of Sustainability, Environment, Water, Population and Communities 2013a) and EPBC Act Policy Statement - Definition of 'Environment' under section 528 of the EPBC Act (Department of Sustainability, Environment, Water, Population and Communities 2013b).

2.5.1 Commonwealth Lands and Waters

2.5.1.1 Land Ownership and Usage

The majority of KAVHA land is owned by the Australian Government as Crown land including Kingston Pier as shown in Figure 2-18. This Commonwealth land is registered as Portion 182 (2.605 square metres) and Portion 164 (1.107 hectares) as shown in Figure 2-19.

The waters around Norfolk Island are considered Commonwealth waters under the jurisdiction of the Australian government and are located in the Norfolk Marine Park. The Norfolk Marine Park is an Australian marine park and is managed under the Temperate East Marine Parks Network. A description of the Norfolk Marine Park is provided in Section 2.4. Kingston Pier is an active working port and NIRC is the Port Manager.

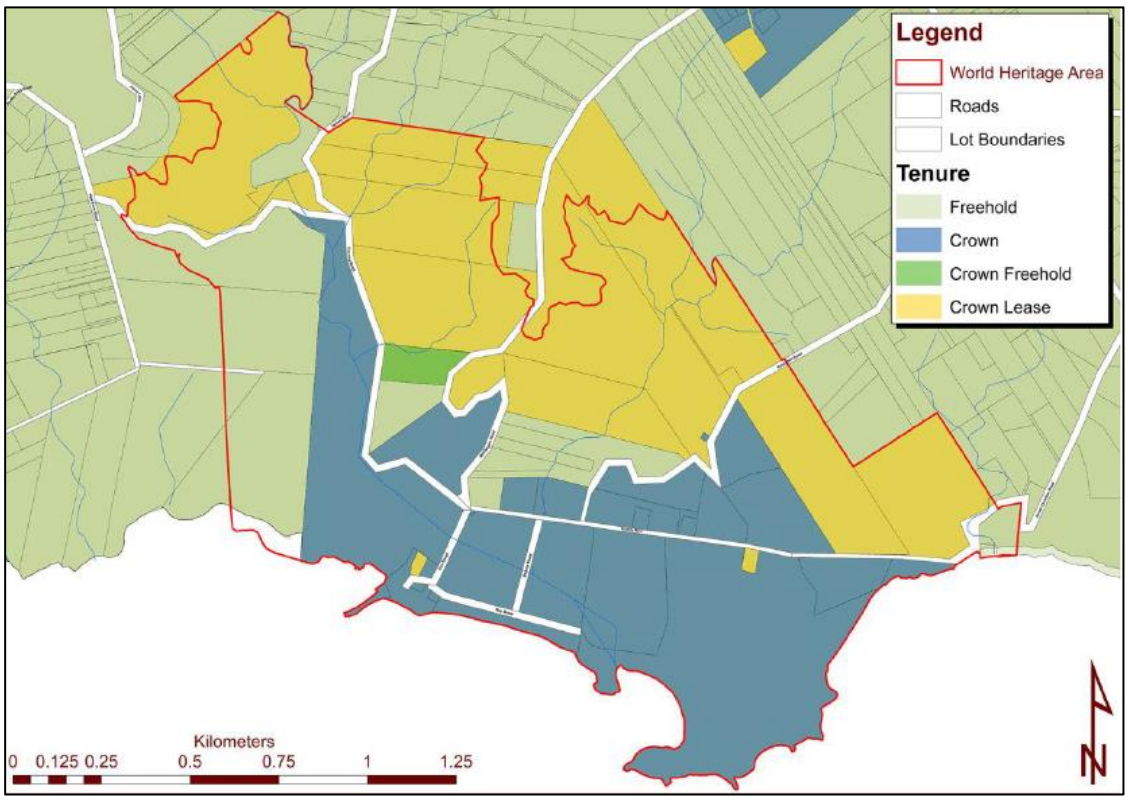


Figure 2-18 KAVHA land tenure status (Source: Jean Rice Architect, Context and GML Heritage 2016).

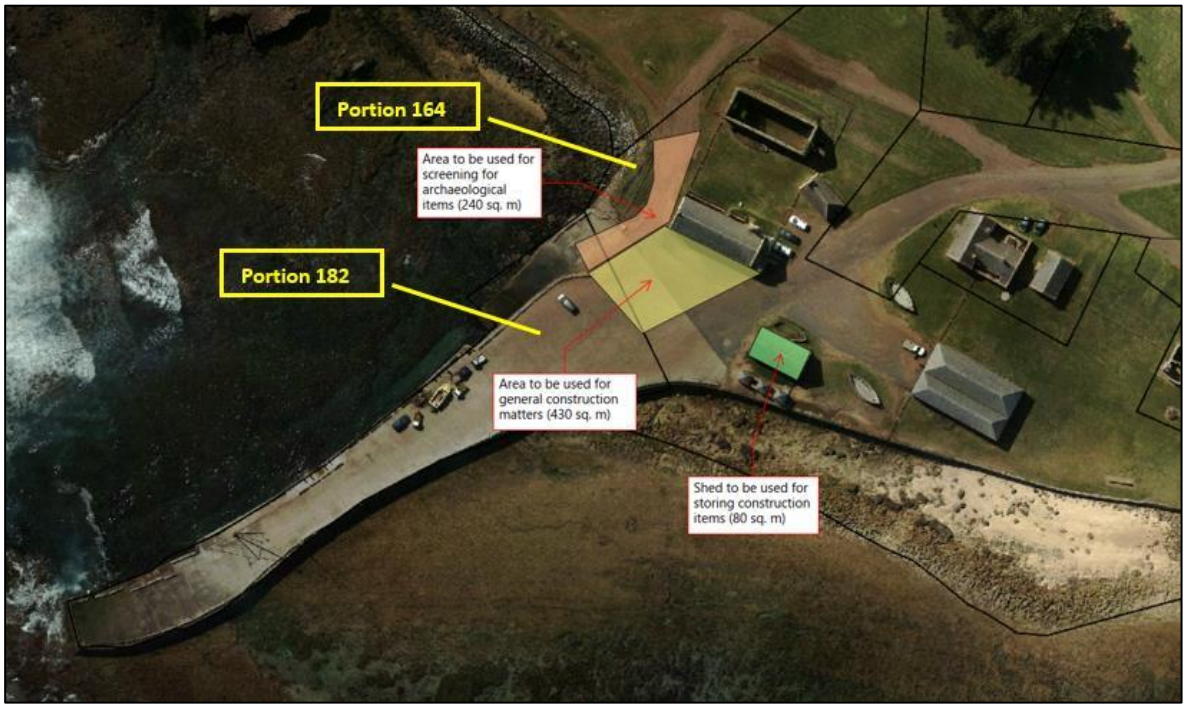


Figure 2-19 Portions 164 and 182 near Kingston Pier.

Portion 182 comprises the Kingston Pier hardstand area, paved areas and grassed areas which are currently used for activities by various vessel operators such as commercial charter, fishing vessels and emergency responders as well as local launches and lighters, and for other public users who use Kingston Pier for fishing and other recreational activities. The land includes Kingston Pier which is considered critical infrastructure for minor freight operations and transfer of cruise ship passengers to access Norfolk Island. Other heritage elements near Kingston Pier include the Pier Store (Museum), Boatsheds, Flaghouses and the Royal Engineers Office (Museum shop and information). The Boatsheds are currently used to store maritime vessels and equipment. Kingston Pier is accessed via Pier Street.

Portion 164 is located west of the Pier Store (Museum) and includes the boat ramp and grassed areas. The land is generally associated with the activities of various vessel operators and other users at Kingston Pier.

2.5.1.2 Landscapes and Soils

The visual quality and catchment of Kingston Pier and the surrounding area is characterised by the heritage elements of the KAVHA which includes heritage structures and port-related uses such as roads, the Rock Revetment, Slaughter Bay Seawalls, car parking, museum facilities and various maritime facilities and the vessels that occupy and/or use those facilities and the associated harbour adjacent to Kingston Pier. The KAVHA is listed on the World and National Heritage Lists.

The landscape character of the KAVHA generally comprises buildings and structures at Quality Row overlooking lowland landscape, the dominant visual screen at Flagstaff Hill, open slopes, open aspects to land and sea and views to Nepean and Phillip Islands.

The visual receptors in the area include:

- Users of existing maritime facilities
- Government and public users of existing buildings
- Pedestrians and vehicles at Kingston Pier and in the vicinity
- Tourists or visitors at Kingston Pier.

A Sediment Quality Assessment (Advisian 2020a) (**Appendix G**) was prepared in accordance with the National Assessment Guidelines for Dredging (NAGD) to assess the physico-chemical properties of existing marine sediments and rock as well as suitability of the spoil for land-based disposal. The assessment also included the findings of sediment sampling undertaken during technical environmental investigations on Norfolk Island in February 2020.

Kingston Pier is remote from known existing or historical sources of pollution. Existing marine sediments and rock are subject to high wave energy. Therefore, it is considered that the material has little potential for contamination. A previous seabed survey (Waterway Constructions 2016) reported that the seabed material was generally very weak; samples were generally able to be indented with a fingernail and easily-broken up by hand. Therefore, it is expected that the seabed material would comprise rock of low to very low strength.

The sediment sampling locations informing the Sediment Quality Assessment are in Figure 2-20.

Figure 2-20 Six sampling locations informing the Sediment Quality Assessment (Source: Advisian 2020a).

The samples were collected by divers using 100 mm diameter, 0.3 m long polycarbonate push cores and analysed for the following analytes:

- Trace metals (Cu, Pb, Zn, Cr, Ni, Cd, Hg, As, Ag and Sb)
- Polycyclic aromatic hydrocarbons (PAHs)
- Total petroleum hydrocarbons (TPH)
- Organotins (MBT, DBT, TBT).

The contaminant testing indicated that the 95% Upper Confidence Limit (UCL) of metal concentrations were below the NAGD low level screening guidelines for all contaminants of concern except for nickel. The elevated levels of nickel may be due to naturally elevated ambient baseline levels, as sediments in Australia commonly have high levels of nickel (Commonwealth of Australia 2009) which has also been documented more recently by Stoddart et al. (2019). The paper also indicated that bioavailability is low so it would present minimal risk to marine species. In addition, as nickel levels are below clean fill guidelines (NSW EPA, 2014) the land-based disposal of spoil would be acceptable. Organic contaminant concentrations including PAHs and petroleum hydrocarbons were very low. In addition, Organotin concentrations including TBT were also very low and below the limits of reporting for all samples tested.

Furthermore, marine sediments and rock were subject to particle size distribution testing. The data was collected into the following seven standard categories:

- Gravel (2,000 – 10,000 micrometre (µm)

- Coarse sand (500 – 2,000µm)
- Medium sand (300 – 500µm)
- Fine sand (60 – 300µm)
- Silt (2 – 60µm)
- Clay (1 – 2 µm).

The marine sediment samples consisted of medium to coarse grained sand with gravel and minimal fines (slit or clay). Particle size distribution testing indicated that the marine sediments are predominantly sand and gravel with a small proportion of clay. The sediment particle size was generally consistent between the six sampling locations. In addition, two samples of marine rock comprised higher proportions of consolidated silt and clay with a smaller proportion of sand.

2.5.1.3 Coastal Landscapes and Processes

A Wave Modelling Report (Advisian 2020b) (**Appendix H**) has been prepared to understand the potential impacts of the Project on the wave climate in the harbour adjacent to Kingston Pier. It involved hydrodynamic numerical wave modelling using SWAN software to establish the nearshore wave climate for various recurrence intervals.

It was noted that as nearshore wave measurements do not exist, all modelling is uncalibrated. It was considered that collection of wave data by deploying instruments for example over three months, would provide more confidence with numerical modelling. However, based on Advisian's experience with similar projects, as the only opportunity to calibrate the model lies in varying the bathymetric boundary conditions, if the bathymetry is known and schematised at an appropriate resolution then the model can be expected to give realistic results.

The existing wave climate at Kingston Pier for the various offshore conditions in Table 2-7 was derived from the SWAN model. The significant wave height and wave direction were derived from the SWAN model at various Points (A to H) for Case No. 1 to Case No. 9.

Table 2-7 Offshore wave cases run through SWAN model (Source: Advisian 2020b).

Case No.	Offshore Wave Direction, °TN	Significant Wave Height, Hs (m)	Peak Wave Period, Tp (s)	Case Description
1	270 (W)	6.2	11.5	1-year ARI westerly offshore waves
2	225 (SW)	7.1	13.4	1-year ARI south-westerly offshore waves
3	180 (S)	5.0	11.9	1-year ARI southerly offshore waves
4	135 (SE)	4.8	10.2	1-year ARI south-easterly offshore waves
5	90 (E)	5.6	10.4	1-year ARI easterly offshore waves
6	225 (SW)	2.0	10.0	Median conditions, south-west offshore waves
7	202.5 (SSW)	2.0	10.0	Median conditions, SSW offshore waves

Case No.	Offshore Wave Direction, °TN	Significant Wave Height, Hs (m)	Peak Wave Period, Tp (s)	Case Description
8	180 (S)	2.0	10.0	Median conditions, S offshore waves
9	90 (E)	2.0	10.0	Median conditions, E offshore waves

It was found that the highest waves occur in the harbour when the offshore wave direction is from the south-west, as the existing shallow rock shelf adjacent to the southern extent of Kingston Pier causes waves to break for the more easterly wave approach directions. The south-west direction also coincides with the most common offshore wave approach sector.

The existing significant wave heights for the south-west offshore waves and for the 1-year ARI and median conditions are shown in Figure 2-21 and Figure 2-22.

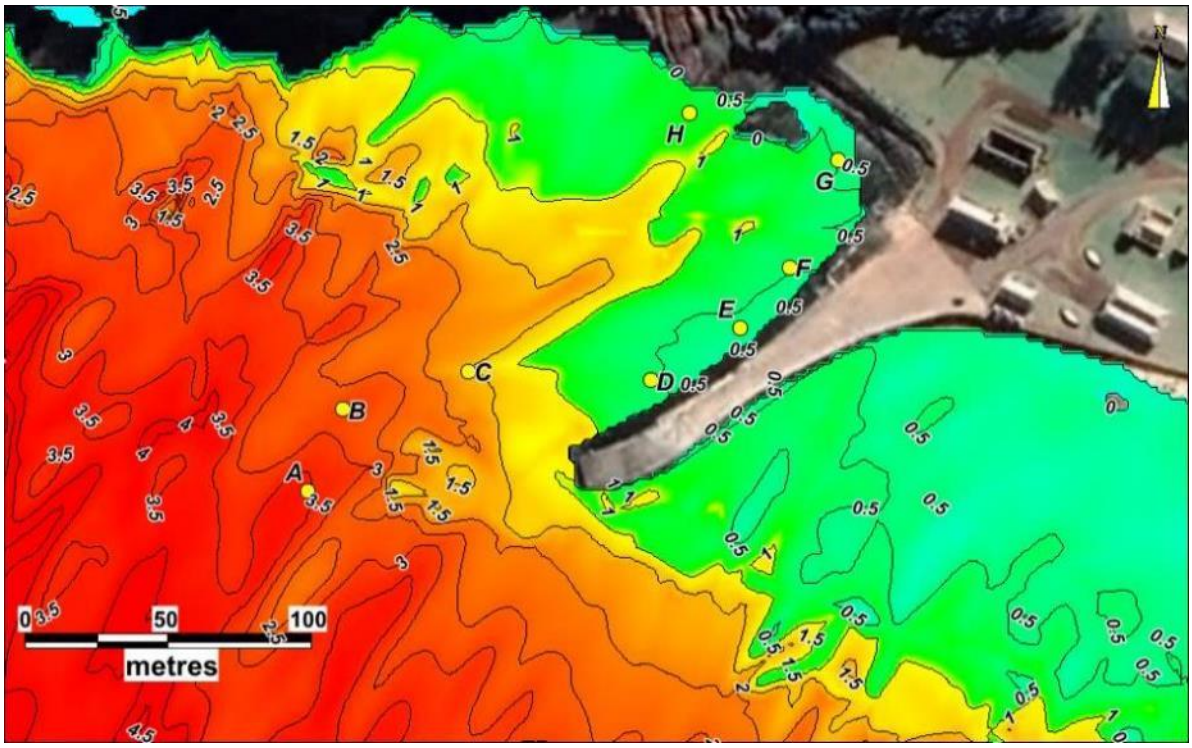


Figure 2-21 Significant wave height (m), (Case 2: south-west offshore waves, 1-year ARI) (Source: Advisian 2020b).

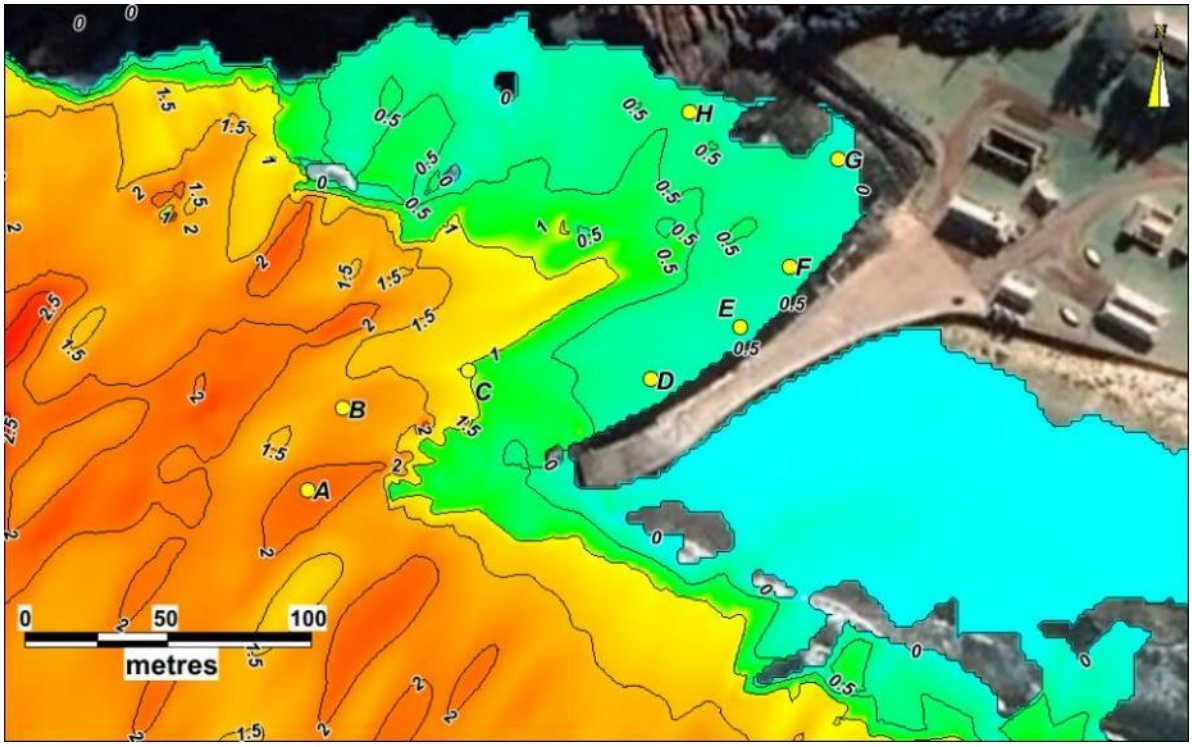


Figure 2-22 Significant wave height (m), (Case 6: south-west offshore waves, median conditions) (Source: Advisian 2020b).

2.5.1.4 Water Resources

Marine water quality testing was undertaken on 19 and 20 February 2020 to obtain basic information on the existing environment in the waters around Kingston Pier. This included physico-chemical parameters which could be measured using a hand-held water quality meter. The testing is documented in the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

Marine water quality was analysed using the ANZECC (2018) Guideline which recommends the following in relation to levels of protection for high conservation areas:

- No change beyond natural variability recommended, using ecologically conservative decision criteria for detecting change. Any relaxation of this objective should only occur where comprehensive biological effects and monitoring data clearly show that biodiversity would not be altered
- Where reference condition is poorly characterised, actions to increase the power of detecting a change recommended
- Precautionary approach taken for assessment of post-baseline data through trend analysis or feedback triggers.

In the absence of the 2018 Default Guideline for the Temperate East Marine Region, the default trigger values for the physico-chemical stressors for south-eastern Australia, for slightly disturbed ecosystems (from the previous ANZECC (2000) Guideline) for south-eastern Australian marine waters, are provided in Table 2-8.

Table 2-8 Guidelines for water quality parameters (Source: ANZECC 2000).

Parameter	Default Trigger Value
Temperature (°C)	N/A
pH	8 – 8.4
Salinity (ppt)	N/A
Conductivity (ms/cm)	N/A
Turbidity (NTU)	0.5 – 10
Dissolved Oxygen (mg/L)	90 – 110% saturation

The marine water quality testing comprised 10 sampling sites as shown in Figure 2-23 and are described as follows:

1. Kingston Pier East
2. Kingston Pier – Seaward End
3. Kingston Pier West – Old Steps
4. Kingston Pier West – New Steps
5. Kingston Pier West – Bottom of Ramp / Fish Cleaning Table
6. Kingston Harbour (Middle)
7. Western Reference 1 – Offshore Flagstaff Hill
8. Western Reference 2 – Bumbora
9. Eastern Reference 1 – Slaughter Bay
10. Eastern Reference 2 – Emily Bay.

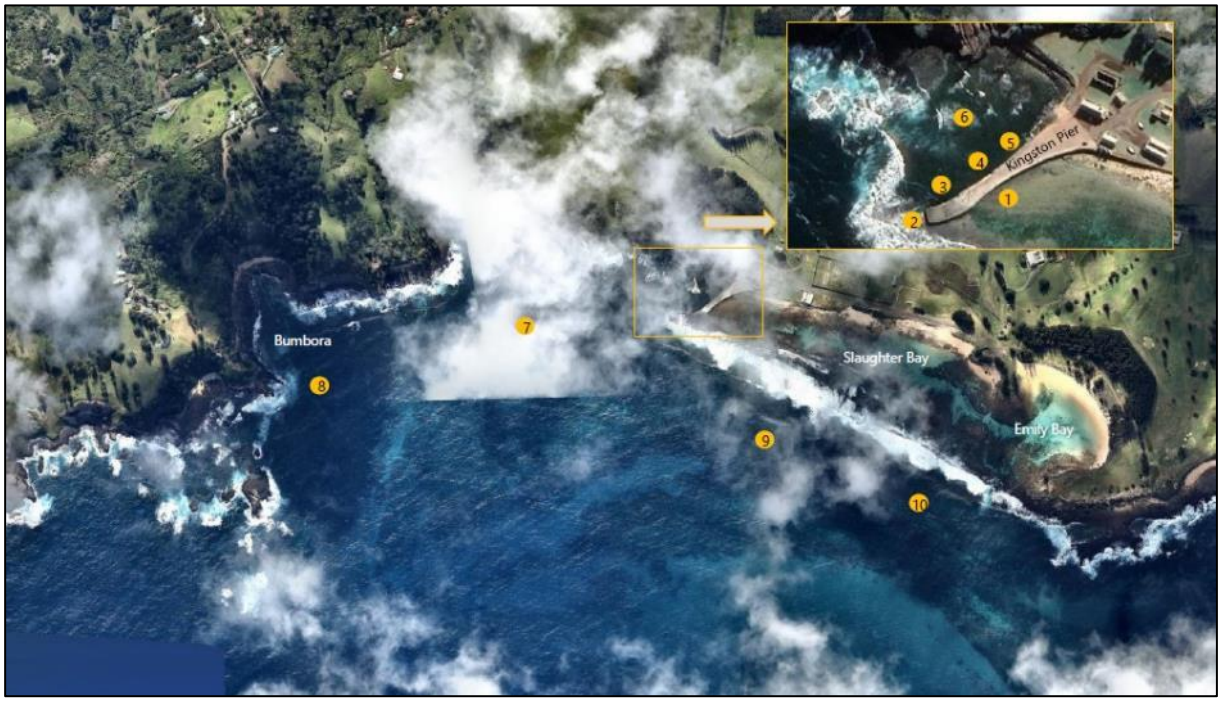


Figure 2-23 Location of marine water quality sampling sites (Source: Advisian 2021a).

Marine water quality monitoring at each site was undertaken using a hand-held water quality meter at the surface level (1m below the surface), midwater (half-water depth) and bottom (1m off the bottom) to measure the physico-chemical parameters listed in Table 2-8.

There was found to be very little difference in water quality data between the two sampling dates as well as between the surface level, midwater and bottom sampling depths at each sampling site.

Measurements obtained for temperature, conductivity, dissolved oxygen and pH at all sampling sites and sampling depths were found to be typical of offshore marine waters and were in accordance with the ANZECC (2000) Guideline.

Turbidity was found to be very low at all sampling sites and sampling depths, with NTU values most often <1 NTU. Turbidity was only very slightly higher at sampling sites located along the edge of Kingston Pier compared to oceanic sampling sites. This was likely due to the resuspension of sandy seafloor sediments from moderate swells entering the harbour. It is likely that the turbidity values for this locality would be in the lower end of the range identified in Table 2-8 for the majority of the time.

2.5.1.5 Terrestrial Plants and Animals

Norfolk Island's terrestrial fauna includes a mixture of native and introduced species. There is diverse invertebrate fauna including collections of endemic land snails, cockroaches and beetles. There are also a number of introduced invertebrates. The only native land mammals that have been recorded on Norfolk Island are the Eastern free-tail bat (*Mormopterus norfolkensis*) and Gould's wattled bat (*Chalinolobus gouldii*). Only the latter has been seen in recent years. It is noted that introduced mammals have been responsible for environmental degradation.

A number of threatened plant species are known to occur or have the potential to occur on Norfolk Island. Norfolk Island is notable for its endemic land birds; 102 species of birds have been recorded on

Norfolk Island and adjacent islands in modern times. Many migratory and vagrant sea birds also visit Norfolk Island to nest on its steep cliffs. Many of the migratory seabirds visit Norfolk Island for the summer breeding season from October to May.

Threatened and protected terrestrial fauna known to occur or with the potential to occur in the study area include:

- 24 listed threatened species (birds)
- No mammals
- Five snails
- Two reptiles
- Six migratory wetland species.

A terrestrial ecology survey was undertaken around Kingston Pier in February 2020. The general location of various terrestrial habitats and their vegetation are summarised in Figure 2-24. The vegetation near Kingston Pier is largely comprised of kikuyu grasses around the KAVHA buildings, kikuyu grassed fields and several areas of planted Norfolk Island pines along nearby roads and the dominant vegetation community at Flagstaff Hill. The seawall behind the existing rock revetment and along the edge of Slaughter Bay was topped with planted grasses and the coastal succulent pigface (*Carpobrotus glaucescens*).

Figure 2-24 Terrestrial vegetation near Kingston Pier (Source: Zoom Imagery 2018).

2.5.1.6 Heritage

KAVHA is of World and National Heritage significance whilst *HMS Sirius* is of National Heritage significance as described in Sections 2.2 and 2.3, which due to their level of significance are considered to be "rare, endemic, unusual, important or otherwise valuable" under the Significant Impact Guidelines 1.2.

KAVHA is also registered on the Commonwealth Heritage List on 22 June 2004 (excluding areas of freehold tenure). It is also listed on the Norfolk Island Heritage Register, dated 9 December 2003. The *HMS Sirius* Shipwreck site is located east of Kingston Pier in the vicinity of the Project. The wreck site was listed on the Commonwealth Heritage List on 25 October 2011 and it is also protected under the *Underwater Cultural Heritage Act 2018* (UCH Act).

The KAVHA and *HMS Sirius* are inextricably linked. It is noted from the heritage listing of the KAVHA on the Commonwealth Heritage List that the:

> *"KAVHA is closely associated, through fabric and artefacts, with the wreck of the Sirius in 1790, a calamitous event in the early history of the colony of New South Wales".*

2.5.2 Old Cascade Quarry

2.5.2.1 Land Ownership and Usage

The land at the onshore disposal site at the Old Cascade Quarry is privately owned at Portion 5a1 (Youngs Road) (2.848 hectares). It is located in the vicinity of Cascade Reserve. It is situated east of Cascade Pier and immediately adjacent to Cascade Cliff (Figure 2-25). The Old Cascade Quarry is not currently in use and was previously used as a quarry to supply stone for various construction projects on Norfolk Island.

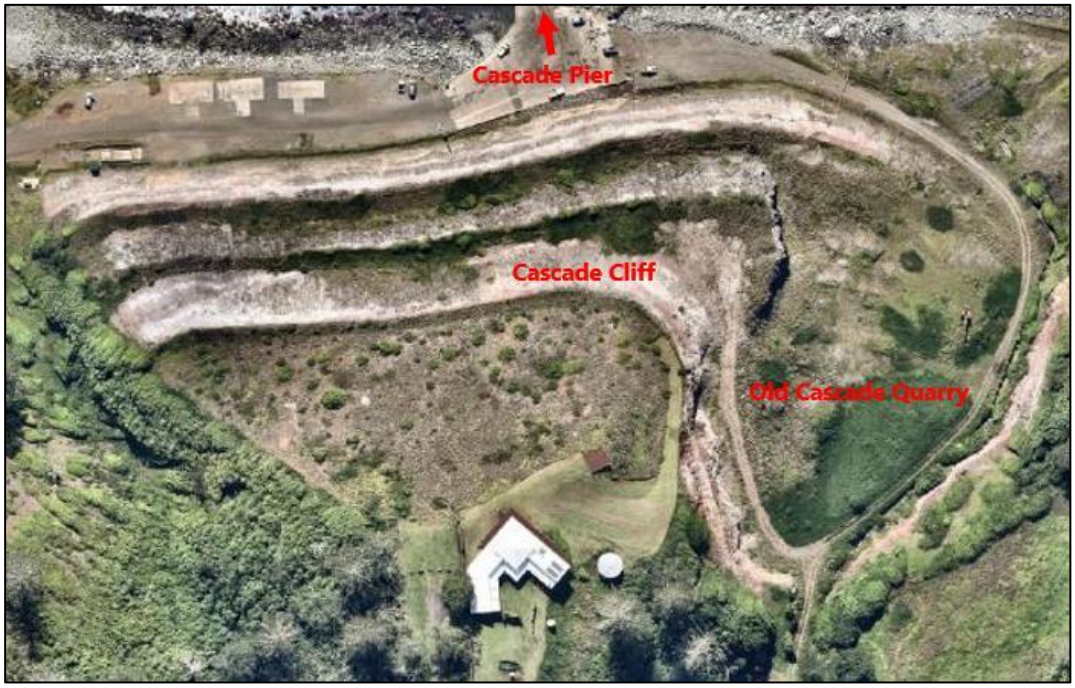


Figure 2-25 Aerial view of Old Cascade Quarry (Source: Nearmap 2019).

2.5.2.2 Landscapes and Soils

The visual quality and catchment at Old Cascade Quarry is characterised by disturbed terrain due to previous land-use activities. The former quarry site is covered in grasses with exposed areas of rock

and rubble. In addition, Cascade Cliff immediately adjacent to Old Cascade Quarry has been completely reshaped and resembles an engineered landscape with some vegetation.

As a result, the landscape character at Old Cascade Quarry comprises a modified landform with natural values at nearby Cascade Reserve as well as Cascade Pier and open aspects to the sea.

The visual receptors in the area include:

- Users of existing maritime facilities at Cascade Pier
- Pedestrians and vehicles at Cascade Pier and in the vicinity
- Private landholders near Old Cascade Quarry including visitors and tourists staying at the Forrester Court Clifftop Cottages
- Tourists or visitors at Cascade Pier.

According to the Cascade Reserve Plan of Management (Norfolk Island Parks and Forestry Service 2003), Cascade Cliff in its natural state was originally a significant feature of Cascade Reserve. It was completely reshaped in 1999-2000 by major engineering work which involved horizontal benching of Cascade Cliff to improve safety and prevent further rockfalls onto Cascade Road and Cascade Pier.

At present, Cascade Cliff resembles an engineered landscape of vertical faces separated by horizontal benches, with some vegetation. It is noted that during the life of the Plan of Management, the boundary of Cascade Reserve would be adjusted to remove Cascade Cliff. The end-date for the life of the Plan of Management is not known. Finally, Old Cascade Quarry is not described in the Plan of Management.

The quarry landowner has a house at the south of the site at the high point of the land. There is an unsealed access road from Cascade Road that extends from around Cascade Pier and then along the eastern perimeter of the quarry site. The section of the access road closest to the pier is showing signs of washout, likely due to uncontrolled runoff from the site.

There is a stockpile of approximately 1,400 m^3 of topsoil located on the south-east corner of the disposal site and a stockpile of approximately 345 m^3 of rock located on the west and south boundaries of the disposal site.

2.5.2.3 Coastal Landscapes, Processes and Water Resources

Cascade Bay is located about 100 metres north of Old Cascade Quarry. Cascade Bay is an open body of water subject to constant wind and wave action. Cascade Bay is remote from known existing or historical sources of pollution. Existing marine sediments and rock are subject to high wave energy similar to Kingston Pier. Therefore, it is considered that material within nearby Cascade Bay has little potential for contamination.

An open concrete channel drain is positioned along the eastern side of the site, draining towards the ocean. However, the landowner informed that little stormwater runoff is directed towards this drain. This is supported by the fact the drain is very overgrown with vegetation. Structurally the drain appears to be in good condition. The concrete drain leads to a sump constructed from gabion baskets that filters flows prior to discharging to the ocean.

2.5.2.4 Plants and Animals

A site inspection at the Old Cascade Quarry was undertaken by the design team for the purposes of reporting on visual observations. The Cascade Reserve Plan of Management (Norfolk Island Parks and Forestry Service 2003) describes a weed infested remnant forest near Cascade Cliff, and in the valley north of Young's Road and the nearby hillsides. A riparian rehabilitation area at the Old Cascade Quarry is also shown in Figure 2-26. A recent site inspection by Advisian at the Old Cascade Quarry indicates that the terrain has been previously disturbed and is covered in grasses with exposed areas of rock and rubble.

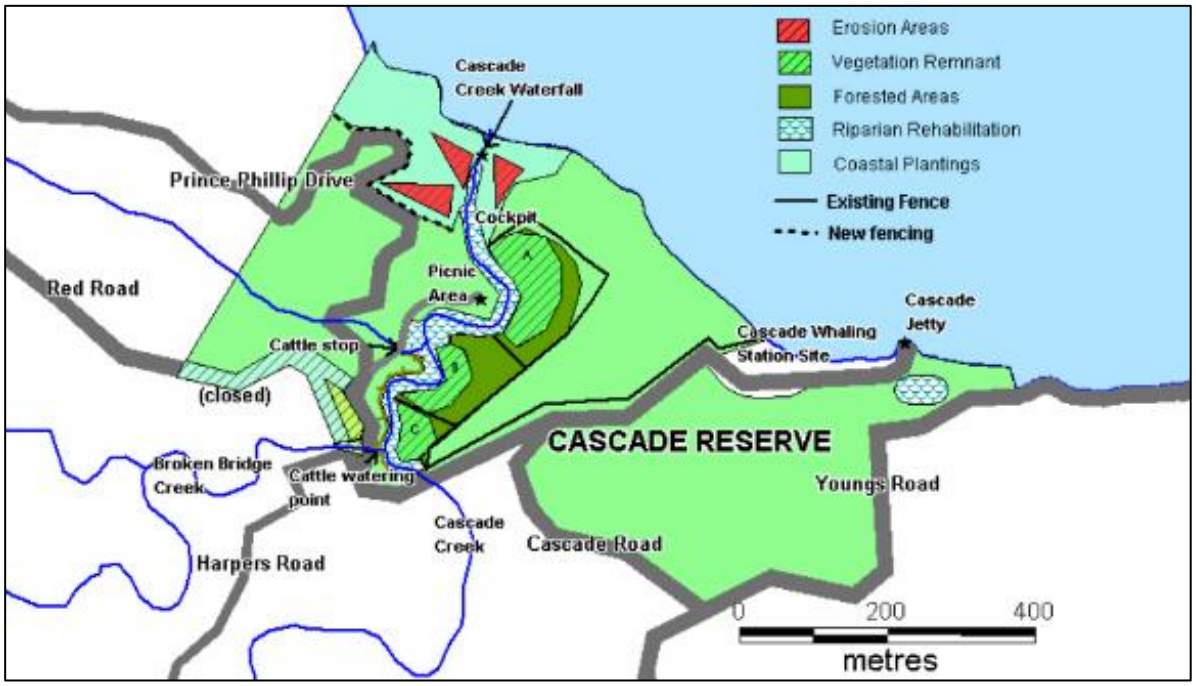


Figure 2-26 Areas of erosion and vegetation remnants in Cascade Reserve (Source: Norfolk Island Parks and Forestry Service 2003).

An Ecological Assessment was undertaken by Castles Environmental (2020) on behalf of NIRC as part of the approval (DA 36/2021) for the proposed small quarry at Youngs Road, Cascade. Apart from potential blasting impacts, the assessment found that impacts to ecological values are generally unlikely due to the high level of disturbance and low flora and fauna habitat values at this site. This conclusion is also applicable to the adjacent Old Cascade Quarry site that is highly disturbed.

Norfolk Island's terrestrial fauna includes a mixture of native and introduced species. There is diverse invertebrate fauna including collections of endemic land snails, cockroaches and beetles. There are also a number of introduced invertebrates. The only native land mammals that have been recorded on Norfolk Island are the Eastern free-tail bat (*Mormopterus norfolkensis*) and Gould's wattled bat (*Chalinolobus gouldii*). Only the latter has been seen in recent years. It is noted that introduced mammals have been responsible for environmental degradation.

Norfolk Island is notable for its endemic land birds; 102 species of birds have been recorded on Norfolk Island and adjacent islands in modern times. Many migratory and vagrant sea birds also visit

Norfolk Island to nest on its steep cliffs. Many of the migratory seabirds visit Norfolk Island for the summer breeding season from October to May.

2.5.2.5 Heritage

The Old Cascade Quarry is located in the vicinity of the of Cascade Reserve which is listed on the Norfolk Island Heritage Register and is a nominated place for the Commonwealth Heritage List.

Cascade Reserve is the largest public reserve on Norfolk Island and is rich in cultural and natural heritage. Cascade Reserve contains historic, landscape and seascape heritage conservation values including important remnant native vegetation. Cascade Reserve is comprised of skeletal soils, including highly erodible red and/or brown ferritic soils, on steep ridges and areas where bedrock lies close to the surface. Cascade Road is adjacent to Cascade Reserve and is identified as one of the earliest roads in Australasia still in use.

Cascade Reserve is described as one of the most important cultural landscapes in Australasia (Varman, 1998). Historical associations and archaeological research potential at Cascade Reserve are generally associated with the following historical periods:

1. First (Colonial) Settlement 1788 – 1814
2. Second (Penal) Settlement 1825 – 1855
3. Third (Pitcairn) Settlement 1856 – Present

The zoning plan (Varman 1998) identifies and describes archaeological and historically significant sites in Cascade Reserve as shown in Figure 2-27.

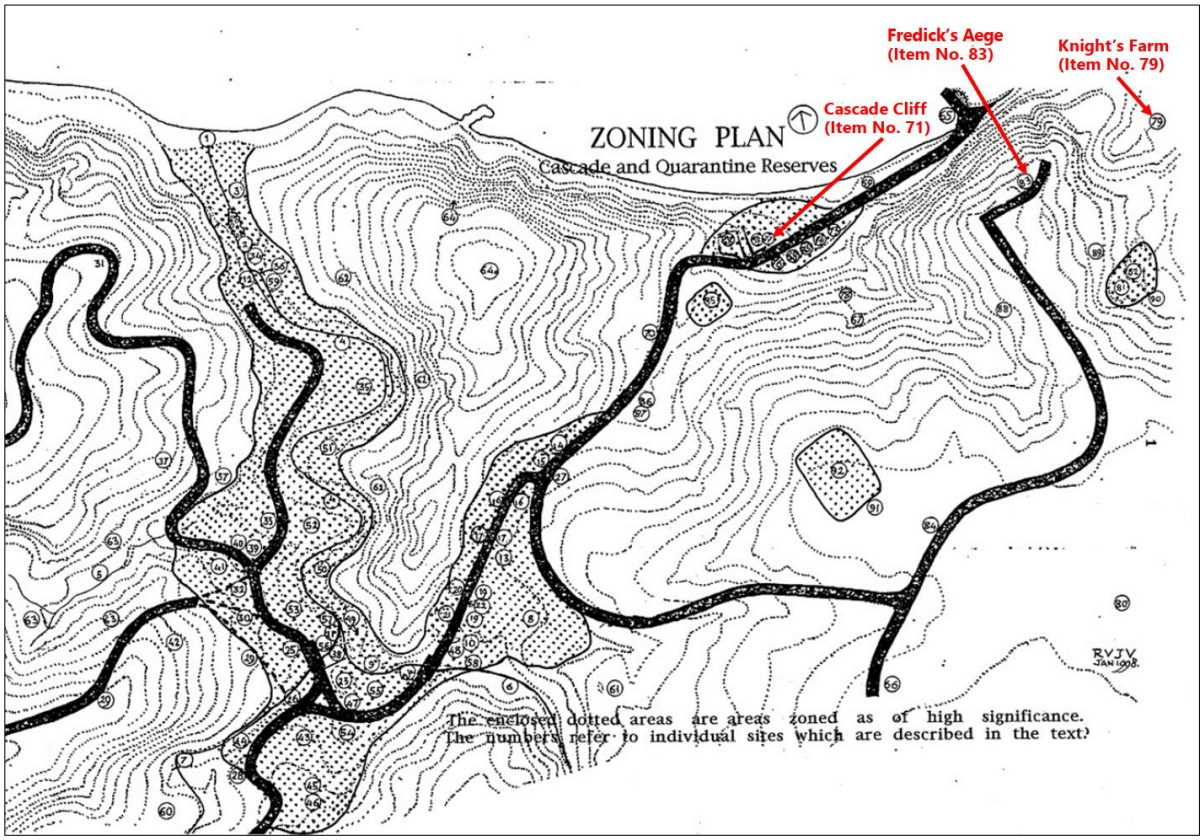


Figure 2-27 Archaeological zoning plan showing significant sites at Cascade Reserve (Source: Varman 1998).

Significant sites located in the vicinity of Old Cascade Quarry are described below.

Cascade Cliff (Item No. 71)

> *"Item: 71*
> *Name: Cascade Cliff*
> *Previous or Alternative Names:*
> *Item Type: Natural environment.*
> *Group: Renmant forests.*
> *Area: Jetty Area Principally in the area above the Jetty and road leading up to the Jetty. Current Use:*
> *Former Uses:*
> *Statement of Significance: An important landscape element connected with Cascade Jetty, depicted at regular intervals since 1794. The harvesting of flax on a grand scale during the 1790s is probably partially responsible for the instability of this cliff.*
> *Statement of Integrity: Denuded of plants and trees since the 1790s, the cliff face has become so unstable as to endanger lives on a daily basis due to regular collapses of rock.*
> *Degree of Significance: High.*
> *Management Recommendations: Although of high significance as an important landscape feature, it is recognized that the cliff presents a constant and unpredictable danger to all who use the road and jetty below it. Any proposal in regard to removing the danger should consider a landscape program that will emphasise the vertical as a back-drop to the jetty."*

Cascade Cliff was significantly altered by major engineering work in 1999-2000. The proposed works at the Old Cascade Quarry would be located adjacent to Cascade Cliff and would have no impact on its historical value as a landscape feature, albeit modified, at the Jetty Area.

Knight's Farm (Item No. 79)

> *"Item: 79*
> *Name: Knight's Farm.*
> *Previous or Alternative Names: Lot 1.*
> *Item Type: Archaeological. Human modified landscape.*
> *Group: First Settlement land grants.*
> *Area: Eastward of the east boundary of East Cascade Reserve, from the Lower Garden creek to little Cascade Stream.*
> *Current Use: Private property, grazing, rock quarry and quarry overburden storage site.*
> *Former Uses: Agriculture and grazing.*
> *Statement of Significance: Important early farming site with archaeological potential associated with Cascade Farm and Phillipsburgh. The Shepherd's Hut remains could possibly be associated with Knight's Farm.*
> *Statement of Integrity: Much of the north-west part of the site has been destroyed by stone quarrying but the masonry remains of an old cottage survive under the stockpiled overburden. The crest of the east hill to little Cascade Stream (Simons Water) still survives.*
> *Degree of Significance: High.*
> *Management Recommendations: Status quo."*

Knight's Farm has been highly disturbed by stone quarrying operations although it is reported that the masonry remains of an old cottage survive under the stockpiled overburden (Varman 1998). The proposed works at the Old Cascade Quarry may impact on the old cottage remains.

Fredick's Aege (Item No. 83)

> *"Item: 83*
> *Name: Fredick's Aege.*
> *Previous or Alternative Names: Fredick's Edge, Ar Bamboo, Shepherd's Hut.*
> *Item Type: Cultural/historical.*
> *Group: Lower Garden, Frederick Young's grant.*
> *Area: East Cascade Reserve. The cliff end area of Young's Road overlooking the jetty.*
> *Current Use: Recreation, lookout and grazing.*
> *Former Uses: Agriculture. Look-out.*
> *Statement of Significance: Of significance to the Third Settlement as an early orientation landmark from the sea still well known locally. Earlier look-out for ships. Some 'recent' confusion has resulted in the upper area also being referred to as Shepherd's Hut.*
> *Statement of Integrity: The giant bamboo plant was removed during initial stone quarry operations and there has been a decline in the number of naturally sown trees in the area.*
> *Degree of Significance: Medium.*
> *Management Recommendations: If the area is to be destroyed, the name should be commemorated by a plaque and perhaps a giant bamboo plant nearby."*

Fredick's Aege is of historical value as a lookout to the Jetty Area and an early orientation landmark from the sea. Given the localised nature of proposed works at the Old Cascade Quarry, there is unlikely to be an impact on the site.

In addition, for the purposes of the zoning plan, geographical features of Cascade Reserve were divided into two categories: flat land and steep land. As a general rule, the flat lands ought to be regarded as archaeologically sensitive and steeply sloping lands need not (Varman 1998). Furthermore, it was considered that areas not regarded as archaeologically sensitive may have historical value as historic landscapes, including the cliff and hill above the Jetty Area.

3 Relevant Impacts

This PER assesses the potential construction and operational impacts of the Project on key environmental factors and identified MNES. The 'environment' is defined in the EPBC Act as follows:

(a) ecosystems and their constituent parts, including people and communities; and

(b) natural and physical resources; and

(c) the qualities and characteristics of locations, places and areas; and

(d) heritage values of places; and

(e) the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), (c) or (d).

This PER provides a detailed assessment of any likely impact that the proposed action may facilitate on the following MNES (at the local, regional, state, national and international scale):

- The World Heritage values of the KAVHA (Australian Convict Sites) World Heritage Area (Section 3.1)
- The National Heritage values of KAVHA and HMS Sirius shipwreck National Heritage places (Section 3.2)
- The Commonwealth marine environment (Section 3.3)
- Commonwealth Agency (Section 3.4).

3.1 The World Heritage Values of KAVHA (Australian Convict Sites)

3.1.1 Potential Impacts to the Outstanding Universal Values

A description of the World heritage values of KAVHA is described in Section 2.2. Table 3-1 considers the potential impact on the official heritage values that constitute the heritage significance of the KAVHA as described on the World Heritage List.

Table 3-1 World heritage values of the KAVHA.

Heritage values	Key Attributes / Potential Impact
Criterion (iv) *to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history*	**Summary of Key Attributes** As part of the Australian convict sites, the KAVHA is an example of the way in which conventional forced labour and national prison systems transformed into a system of deportation and forced labour forming part of the British Empire's vast colonial project. It illustrates a penal colony and bears witness to a penitentiary system, the objective of which ranged from punishment through to the rehabilitation of convicts. **Potential Impact** The works would not adversely impact extant buildings, structures, ruins, landscapes or land-based subsurface archaeological remains that are

Heritage values	Key Attributes / Potential Impact
	associated with, and provide an understanding of settlement and penal colony activities at the KAVHA.
Criterion (vi) *to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance*	**Summary of Key Attributes** The transportation of criminals, delinquents and political prisoners to colonial lands between the 18th and 20th centuries is an important aspect of human history, particularly with regard to its penal, political and colonial themes. As part of the Australian convict sites, the KAVHA provides an example of this history and the associated symbolic values derived from discussions in modern and contemporary European society. It illustrates an active phase in the occupation of colonial lands and the creation of a colonial population from punishment through to rehabilitation and social integration of convicts. **Potential impact** The works would not impact on the penal, political and colonial themes of the KAVHA nor the evidence which demonstrates the historical occupation and development of the land. The stabilisation of Kingston Pier would improve the integrity of the structure and enable the continuity of culturally significant events and living traditions at the place. This includes the annual Anniversary Bounty Day Celebrations which commemorate the arrival of the Pitcairn Islanders on 8 June 1856.

3.1.2 Potential Construction Impacts

A summary of the potential construction impacts is provided below. For further detail, refer to the Underwater Cultural Heritage Statement of Heritage Impact (Cosmos Archaeology 2020a) (**Appendix N**), the Heritage Impact Statement (Advisian 2021b) (**Appendix O**) and the Underwater Archaeological Test Excavation Report (Cosmos Archaeology 2021) (**Appendix C**).

3.1.2.1 Heritage Elements

Kingston Pier is a key heritage element in Precinct H of the KAVHA. The augmentation works located immediately adjacent to the western side of Kingston Pier have the potential to undermine the existing steel sheet pile wall. To mitigate potential impacts, stabilisation works would be carried out during augmentation works to reduce the existing bending stress on the sheet piles and improve the structural integrity of Kington Pier. Consequently, the fabric of Kingston Pier would be protected.

Access to Kingston Pier would be temporarily restricted during construction. The establishment of the land-based contractor's working area at Kingston Pier and the movement of spoil-laden trucks would also temporarily restrict access to Kingston Pier. Access is critical in maintaining the existing use of Kingston Pier which is of cultural significance to the people of Norfolk Island.

Public access to existing buildings and structures would be maintained during construction. However, it is noted that archaeological artefacts would seek to be securely stored within an available building near Kingston Pier such as the Boatshed which may hinder public access.

There would be no impact on any other heritage elements in Precinct H of the KAVHA.

3.1.2.2 Archaeological Potential – Water

Potential impacts to underwater cultural heritage identified by (Cosmos Archaeology 2021) include:

- Removal of seabed material from the harbour adjacent to Kingston Pier would remove and potentially destroy any cultural material within the Project envelope. The full extent of Option 3a is such that almost all of the remaining underwater archaeological resource associated with the Landing Place and Pier could be lost. Any shipwreck artefacts within the works envelope could also be lost
- Anchoring and spuds from a jack-up barge could impact (break up and/or destroy) archaeological remains
- Channel marker installation could impact the remains of the earlier convict period beacon – if any project machinery is to be installed on top of the reef beyond the Pier.

All identified artefacts would be recorded, and significant artefacts would be transferred to KAVHA ownership and managed appropriately. Artefacts determined to be of heritage value will be stored or displayed in the KAVHA museum, while the remainder would be reburied at sea near the site or discarded, should they be determined to not be of heritage value. The management of the underwater cultural remains is to be undertaken in accordance with the KPUAMP (Cosmos Archaeology 2022), which is provided in **Appendix I**.

The MNES guidelines (Department of Environment 2013) indicates that:

> *"An action is likely to have a significant impact on the World Heritage values [and/or National Heritage values] of a declared World Heritage property [and/or National Heritage place] if there is a real chance or possibility that it will cause:*
>
> - *one or more of the World [and/or National] Heritage values to be lost*
> - *one or more of the World [and/or National] Heritage values to be degraded or damaged, or*
> - *one or more of the World [and/or National] Heritage values to be notably altered, modified, obscured or diminished."*

It was assessed that the scale of the potential impact of the augmentation works on underwater cultural sensitivity areas without mitigation would be from Moderate to Major (Cosmos Archaeology 2021). In summary, the construction of the Project would likely:

> *"permanently remove, destroy, damage or substantially disturb a portion of an archaeological resource assessed to have critical cultural significance values in relation to World Heritage [and National Heritage] listed KAVHA."*

Therefore, the Project would likely have a significant impact without acceptable mitigation on the underwater cultural archaeological resource of the KAVHA and HMS Sirius which are of World and/or National Heritage significance. The potential impact on the underwater cultural archaeological resource of *HMS Sirius* would subsequently have an impact on the KAVHA as the cultural heritage values of both places are inextricably linked. The underwater cultural archaeological resource is an extension of the archaeological resource within the KAVHA created by different cultural behaviours and shaped by different site formation processes (Cosmos Archaeology 2020a).

The KAVHA and *HMS Sirius* are key heritage values of the Norfolk Marine Park which is a Commonwealth Marine Area. Given the Project would likely have a significant impact on the underwater cultural archaeological potential of the KAVHA and *HMS Sirius* as previously described, it is considered that the Project would also likely have a significant impact on the heritage values of the Norfolk Marine Park.

3.1.2.3 Archaeological Potential – Land

The construction of the Project would not involve any subsurface works on land located above the MHWM. Therefore, there would be no impact on the archaeological resource within the KAVHA, in particular Precinct H shown previously in Figure 2-3.

3.1.2.4 Land-Based Disposal Site

Old Cascade Quarry

The Old Cascade Quarry is located in the vicinity of Cascade Reserve. It is situated east of Cascade Pier and immediately adjacent to Cascade Cliff. The Old Cascade Quarry would be utilised as the land-based disposal location for spoil.

Filling and earthworks at Old Cascade Quarry would assist with the future rehabilitation of the former quarry site in accordance with NIRC's objectives as follows:

- Filling would re-use existing stockpiles and include free draining material to promote adequate drainage properties
- Earthworks and battering would provide effective runoff and good cross-falls towards the existing concrete drain to ensure good long-term surface drainage
- The design slopes and revegetation are required to provide adequate surface drainage and reduce the impact of substantial strength loss of the underlying tuff material when wet.

In doing so, the land-based works would ensure that a stable landform and topography is reinstated for an appropriate use. Topsoil would then be applied over reconstructed areas and grassed.

In a general sense, the proposed works at the Old Cascade Quarry would involve earthworks and therefore may impact subsurface archaeological potential. However, it is noted that the Old Cascade Quarry is already a highly disturbed environment which reduces this archaeological potential.

Knight's Farm (Item No. 79) has been highly disturbed by stone quarrying operations although it is reported that the masonry remains of an old cottage survive under the stockpiled overburden (Varman 1998). The proposed works at the Old Cascade Quarry may impact on the old cottage remains.

Cascade Cliff (Item No. 71) was significantly altered by major engineering work in 1999-2000. The proposed works at the Old Cascade Quarry adjacent to Cascade Cliff would have no impact on its historical value as a landscape feature, albeit modified, at the Jetty Area.

Fredick's Aege (Item No. 83) is of historical value as a lookout to the Jetty Area and an early orientation landmark from the sea. Given the localised nature of proposed works at the Old Cascade Quarry, there is unlikely to be an impact on the site.

In order to mitigate potential impacts, the Old Cascade Quarry will be inspected and surveyed to determine whether any above-ground archaeological potential exists that may be associated with Knight's Farm or Fredick's Aege.

3.1.3 Potential Operational Impacts

The Project would support the potential for greater use of Kingston Pier by various vessel operators. Following the completion of construction, Kingston Pier would continue to be used and appreciated by vessel operators, visitors and the local community. In addition, significant remains recovered during construction would be transferred to KAVHA ownership. The remains are expected to be stored and/or displayed at the Norfolk Island Museum.

As a result, there would be no impact on the KAVHA, its archaeological resource nor underwater cultural archaeology during operation. Rather, the display of significant remains would contribute to the interpretation and appreciation of the cultural significance of the place.

It is considered that the earthworks design at Old Cascade Quarry would effectively manage and divert the runoff flow path into the concrete drain. In addition, the concrete drain leads to a sump constructed from gabion baskets that filters the flow before it is discharged to the ocean. As a result, it is expected that there would be no impact on marine water quality during operation.

3.1.4 KAVHA Heritage Management Plan

The KAVHA HMP sets out conservation and management policies for the KAVHA. The Project has had consideration for the following relevant conservation and management policies:

- Section 8.1 Natural Environment – including to maintain water quality and reduce impacts on biodiversity
- Section 8.2 Cultural Landscape – including to conserve the heritage values of the cultural landscape and maintaining views and vistas
- Section 8.3 Structures and Objects – including to avoid impacts of significant heritage fabric, retain, repair and stabilise original fabric where possible and undertake the Project in accordance with the relevant articles of the Burra Charter
- Section 8.4 Archaeology – including to protect nearby land-based archaeological sites and features
- Section 8.6 Sustainable Development – including to facilitate continuation of significant traditional uses, cultural traditions and community uses which are of heritage value.

In addition, Sections 8.6.7 and 8.6.8 of the KAVHA HMP describe key elements of the approval process and impact assessment, respectively.

It is noted that in 2021, DITRDCA has engaged GML Heritage to review and update the current HMP, and a team lead by Conrad Gargett architects to prepare a Site Master Plan (SMP) for Kingston. Initial rounds of public consultation have occurred in 2022 with exhibition of the draft HMP and SMP to occur in coming months.

3.1.5 World Heritage Management Requirements

The proposed action adheres to and is consistent with the following:

- Australia's obligations under the World Heritage Convention and the *Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO 2021):
  - The Project is subject to approval under the EPBC Act, which is the Australian Government's main instrument for implementing its obligations under the World Heritage Convention and under the Operational Guidelines
  - The Project is consistent with paragraphs 96-119 of the Operational Guidelines in that the Outstanding Universal Value is sustained and enhanced and is guided by the approved KAVHA HMP which complies with the EPBC Act and the EPBC Regulations.
- Australian World Heritage management principles (Schedule 5 of the EPBC Regulations)
  - The Project is consistent with the General principles 1.01 to 1.04 that relate to implementing Australia's obligation under the World Heritage Convention and conducting extensive public consultation and involvement of KAHVA stakeholders
  - The Project has considered the relevant conservation and management policies of the KAVHA HMP which complies with Management planning principles 2.01 and 2.02 (refer to Section 3.1.4
  - The PER has been prepared to comply with Environmental impact assessment and approval principles 3.01 to 3.03 and the action will be subject to assessment and approval by the responsible authority under 3.04 to 3.06.
- *World Heritage Advice Note: Environmental Assessment* (IUCN 2013):
  - The Project has been subject of a rigorous environmental assessment through the submitted referral and with this PER and its supporting studies which meets the World Heritage Impact Assessment Principles
  - The Project meets IUCN's position on ensuring that it is compatible with the long term objective of preserving Outstanding Universal Values.
- *Australian Convict Sites Strategic Management Framework* (Department of the Environment and Energy 2018):
  - The Project has complied with the legislative framework and governance arrangements applicable to KAHVA, including the KAVHA HMP.

3.2 The National Heritage Values of KAVHA and HMS Sirius Shipwreck

3.2.1 Potential Impacts to the National Heritage Values of KAVHA

A description of the National heritage values of KAVHA is described in Section 2.3.2. Table 3-2 considers the potential impact on the official heritage values that constitute the heritage significance of the KAVHA as described on the National Heritage List.

Table 3-2 National heritage values of the KAVHA.

Heritage values	Key Attributes / Potential Impact
Criterion A Events, Processes	**Summary of Key Attributes** KAVHA demonstrates historical processes of four distinct settlement periods. Extant features such as buildings, ruins and landscapes as well as artefacts demonstrate the historical events, processes and practices at the place. The KAVHA is an outstanding example of a place of severe punishment. **Potential Impact** The works would not impact extant buildings, ruins, landscapes or land-based subsurface archaeological remains which provide an understanding of the historical development at the place. The stabilisation of Kingston Pier would improve the integrity of the structure.
Criterion B Rarity	**Summary of Key Attributes** KAVHA is uncommon as a place where pre-European Polynesian settlement and the European community has lived and practiced cultural traditions. **Potential Impact** The works would not impact on land-based subsurface archaeological evidence of European settlement. The works would also not impact on the ongoing use of the Cemetery.
Criterion C Research	**Summary of Key Attributes** KAVHA demonstrates archaeological research potential in understanding pre-European Polynesian culture, exploration and settlement patterns as well as the living and working conditions of Europeans, and changes in penal practices and philosophy during the period of convict transportation. **Potential Impact** The works would not impact on land-based subsurface archaeological evidence of European settlement which may contribute to an understanding of the settlement history of Norfolk Island.
Criterion D Principal characteristics of a class of places	**Summary of Key Attributes** KAVHA demonstrates extant elements of a longstanding penal settlement including buildings, structures and remains indicative of the activities and historic development associated with settlement. The role of harsh labour as punishment is evident in the archaeological remains of extant structures such as Kingston Pier. **Potential Impact** The works would not impact extant buildings, structures, ruins, land-based subsurface archaeological remains or landscapes that are associated with settlement activities. The integrity of Kingston Pier will be respected and enhanced.
Criterion E Aesthetic characteristics	**Summary of Key Attributes** KAVHA demonstrates aesthetic qualities of landscape and setting which are enhanced by elements including extant buildings, ruins, historic associations, the seascape and views.

Heritage values	Key Attributes / Potential Impact
	Potential Impact The works would have a temporary visual impact during construction on significant views and important visual relationships. However, residents and visitors would still be able to interpret and appreciate the aesthetic characteristics of the place.
Criterion G Social value	**Summary of Key Attributes** KAVHA demonstrates significant associations with the Pitcairn Islanders and their descendants. It is valued as a place of ongoing uses including continuity of the working port at Kingston Pier as well as areas for recreation, social and cultural events, and museums. **Potential Impact** The works would have temporary impacts on the continuation of existing port operations and access to Kingston Pier during construction. The stabilisation of Kingston Pier would improve the integrity of the structure and enable the continuity of culturally significant activities and processes at the place.
Criterion H Significant people	**Summary of Key Attributes** KAVHA demonstrates significant associations with early Australian identities. **Potential Impact** There would be no impact on associations with early Australian identities.

3.2.2 Potential Impacts to the National Heritage Values of HMS Sirius

A description of the National heritage values of *HMS Sirius* is described in Section 2.3.3. Table 3-3 considers the potential impact on the official heritage values that constitute the heritage significance of *HMS Sirius* as described on the National Heritage List.

Table 3-3 National heritage values of HMS Sirius.

Heritage values	Key Attributes / Potential Impact
Criterion A Events, Processes	**Summary of Key Attributes** The shipwreck of *HMS Sirius* represents a tangible link to one of the most significant vessels of the first fleet that is associated with early migration of European people to Australia. It was a mainstay of early colonial defence and the primary supply and communication link with Great Britain during the first two years of settlement. **Potential Impact** The augmentation works has the potential to disturb archaeological remains associated with the nearby shipwreck site that has spread into the channel from wind and wave action.
Criterion B Rarity	**Summary of Key Attributes** The archaeological remains of *HMS Sirius* are the only known remains of a vessel of the first fleet that sailed to Australia. The story and in-situ remains are pivotal

Heritage values	Key Attributes / Potential Impact
	to understanding aspects of life during the early years of the colony and is globally one of the few located examples of an 18th Century British warship. **Potential Impact** The augmentation works has the potential to disturb archaeological remains associated with the nearby shipwreck site.
Criterion C Research	**Summary of Key Attributes** The artefact collections and remaining in-situ fabric contain important physical evidence of the voyage to Australia and the movement of colonists to Norfolk Island. There is significant archaeological potential for research and represents a "time capsule" of cultural life up to the shipwreck in 1790. **Potential Impact** The augmentation works has the potential to disturb archaeological remains associated with the nearby shipwreck site. The identification of artefacts from the shipwreck would provide valuable information on how the vessel broke up and where the wreckage has spread in the area.
Criterion G Social value	**Summary of Key Attributes** The shipwreck has strong and special association with the Norfolk Island community, the descendants of the first fleet settlers and Australian community as a whole. The arrival of *HMS Sirius* and the first fleet on 26 January 1788 in Sydney Cove is one of the most important moments in the country's history **Potential Impact** Any information uncovered during the course of the construction would contribute to society's understanding of the shipwreck.
Criterion H Significant people	**Summary of Key Attributes** The shipwreck has special associations with the lives of prominent officers who served as officers on *HMS Sirius* including the first three governs of the colony of New South Wales. **Potential Impact** There would be no impact on associations with prominent identities.

3.2.3 KAVHA Heritage Management Plan

Refer to discussion in Section 3.1.4 which would apply to the National Heritage values of KAHVA.

3.2.4 Potential Construction Impacts

3.2.4.1 Kingston Pier

Refer to Section 3.1.2 for a discussion on construction impacts.

Where possible, local plant and equipment such as smaller excavators and heavy vehicles would be mobilised to Kingston Pier via Pier Street. A sediment box containing spoil would be lifted from the water to Kingston Pier to be screened for archaeological artefacts. Skip bins may also be used to assist the transfer of spoil to Kingston Pier.

Pier Street located within KAVHA would be used as the main access road for heavy vehicle haulage to and from Kingston Pier. It is noted that there is forecasted remediation work to the Pier Street Bridge, but this would likely commence after completion of the Project. It is understood that there is no official load limit at Pier Street Bridge. However, 25-tonne vehicles have previously travelled across the structure. There would be no impact to the bridge as a result of this Project.

All water-based vessels and plant and equipment are to operate within the harbour adjacent to Kingston Pier. As required, it is expected that existing vessel operators at Kingston Pier may be temporarily restricted at some point during construction. In addition, the Contractor would be required to coordinate the movement of existing vessel operators during construction in accordance with a Construction Environmental Management Plan (CEMP).

3.2.4.2 HMS Sirius

The KPUAMP (Cosmos Archaeology 2022) indicates that the *HMS Sirius* was wrecked on the outer reef 200 m to 250 m to the south-east of the proposed dredge envelope. It is possible that the strong currents flowing along the edge of the reef fringing Slaughter Bay may have brought floating wreckage into the vicinity of Kingston Pier before sinking or being pushed towards shore by wind and wave (Cosmos Archaeology 2022). Further, during the November 2020 test excavation by Cosmos Archaeology, a copper alloy nail of similar form to those found on the wreck site of *HMS Sirius* was also recovered.

The remains of wreckage that could be expected in the study area would be the rigging, decking and upper hull of a timber built vessel as well as cargo (Cosmos Archaeology 2022). Therefore, according to Cosmos Archaeology (2022), the identification of any artefacts from the wreck of the *HMS Sirius* during construction will provide valuable insights into how the vessel broke up and where the wreckage spread. In turn, this would allow for an informed prediction as to where cultural material associated with the wreck may be found across a wider area beyond the main wreck site as well as to the type of remains.

The KPUAMP identifies the focus and recovery aspects of the management of underwater archaeological resources including any artefacts related to *HMS Sirius* shipwreck, (Cosmos Archaeology 2022).

3.2.4.3 Old Cascade Quarry

The direct route from Pier Street to the Old Cascade Quarry is via Middlegate Road followed by Cascade Road. The Bounty Street and Quality Row bridges will not be used. Trucks would transfer spoil from Kingston Pier to the land-based disposal site at the Old Cascade Quarry. Each truck would have about a 12 to 14-tonne maximum load carrying capacity. It is estimated there would be about 510 to 595 return truck movements would be required.

Earthworks at Old Cascade Quarry would provide effective runoff through grading from south-west to north-east at a grade of -0.8%, allowing rainwater to runoff towards the north-east of site. The earthworks design would ensure good surface drainage in the long term. Therefore, it is considered that the earthworks design would effectively mitigate potential marine water quality impacts to Cascade Bay. In addition, it is expected that appropriate erosion and sediment controls would be implemented around the spoil stockpiles to minimise the potential for sediment-laden runoff.

3.2.5 Potential Operational Impacts

Refer to Section 3.1.3 for a discussion on potential operational impacts.

3.2.6 National Heritage Management Principles

The Project adheres to and is consistent with the National Heritage management principles under Schedule 5B of the EPBC Regulations, in particular principles 1 to 5 that aim to protect, conserve and respect the heritage values of the places. The Project also complies with the KAVHA HMP which has been made under Schedule 5A of the EPBC Regulations.

DITRDCA has as overall responsibility for the management of KAVHA, supported by the Heritage Manager and guided by the KAVHA Advisory Committee. The KAVHA Community Advisory Group also provides input on conservation and tourism activities at KAVHA. The NIRC provides services under an agreement with the Australian Government. Parks Australia is responsible for the management of the Norfolk Marine Park which includes the location of the National Heritage place, *HMS Sirius*.

3.3 Commonwealth Marine Environment

The Commonwealth Marine Environment including marine flora and fauna is described previously in Section 2.4.

3.3.1 Likely impacts with consideration to the Norfolk Marine Park Management Plan

The Project is located within the Norfolk Marine Park. The Norfolk Marine Park is around Norfolk Island, including Nepean Island Reserve and Phillip Island, approximately 1400 km offshore from Evans Head in NSW. The Norfolk Marine Park spans 700 km in a north–south direction, covering an area of 188,444 km^2 and a depth range of 5,000 m up to the high-water mark. The Norfolk Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Norfolk Marine Park on 9 October 2017. The Norfolk Marine Park is assigned IUCN category IV and includes three zones assigned under this plan: National Park Zone (II), Habitat Protection Zone (IV) and Special Purpose Zone (Norfolk) (VI) (refer to Figure 2-12). The Project occurs within the Special Purpose Zone (Norfolk) (VI) which allows for both conservation and sustainable use in a highly valued natural area (Parks Australia 2020). The Project scope is a permissible activity within this zone.

The Norfolk Marine Park is managed under the Temperate East Marine Parks Network Management Plan 2018; https://parksaustralia.gov.au/marine/pub/plans/temperate-east-management-plan-2018.pdf.

The values of the Norfolk Marine Park, as outlined in the Temperate East Marine Parks Network Management Plan 2018 (Director of National Parks 2018) are provided in Section 3.3.2. Potential impacts on these key values are covered within previous and ensuing Sections of this document.

3.3.2 Values of the Norfolk Marine Park

3.3.2.1 Statement of Significance

The Norfolk Marine Park is significant because it contains habitats, species and ecological communities associated with the Norfolk Island Province. It includes two key ecological features: Norfolk Ridge, and the Tasman Front and eddy field, both valued for high productivity, aggregations of marine life, biodiversity and endemism.

3.3.2.2 Natural Values

The Norfolk Marine Park includes examples of ecosystems representative of the Norfolk Island Province. The mixing of warm-water and cold-water currents and eddies, and their interactions with seamounts influence biological productivity, with east-moving eddies associated with the Tasman Front transporting Coral Sea biota including corals, crustaceans and molluscs to the area. The shallow-water habitats of Norfolk Island support diverse tropical and temperate species of fish, corals and other marine organisms similar to those found in the reefs surrounding Lord Howe Island, but with a unique reef fish assemblage of endemic, sub-tropical and temperate species. Coral reefs in Emily Bay and Slaughter Bay are the eastern-most coral reefs in Australian waters.

Key Ecological Features of the Norfolk Marine Park are:

- Tasman Front and eddy field—a region that separates the warm, nutrient-poor waters of the Coral Sea from the cold, nutrient-rich waters of the Tasman Sea, providing increased nutrients and plankton aggregations, and enhanced productivity that attracts mobile species such as turtles, cetaceans, tuna and billfish.
- Norfolk Ridge—a steep-sided, narrow and elongated feature approximately 1,000 km long and 70 km wide. The pinnacles and seamounts of the Norfolk Ridge support relatively productive and diverse benthic habitats, and are thought to act as stepping stones for faunal dispersal, connecting deep-water fauna from New Caledonia to New Zealand.

The Norfolk Marine Park supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the Norfolk Marine Park include breeding and foraging habitat for seabirds, and a migratory pathway for humpback whales.

The natural values of the Norfolk Marine Park are described previously in Section 2.4.

3.3.2.3 Cultural Values

The marine environment around Norfolk Island has long held significance among Norfolk Islanders. A unique community and culture has been developed by those who have visited and settled the island over time.

Polynesian

The first people to inhabit Norfolk Island were of Polynesian descent. Stone tools have been found at both Emily and Slaughter bays within the Kingston and Arthur's Vale Historic Area (see Heritage values). Archaeological investigations have revealed evidence of landscape modifications in the Emily Bay area including artefact assemblages and structural remains that have been interpreted as a

rudimentary marae, a religious structure characteristic of East Polynesian culture. Radiocarbon dating indicates Polynesian settlement of the area occurred between AD 1200 and AD 1600.

Pitcairn Islanders

In 1853, an Order in Council repealed all previous orders making Norfolk Island a penal settlement. Occupation was granted to incoming settlers from Pitcairn Island, who constituted the third settlement phase of the island's history. The whole Pitcairn community landed on Norfolk Island in 1856. Their descendants, who comprise the majority of Norfolk Island's population, still speak the Pitcairn language.

Indigenous Australians

Across Australia, Indigenous people have been sustainably managing their sea country for tens of thousands of years. At the commencement of this plan, there is limited information about the cultural significance of the Norfolk Marine Park to Indigenous people due to its remote location.

3.3.2.4 Heritage Values

National heritage

Kingston and Arthur's Vale Historic Area (on Norfolk Island, adjacent to the Norfolk Marine Park), is one of 11 sites that make up the Australian Convict Sites world heritage property.

Commonwealth heritage

There are no Commonwealth heritage sites within the Norfolk Marine Park. However, there are Commonwealth heritage places on Norfolk Island that provide important habitat for seabirds that forage in the Marine Park.

Adjacent to Norfolk Island, Nepean Island Reserve and Phillip Island are on the Commonwealth Heritage List, providing important breeding habitat for at least eight species of seabird that also forage in the Norfolk Marine Park.

Historic shipwrecks

The Norfolk Marine Park contains over 20 known shipwrecks listed under the Historic Shipwrecks Act 1976 (including six shipwrecks that are less than 75 years old that will become eligible for listing as historic shipwrecks during the life of this plan). One of these is the *HMS Sirius*, a flagship of the First Fleet, which was wrecked on the coral reef off Slaughter Bay, Norfolk Island in 1790.

European heritage

Discovered by Captain James Cook in 1774, Norfolk Island was inhabited by convicts and free settlers from 1788. This first settlement's population peaked at 1156 in 1792. By 1804, the free settlers on the island significantly outnumbered convicts. The first settlement was abandoned in 1814, and later reoccupied in 1825 as a penal settlement

3.3.2.5 Social and Economic

Fishing in the Norfolk Island Inshore Fishery area is managed by the Norfolk Island Regional Council in collaboration with the Norfolk Island Fishing Association, and in accordance with the Norfolk Island

Inshore Fishery Policy 2009. The associated Memorandum of Understanding (MoU) with the Australian Fisheries Management Authority (AFMA) for the inshore fishery area known locally as the "MoU Box" has enabled AFMA to provide management expertise and guidance to the Norfolk Island Regional Council and the Norfolk Island Fishing Association as required. The "MoU Box" area existing at the time of commencement of this plan has been zoned Special Purpose Zone (Norfolk) and the community has a strong affinity and interest in its management.

Within the coastal waters surrounding Norfolk Island, boating and shipping, tourism and recreation are important activities in the Norfolk Marine Park. This includes the sheltered coral lagoon of Emily Bay which is a valuable community asset used for swimming, snorkeling and tourism. These activities contribute to the economy and wellbeing of the island community.

3.3.3 Impacts on the natural, cultural, heritage and socio-economic values of the Norfolk Marine Park

The natural, cultural, heritage and socio-economic values of the Norfolk Marine Park are described in Section 3.3.2 as well as Sections 3.1 and 3.2.

Potential Impacts

Potential impacts on the natural, cultural, heritage and socio-economic values of the Norfolk Marine Park are described below. Impacts on the following matters are considered:

- Habitats, species and ecological communities within the Norfolk Marine Park, and the processes that support their connectivity, productivity and function
- The benefit of the Norfolk Marine Park for people, businesses and the economy
- Living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites
- Non-Indigenous heritage that has aesthetic, historic, scientific or social significance
- The heritage values of the historic shipwreck, *HMS Sirius*.

3.3.3.1 Habitats, species and ecological communities within the marine park, and the processes that support their connectivity, productivity and function

The Norfolk Marine Park begins approximately 1,400 km offshore and covers 188,444 km^2 with depths of up to 5,000 m. The Norfolk Marine Park comprises a number of zones, including a National Park, Multiple Use and Special Purposes zone. The Special Purpose Zone is located directly around Norfolk Island and allows for both conservation and sustainable use in a highly valued natural area (Parks Australia 2020). Within the Norfolk Marine Park lies the Norfolk Ridge. The Norfolk Ridge provides a rich biological source of benthic biodiversity and endemism. Similarly to the Lord Howe chain, the ridge also generates localised oceanographic changes which create sites of enhanced productivity and aggregates of marine species (Parks Australia 2020).

The values of the Norfolk Marine Park including ecosystems and their constituent parts, bathymetric characteristics, coral structures, natural and physical resources, social, economic and cultural values and heritage values are described in Section 2.4. In addition, marine species and potential impacts on them are described in Section 3.3.5.

3.3.3.2 The benefit of marine parks for people, businesses and the economy

The Norfolk Marine Park plays a large role in the fishing industry on Norfolk Island. The NIRC and the Norfolk Island Fishing Association manages the Norfolk Island Inshore Fishery area, located in Special Purpose Zone (Norfolk) (IUCN VI). Other activities within the Norfolk Marine Park include boating and shipping, tourism and recreation, which provide a variety social and economic value to the community. Emily and Slaughter Bay, adjacent to Kingston Pier, are particularly popular swimming and snorkeling destinations due to their extensive coral reef system, with Emily Bay offering more sheltered conditions, ideal for families and tourists without the knowledge of the changing ocean and tide conditions in Slaughter Bay.

3.3.3.3 Living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites

It is noted for the Norfolk Marine Park that "*Across Australia, Indigenous people have been sustainably managing their sea country for tens of thousands of years. At the commencement of this plan, there is limited information about the cultural significance of this Marine Park to Indigenous people due to its remote location*" (Director of National Parks 2018). On this basis, Indigenous beliefs have not been considered further in the PER.

3.3.3.4 Non-Indigenous heritage that has aesthetic, historic, scientific or social significance

The KAVHA is comprised of precincts. The Project is located adjacent to Precinct H. There are 57 significant elements within Precinct H, as described previously in Section 2.2.1.

The KAVHA is listed on the following heritage lists:

- UNESCO World Heritage List as one of the 11 places that make up the 'Australian Convict Sites' World Heritage serial listing inscribed 31 July 2010
- Commonwealth Heritage List on 22 June 2004 (excluding areas of freehold tenure)
- National Heritage List on 1 August 2007
- Norfolk Island Heritage Register dated 9 December 2003.

The wreck site of *HMS Sirius* is located east of Kingston Pier in the vicinity of the Project. The wreck site is listed on the following heritage lists:

- Commonwealth Heritage List on 25 October 2011
- National Heritage List on 25 October 2011.

The KAVHA and *HMS Sirius* are inextricably linked. It is noted from the heritage listing of the KAVHA on the Commonwealth Heritage List that the:

> *"KAVHA is closely associated, through fabric and artefacts, with the wreck of the Sirius in 1790, a calamitous event in the early history of the colony of New South Wales".*

Refer to Sections 2.2, 2.3 and 2.4.6 for description of the respective heritage values of the listings.

3.3.3.5 The heritage values of the historic shipwreck, HMS Sirius

The shipwreck that had the most impact on the fledgling first Norfolk Island settlement was the wrecking of *HMS Sirius*. In March 1790, HMS *Sirius* was sent to Norfolk with a contingent of supplies, convicts and marines to relieve the overcrowding at Sydney Cove.

On 19th March 1790, *HMS Sirius* sailed close to shore at Sydney Bay (Kingston) to unload its supplies when a strong current forced the vessel to lose control while attempting to leave the bay. Its dropped anchor was not enough to withstand the strong winds which eventually snapped the chain and threw the vessel more than its own length nearer to the shore. HMS *Sirius* remained here until it fully disintegrated almost two years later.

The archaeological remains of *HMS Sirius* are considered to be of critical significance value in accordance with the following excerpt from the Commonwealth Heritage List:

> *"The archaeological investigations of the shipwreck site of HMS Sirius have demonstrated its significant archaeological potential for research into the cultural heritage of the early European settlement of Australia. The remaining fabric of HMS Sirius and associated artefact assemblages represents a "time capsule" of cultural life from the period leading up to its shipwreck in 1790."*

Refer to Section 2.3.3 for a description of the heritage values.

3.3.4 Likely impacts associated with the construction and operation of the proposed action

Likely construction and operational impacts on the Commonwealth Marine Environment are described below including impacts on water quality, sediment quality, aquatic ecology (marine habitats). Impacts on marine fauna are outlined in Section 3.3.5. Impacts on terrestrial ecology are outlined in Section 3.4.5.

3.3.4.1 Potential Construction Impacts

Water Quality

The main sources of potential marine water quality impacts during construction are described below:

- Sediment plumes generated during augmentation works
- Accidental spills of fuel, oil and other harmful substances from construction vessels, plant and equipment into the harbour adjacent to Kingston Pier
- Incorrect disposal of general waste and construction waste into the harbour.

Other sources of potential marine water quality impacts during construction include:

- Sediment spills occurring from transfer of the sediment box from the seabed to Kingston Pier
- Sediment spills occurring from the transfer of marine sediments and rock from the jack-up barge to Kingston Pier via floating hopper or flat topped barge and/or skip bins
- Dewatering activities at Kingston Pier.

Sediment Plumes

Advisian undertook a Dredge Plume Modelling Study (Advisian 2021c) (**Appendix H**) to investigate the dispersion of sediments into nearby marine area as a result of the activities required for the Project. The study investigated the potential risk of dispersion of sediments into nearby Slaughter Bay Lagoon and fringing reef area, as a result of the dredging works for the deepening of the harbour.

The purpose of the modelling exercise was to understand:

- The potential distribution of sediment plumes that could be generated by the dredging
- The intensity of the sediment plumes
- Seasonal effects on the suspension of material and sedimentation patterns in the vicinity of the harbour, to support the environmental assessment.

The Dredge Plume Modelling exercise informed the selection of a timeframe (or season) for undertaking the Project activities to minimise the risk to the sensitive nearby reef areas, as well as informing the daily operation of the dredging to minimise any impact.

The full range of conditions that could be experienced at the site, based on analysis of historical measurements of waves, winds and currents, was modelled to understand how far the sediment plume may travel from the dredge site, and whether there would be any settling of sediments outside the immediate construction area as a result of the Project. A highly conservative approach was adopted for the study (see scenarios below) with a full description of study methods, including study limitations/accuracy, provided in the Dredge Plume Modelling Study (Advisian 2021c, **Appendix H**).

Eight separate scenarios were examined to understand the full range of possible wave and current conditions that can occur during the dredging period and assess the full extent of dispersion and movement of the plumes away from the dredge site under the different conditions. The conditions examined included:

- **Scenario 1 (ambient wind, no waves)** - a baseline scenario simulated the dredge plume dispersion under ambient winds (or "everyday" wind speeds and directions) but without waves. This scenario provided a baseline for comparison between the other scenarios and to understand the sensitivity of the model without waves. This scenario does not represent real world conditions but does demonstrate the positive effect of waves containing a sediment plume.
- **Scenario 2 (ambient wind, ambient waves)** - ambient winds from all directions and with ambient (or everyday) waves. These are considered typical conditions that can be expected at the site and represent the most likely scenario that may occur during the dredging campaign.
- **Scenario 3, 4, 5 and 6 (strong winds from the north, south, east and west respectively, no waves)** – these scenarios used an extreme (95th percentile) wind speed coming from the north, south, east and west and without including the impact of waves, and therefore are conservative. The purpose of these scenarios was to determine which wind directions could result in the plume moving toward the reef and lagoon areas, and to inform which wind directions should be tested with the inclusion of waves. From these scenarios, northerly and westerly winds were found to have the greatest potential for movement of sediments toward the lagoon area. The scenarios that modelled winds from the south and east demonstrated

little to no potential for sediment to move towards the lagoon area and therefore were not investigated further.

- **Scenario 7 and 8 (strong winds from the north and west respectively, ambient waves)** – these scenarios investigated the effect of ambient waves on Scenarios 3 and 6, for northerly and westerly winds, thus representing a realistic "worst-case scenario" representation of real-world conditions during the dredging period.

Importantly, no sediment plume was detected for the lagoon and coral reef areas for both the 80th and 95th percentile for the typical (most likely) scenario, or for the real world worst case scenario.

The study also showed that sedimentation would be confined within Kingston Harbour around the proposed dredging area. No sedimentation was detected for the nearby lagoon and coral reef areas for any scenario.

A summary of results is provided in Table 3-4.

Table 3-4 Summary of sediment plume modelling results.

Scenario	Result
Scenario 1 (baseline scenario with ambient wind, no waves)	No plume detected for the lagoon and coral reef areas for both the 80th and 95th percentile.
Scenario 2 (typical conditions - most likely scenario; ambient wind, ambient waves)	No plume detected for the lagoon and coral reef areas for both the 80th and 95th percentile.
Scenarios 4 and 5 (strong winds from south and east)	No plume detected for the lagoon and coral reef areas for both the 80th and 95th percentile.
Scenarios 3 and 6 (strong winds from north and west – unrealistic scenario)	Limited dredge plume (less than 10 mg/L) detected for lagoon and coral areas for the 80th percentile. For the 95th percentile, the dredge plume (up to 25 mg/L) was detected heading toward the lagoon and coral reef areas (i.e. the western end of Slaughter Bay).
Scenario 7 and 8 (strong winds from the north and west respectively, ambient waves – real world 'worst case' scenario)	No plume detected for the lagoon and coral reef areas for both the 80th and 95th percentile.
Sedimentation	Sedimentation confined within Kingston Harbour around the proposed dredging area. **No sedimentation detected for the lagoon and coral reef areas for any scenario.**

Placement of Dredge Spoil on Land

The dredge spoil has been categorised as suitable for unconfined water-based disposal as well as land-based disposal. The spoil would be transported and placed at the land-based disposal site at the Old Cascade Quarry. The spoil would be dewatered at Kingston Pier and then transported for stockpiling at the Old Cascade Quarry. The Contractor will implement erosion and sediment controls around the stockpiles to minimise any potential impacts on sediment and marine water quality at nearby coastal environments and at any nearby surface water bodies.

Sediment Quality

Augmentation and Sediment Disturbance

Marine sediments and rock may be mobilised at the site during construction via:

- Direct disturbance of the seabed from plant and equipment used to augment the existing channel bed (approximately 0.29 ha for Option 3a)
- Sediment spills occurring from transfer of the sediment box from the seabed to Kingston Pier
- Sediment spills occurring from the transfer of marine sediments and rock from the jack-up barge to Kingston Pier via floating hopper or flat-topped barge and/or skip bins
- Dewatering activities at Kingston Pier
- Driven or bored piling of the jack-up barge legs into the seabed
- Installation of the channel navigation aid.

Minor disturbance and mobilisation of marine sediments may also occur as a result of other construction activities such as boat movements (i.e. propeller wash) in the harbour.

While the 95% UCL of metal concentrations in tested marine sediments proposed to be augmented were below the NAGD low level screening guidelines for all contaminants of concern except for nickel, the settlement of resuspended marine sediments has the potential to impact marine flora and fauna.

The use of plant and equipment associated with the activities of the Project have the potential to impact the quality of marine sediments and rock. This may occur via a water quality contamination event such as fuel and/or oil spills which consequently impact marine sediment quality. The quantities of fuels, oils and other chemical pollutants that may be spilled into the harbour adjacent to Kingston Pier would be small. In addition, that fact that the site is already used by a range of vessel operators suggests that the likelihood of these impacts from short-term use by plant and equipment is considered to be low.

Placement of Dredge Spoil on Land

The dredge spoil has been categorised as suitable for unconfined water-based disposal as well as land-based disposal. The spoil would be transported and placed at the Old Cascade Quarry. Land-based sediments and rock may be mobilised at the Old Cascade Quarry during construction via some disturbance of existing grasses, remnant shrubs and habitat to allow for stockpiling.

Aquatic Ecology

Marine Habitats

The potential impacts on marine habitats which occur within the study area are described below.

Marine Protected Areas

The Project is located within the Special Purpose Zone of the Norfolk Marine Park and has the potential to have direct and indirect impacts on marine habitats and fauna within this area as described in the ensuing sections.

Critical Habitat

There are no listed areas of Critical Habitat under the EPBC Act that occur within the study area. Therefore, there would be no impact on these.

Key Ecological Features

KEFs which occur within the Temperate East Marine Region and which were listed in the Protected Matters Search within a 10 km radius of the study area are the Norfolk Ridge and the Tasman Front and eddy field. It is not expected that the Project would significantly impact either of these KEFs.

The Norfolk Ridge stretches across the Temperate East Marine Region, including waters around Norfolk Island. The Norfolk Ridge provides a rich biological source of benthic biodiversity and endemism. The Project is not expected to significantly impact these attributes as discussed in ensuing sections relating to marine biodiversity and potential impacts.

The Tasman Front is a region of intermediate productivity that separates the warm, nutrient-poor waters of the Coral Sea from the nutrient-rich waters of the Tasman Sea. The Project will not include any activities which will significantly impact on this region of productivity.

Marine Habitats

Potential construction impacts on marine habitats and flora are included in the Marine and Terrestrial Ecology Report (Advisian 2021a, **Appendix F**) and are summarised below:

- Sedimentation of seafloor habitats within the immediate construction area, including inshore subtidal reef dominated by macroalgae, from the settlement of sediments which may be generated during augmentation and from the activities of construction vessels. These impacts would not be able to be avoided within the immediate construction zone. However, the implementation of mitigation measures can mitigate impacts outside of the immediate construction zone under most oceanic and/or meteorological conditions as described in the Dredge Plume Modelling Study (**Appendix H**) - *No sediment plume was detected for the lagoon and coral reef areas for both the 80th and 95th percentile for the typical (most likely) scenario, or for the real world 'worst case' scenario. The study showed that sedimentation would be confined within Kingston Harbour around the proposed dredging area. No sedimentation was detected for the nearby lagoon and coral reef areas for any scenario.*
- Short-term reductions in light availability in the immediate construction area through increased turbidity caused by augmentation. It is expected that the use of mitigation measures to prevent the spread of sediment plumes would avoid or limit the potential for this risk further afield of the immediate construction zone
- Direct harm (removal) to the seafloor habitat which includes areas of low profile subtidal reef within the area of augmentation from the proposed works
- Direct harm to the seafloor habitat and potentially small areas of marine vegetation (macroalgae) in the immediate construction area from Kingston Pier stabilisation works
- Highly localised direct harm to seafloor habitats in Kingston Harbour (including subtidal reef and soft sediment areas) through the activities of construction vessels, such as anchoring, during construction

- Impacts of water pollution on marine habitats and species from vessel activities such as accidental spills of fuel, oils and other harmful substances, and incorrect disposal of general and construction waste.

Turbidity Impacts to Marine Habitat

The mobilisation of uncontained marine sediments outside the immediate construction zone has the potential to cause sedimentation of nearby sensitive subtidal habitats including the macroalgae and corals which form part of the subtidal rocky reef. However, it is considered that with appropriate containment these potential impacts can be minimised. Although a range of marine species (including algal-grazing fish species) in the vicinity of Kingston Pier have the potential to be impacted by turbidity-generating construction activities, it is generally considered that corals are amongst the most sensitive to disturbance, and therefore, would be susceptible to potential changes in light availability as well as sedimentation from turbidity-generating activities. Subtidal rocky reef to the west of Kingston Pier was primarily macroalgal dominated, whereas reef to the east and inside the lagoon at Slaughter Bay was predominantly coral. The algae within the area around Kingston is heavily relied upon by lagoon and other fishes as an important food source. The tolerance limits of corals for suspended matter is wide and demonstrates that different coral species and corals in different geographic regions may respond differently to turbidity increases. Tolerance limits are presented in Table 6-1 of the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**). In addition, it is noted that tolerance may also be a function of coral morphology. Given the ecological significance of the present corals and the high ambient marine water quality around Kingston Pier, it is assumed that tolerance limits for turbidity would be in the lower range.

While turbidity impacts within the immediate construction zone cannot be avoided, turbidity impacts on corals and other marine flora and fauna (including algal-grazing fish species) with Slaughter Bay and Emily Bay are not expected to occur or will be minimal. The Dredge Plume Modelling Study (**Appendix H**) indicated that no sediment plume was detected for the lagoon and coral reef areas for both the 80th and 95th percentile for the typical (most likely) scenario, or for the real world 'worst case' scenario. In addition, the proposed augmentation works have been planned to be completed by the expected start of the coral spawning period (which is anecdotally reported to occur from late December through to February).

Sedimentation Impacts to Marine Habitat

While long-term sedimentation is a major stressor that can lead to significant coral mortality, it need not necessarily kill a reef. An important factor minimising permanent damage is a high-energy wave environment, either by surge or currents, that serves to resuspend and move sediment from corals. This scenario would be observed for the reefs to the west of Kingston Pier.

Overall, it is considered that the increases in turbidity and/or sedimentation from construction activities including augmentation and pier stabilisation are likely to be very short-lived and highly localised with the implementation of the proposed mitigation measures to contain sediment plumes. The works are not expected to result in extended periods of impact on coral survival adjacent to Kingston Pier or in Slaughter Bay. Furthermore, increases in turbidity are not expected to result in any significant impacts on sessile marine flora and fauna in areas of subtidal rocky reef, for example through clogging of pores or filter feeding apparatus. While the Dredge Plume Modelling Report has shown that the likelihood of significant turbidity impacts in Slaughter Bay or Emily Bay is low during the majority of oceanic and meteorological conditions, it is recommended that caution be applied in

the use of threshold limits for turbidity and sedimentation considering the sensitivity of corals in these areas.

The Dredge Plume Modelling Study (**Appendix H**) indicated that sedimentation would be confined within Kingston Harbour around the proposed dredging area. No sedimentation was detected for the nearby lagoon and coral reef areas for any scenario. In addition, the proposed augmentation works have been planned to be completed by the expected start of the coral spawning period (which is anecdotally reported to occur from late December through to February).

Potential Impacts to Seafloor Habitat

Augmentation works would disturb approximately 0.29 ha of the seabed and remove existing areas of soft sediment habitat with loss of residing epifauna. There would also be loss of some areas of previously disturbed rocky substrate with little epibiotic cover. There was no evidence of infauna in collected sediment samples within the existing channel. The pier stabilisation works would impact on largely unvegetated, soft sediment seafloor habitat and associated reef fauna which is not considered to be significant in the context of potential impacts resulting from augmentation. Furthermore, it is considered that any small-scale and localised impacts to macroalgae would not be significant as there is an abundance of macroalgae, in better condition, inhabiting nearby subtidal reefs to the west and east of Kingston Pier. Algal-grazing fish species would therefore be able to utilise for example, nearby subtidal rocky reef to the west of Kingston Pier which is primarily macroalgal dominated.

The proposed works to the Rock Revetment would have an impact on a small area of the foreshore and would be minimised through the replacement of select areas of rock. This impact is considered insignificant. The Seawall works would similarly be localised to the repair areas and would leave the remaining beach undisturbed.

The area likely to be directly impacted by augmentation is within the existing channel, and therefore, has been previously disturbed. Any channel widening beyond the existing channel would most likely impact small areas of rocky reef including the likely removal of some macroalgae and isolated corals. Therefore, the potential impact of the preferred design option, Option 3a, on direct disturbance of the seabed is considered to be negligible.

For further detail on potential impacts on marine and terrestrial habitats, including corals, refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

3.3.4.2 Potential Operational Impacts

Water Quality

The Project would support the potential for greater use of Kingston Pier by various vessel operators. Potential impacts would be largely associated with vessel operators and include the following:

- Accidental spills of fuel, oil and other harmful substances
- Run-off from washing the topside of vessels leading to contamination of the local water column with potential pollutants such as oils, detergents and plastics
- Increased levels of suspended sediments resulting from propeller wash from vessels disturbing sediments on the seabed upon entry and exit from the harbour and accumulating on nearby marine habitats

- Pollution of the harbour with general waste.

Compared to the existing use of Kingston Pier by various vessel operators, the potential impacts on marine water quality during operation are considered to be negligible.

Sediment Quality

Increased Use of Kingston Pier

The Project would support the potential for greater use of Kingston Pier by various vessel operators although, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic would be minimal. Nevertheless, this increases the risk of contaminants entering the harbour and potentially contaminating marine sediments and rock. Potential contaminants include accidental spills of fuels and oils, general waste material from passenger and commercial vessels. Any liquid spills would remain on the surface of the water or become entrained in the water column and subsequently dispersed through wave and current action, while some may settle on the seabed and lead to potential contamination of marine sediments and rock. The likelihood for contamination of marine sediments and rock during operation is considered to be low given the scale of port operations at Kingston Pier and the existing wave climate in the harbour.

Future Channel Maintenance

The channel is not expected to require ongoing maintenance as the area is surrounded by rocky reef and is not fed by a nearby sediment source. Marine sediments that are deposited within the channel would typically not build up to levels that would potentially impact on navigation as it would be flushed as a result of wave action.

Placement of Spoil on Land

Any spoil that is stockpiled for an extended period of time, albeit unlikely, would be vegetated and moved to flat ground. This would help to stabilise the stockpiles and minimise any potential impacts on sediment and marine water quality.

Aquatic Ecology (Marine Habitats)

Increased Use of Kingston Pier

The Project would support the potential for greater use of Kingston Pier by various vessel operators although, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic would be minimal.

Marine Habitats

Compared to existing conditions at Kingston Pier, the potential marine water quality impacts on marine habitats during operation are expected to be negligible as the increase in vessel traffic would be minimal.

Marine Debris

The potential impacts of marine debris during operation are considered to be the same as those identified during construction with the exception of construction waste. Compared to existing

conditions at Kingston Pier, the potential impacts of marine debris during operation on marine habitats are expected to be negligible.

Recolonisation of the Augmented Channel

It is highly likely that the composition of the seabed would revert to that in the existing channel, including coarse sand and rock as well as loose gravel substrate. The potential for infauna and macroalgal species to recolonise sand and rock, respectively, would depend on the amount of turbulence on the seabed caused by the prevailing wave climate as well as potential scouring from vessel operators. Therefore, it is likely that some seabed areas nearest Kingston Pier would remain devoid of marine growth, whilst other areas along the seaward edge of the channel would likely recolonise with corals and macroalgae.

3.3.4.3 Methodology for Inspection and Cleaning of Marine Vessels

The plant and equipment which will be used during construction includes marine vessels for transportation of construction equipment and vehicles to the island, as well as plant and equipment that will be used in the construction, dredging and pier stabilisation operations. These plant and equipment are anticipated to include:

- Venturi suction pipe
- Jack-up barge
- Backhoe
- Hand-tools
- Rock breaker attachment
- Drum cutter attachment
- Hopper/flat barge and skip bins
- A tug.

There are no dry-docking facilities on the island, however the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) inspects all vehicles as they land on the island. For all commercial vessels and/or barges dredge or other equipment coming from overseas the DAFF processes for pre-arrival, arrival and inspection and post-arrival will be followed. All plant and equipment will be required to be thoroughly cleaned and inspected as part of that process and subject to a Vessel Risk Assessment prior to mobilisation to site. The final methodology and responsibility of ensuring this occurs will lie with the Contractor and DITRDCA and be in accordance with the mitigation measures outlined in this PER and the CEMP.

3.3.4.4 Maritime Incident Response Plan

A description of the proposed methodology to be implemented for any maritime incidents/accidents involving vessels that will be used in construction, dredging and pier stabilisation operations (e.g. grounding, sinking, fuel spills) has been included within a standalone Maritime Incident Response Plan which is attached at **Appendix K**.

3.3.5 Potential impacts on marine species including but not limited to cetaceans, turtles, fish and marine invertebrates

Marine fauna in the Norfolk Marine Park and described in Section 2.4. Potential impacts from construction and operation are described below.

3.3.5.1 Potential Construction Impacts

Marine Fauna

Potential direct and indirect impacts during construction on marine fauna including marine and migratory seabirds, are described below. Direct impacts on terrestrial fauna are very unlikely to occur but are described in Section 3.4.5.

Marine Vertebrates

Potential impacts on marine fauna are summarised below:

- Entanglement and/or ingestion of marine debris which can cause restricted mobility, starvation, infection, amputation, drowning and smothering of marine fauna
- Impacts of floating plant which has the potential to impact marine fauna through noise impacts, vessel strike, liquids or solid material spills or cable strike
- Potential entanglement in / entrapment within silt curtains
- Impacts of water pollution from accidental spills of fuel, oil and other harmful substances which may be ingested by marine fauna or stick to their bodies, feathers or fur
- Lighting impacts predominantly relating to the use of artificial lighting on vessels and equipment. Artificial lighting may influence the behaviour of coastal, marine and migratory birds
- Noise impacts relating to augmentation works, pilling and construction vessel engines. The impacts of noise on marine fauna may be behavioural or physiological. The augmentation works and piling would be the main sources of underwater construction noise. Piling typically emits the noise frequencies which are potentially most harmful to marine fauna.

Mobile marine fauna species including seals, fishes (including algal-grazing species), turtles and other vertebrates will either avoid or remove themselves from the immediate construction area during the works if they happen to be in the area during this work. The species are expected to continue to use surrounding areas outside the immediate construction area including the waters of Slaughter Bay and Emily Bay given that the potential increases in turbidity and/or sedimentation from construction activities including augmentation and pier stabilisation are likely to be very short-lived and highly localised (refer to discussion in Section 3.3.4.1 for impacts to marine habitats). Further discussion on specific impacts where these species may avoid the immediate construction area such as due to construction lighting and noise impacts are discussed below.

Entanglement / Ingestion of Marine Debris

Marine fauna which utilise the study area have the potential to be adversely affected by marine debris which may be generated during construction or operation and accidentally or deliberately disposed of

into the local waterway. This risk is also possible for terrestrial fauna which occur near the marine study area (although this would be expected to be very uncommon).

Harmful marine debris may include plastic garbage. Plastic materials are defined as bags, bottles, strapping bands, sheeting, synthetic ropes, synthetic fishing nets, floats, fibreglass, piping, insulation, paints and adhesives. There is the potential for plastic general waste and construction waste to be generated during construction. Disposal of plastics at sea is totally prohibited by the International Convention (DEH 2003).

Entanglement of fauna in marine debris can cause restricted mobility, starvation, infection, amputation, drowning and smothering. Ingestion of marine debris occurs when species confuse items such as plastic bags, rubber, balloons and confectionery wrappers with prey and ingest them, causing a physical blockage in the digestive system, leading to internal injuries.

DEH (2003) lists the following marine fauna listed under the EPBC Act 1999 which are thought to be particularly vulnerable to ingestion or entanglement in marine debris:

- Loggerhead turtle (*C. caretta*) - endangered
- Southern right whale (*E. australis*) - endangered
- Blue whale (*B. musculus*) - endangered
- Leatherback turtle (*D. coriacea*) - vulnerable
- Hawksbill turtle (*E. imbricata*) - vulnerable
- Flatback turtle (*N. depressus*) - vulnerable
- Green turtle (*C. mydas*) - vulnerable
- Humpback whale (*M. novaeangliae*) - vulnerable
- Grey nurse shark (*C. taurus*) – vulnerable

Construction Equipment and Cable Strike

The expected construction equipment required for the Project includes:

a. a venturi suction pipe

b. a jack-up barge

c. an appropriately sized backhoe

d. a hopper/flat barge and skip bins

e. a tug

f. sediment curtain / boom.

This equipment has the potential to impact on marine fauna through noise impacts, vessel strike, liquids or solid material spills or cable strike. Cable strike is related to anchor cables that may stretch and slacken in the water column. Cables may strike marine fauna, causing slashing or other injuries,

particularly larger fauna if swimming past. The risk of cable strike is generally greater for inquisitive young cetaceans and pinnipeds (seals) than for older animals, although all animals are susceptible to injuries from cable movement in the water column. The risk of cable strike is also greater at night when floating plant may be left on site with multiple anchors and/or moorings. The potential of risk from cable strike is related to the number of animals in the area, which in turn can be related to the time of year.

The potential for this impact would be extremely localised and only during the construction period.

Vessel Strike (Collision)

Damaging vessel strike during the proposed dredging is unlikely to occur due to the low speeds that construction vessels would typically be travelling within the Kingston Harbour. However, if construction vessels are entering the site from oceanic waters they may be moving at faster speeds, in which case the potential for vessel strike would be greater. Vessel strike during any night time construction is most likely to occur if fauna are attracted to lights on vessels. However, any vessels undertaking construction works at night (noting that night time works are not proposed and would likely only occur in the case of emergency works being needed) are likely to be sedentary or moving very slowly so the potential impact of vessel strike from construction vessels at night is considered to be minor.

The potential for this impact would be localised and only during the construction period.

Mitigations for this potential impact are included in Section 4.

Impacts of Water Pollution

There is the potential for hazardous substances (e.g. fuels, oils and other construction plant related fluids) to accidently enter the waterway through spills or leaks from construction vessels and other equipment (both marine and land based). Potential water pollution impacts may be related to construction vessel/vehicle management (i.e. fuel, bilge and on-board fuel tank and material lifting (crane) regulation) and over water work practices.

Impacts of water pollution on marine fauna can potentially occur through two main routes being:

1. Ingestion; and
2. Substances such as oils sticking to their bodies, feathers or fur.

Oil in the environment or oil that is ingested can cause:

- Damage to the airways, lungs, eyes, immune systems, red blood cells and organ functioning of marine fauna
- Damage to fish eggs, larvae and young fish
- Damage to estuaries, coral reefs, seagrass and mangrove breeding habitats
- Irritation or ulceration of skin, mouth or nasal cavity
- Decrease in thickness of egg shells
- Hyperthermia in fur seals and birds
- Drowning of fur seal pups if oil sticks their flippers to their bodies
- Drowning of birds
- Loss of body weight of marine mammals

Lighting Impacts

Artificial lighting has the potential to influence the behaviour of fauna, primarily by attraction, avoidance, disorientation or interruption to reproductive processes such as selection of oviposition sites (see review by Davies et al. 2014). The key receptors likely to be impacted by artificial lighting are coastal, marine and migratory birds, however; other marine fauna also have the potential to be impacted.

Potential impacts of lighting on coastal, marine and migratory species include:

- Disorienting or interruption of reproductive processes, e.g. nesting turtles
- Increased attraction of marine fauna to the construction area during the evening/night
- Disruption of foraging/feeding nocturnal birds
- Change of migratory path of some bird species over lit areas.

Noise Impacts

Construction noise impacts related to the Proposal are likely to include:

- Vessel engine noise
- Excavation noise
- Piling Noise.

The potential for this impact would be extremely localised and only during the construction period.

Behavioural Impacts

Behavioural related noise impacts on marine fauna may include:

- Behavioural responses to noise include changes in vocalisation, resting, diving and breathing patterns, changes in mother-infant spatial relationships, and avoidance of the noise source.
- Masking of biologically important sounds may interfere with communication and social interaction, and cause changes in behaviour as well.

Avoidance behaviour is most likely to occur for seals and for other mobile vertebrates present in the study area including fishes and marine reptiles (e.g. turtles).

Physiological Impacts

When the auditory system is exposed to a high level of sound for a specific duration, the sensory hair cells begin to fatigue and do not immediately return to their normal shape. This causes a reduction in the animal's hearing sensitivity, or an increase in hearing threshold. If noise exposure is below some critical sound energy level, hair cells will eventually return to their normal shape. This effect is called a temporary threshold shift (TTS) as the hearing loss is temporary. If the noise exposure exceeds the critical sound energy level, the hair cells become permanently damaged (the effect is called permanent threshold shift (PTS)) (Pacific Environment Limited 2016).

Zones of Impact

The Underwater Piling Noise Guidelines provide 'zones of impact' for marine fauna including:

- Zone of audibility – Area within which marine mammal might hear the source noise but not show any significant behavioural response. The size of the zone of audibility is highly dependent on the ambient noise environment.
- Zone of responsiveness – Area within which the considered marine mammal might react behaviourally to the noise source. This zone can be smaller than the zone of audibility as marine mammals usually do not show significant behavioural responses to noises that are faint but audible.
- Zone of hearing injury – Area closest to the noise source where the noise levels may be high enough to cause a physiological impact such as TTS or PTS.

The zones of impact define the likely environmental footprint of a noise source and indicate how far away a noise source is expected to have an impact on a marine mammal species, either behaviourally or physiologically.

Vessel related noise impacts during operation are highly unlikely to have any significant impacts on marine fauna in the local area, especially considering that the area is already utilised by numerous commercial and recreational vessels.

Marine Infauna

Any benthic marine infauna within soft sediments at the location of the augmentation works would be directly impacted. Direct impacts are unable to be mitigated. However, there is an abundance of similar habitat within the local area which would be expected to support similar collections.

For further detail on potential impacts on marine fauna refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

Introduced Species

Norfolk Island has a unique collection of marine species and supports both endemic species, and subtropical and Tasman Sea endemics. The Slaughter Bay and Emily Bay lagoon systems support a number of species listed under the EPBC Act.

The most likely method of introduction of invasive marine species to the local area during construction is via the transport of organisms or their eggs and/or cysts attached to:

- The hulls of construction vessels which are mobilised to Norfolk Island from mainland Australia or New Zealand
- Construction equipment
- In the ballast of vessels.

The introduction of invasive marine species to Norfolk Island may have a significant impact on the local marine ecology. However, potential impacts can be minimised through mitigation measures.

For further detail on potential impacts from invasive marine species refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

3.3.5.2 Potential Operational Impacts

Aquatic Ecology

Increased Use of Kingston Pier

The Project would support the potential for greater use of Kingston Pier by various vessel operators although, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic would be minimal.

Marine Fauna

The following potential impacts on marine fauna during operation are expected to be negligible as while the Project would support the potential for greater use of Kingston Pier by various vessel operators, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic would be minimal.

- Entanglement and/or ingestion of marine debris
- Impacts of water pollution
- Lighting and noise impacts
- Vessel strike.

The risk of vessel strike on marine fauna associated with the operation phase may include slightly increased movements of commercial charter, fishing vessels and emergency responders as well as local launches and lighters into Kingston Harbour to utilise the facility. However, the increased number of these vessels potentially accessing the Pier at any given time are expected to be low and insignificant. In addition, vessels would typically be travelling at low speeds coming into the Harbour and the risk of vessel strike is considered to be low. Marine fauna species would therefore continue to use Kingston Pier and surrounds, including Slaughter Bay and Emily Bay, during operation.

These potential impacts are described previously.

Invasive Marine Species

The potential impacts of invasive marine species on marine fauna during operation are expected to be negligible as while the Project would support the potential for greater use of Kingston Pier by various vessel operators, vessels on Norfolk Island are limited. Therefore, any increase in vessel traffic would be minimal and would mainly include local vessels.

3.4 Commonwealth Agency

3.4.1 Likely impacts on landscapes and soils resulting from the proposed action

3.4.1.1 Potential Construction Impacts

Augmentation and Sediment Disturbance

Marine sediments and rock may be mobilised at the site during construction via:

- direct disturbance of the seabed from plant and equipment used to augment the existing channel bed (approximately 0.29 ha for Option 3a)
- Sediment spills occurring from transfer of the sediment box from the seabed to Kingston Pier sediment spills occurring from the transfer of marine sediments and rock from the jack-up barge to Kingston Pier via floating hopper or flat-topped barge and/or skip bins
- Dewatering activities at Kingston Pier
- Driven or bored piling of the jack-up barge legs into the seabed
- Installation of the channel navigation aid.

Minor disturbance and mobilisation of marine sediments may also occur as a result of other construction activities such as boat movements (i.e. propeller wash) in the harbour.

While the 95% UCL of metal concentrations in tested marine sediments proposed to be augmented were below the NAGD low level screening guidelines for all contaminants of concern except for nickel, the settlement of resuspended marine sediments has the potential to impact marine flora and fauna.

The use of plant and equipment associated with the activities of the Project have the potential to impact the quality of marine sediments and rock. This may occur via a water quality contamination event such as fuel and/or oil spills which consequently impact marine sediment quality. The quantities of fuels, oils and other chemical pollutants that may be spilled into the harbour adjacent to Kingston Pier would be small. In addition, that fact that the site is already used by a range of vessel operators suggests that the likelihood of these impacts from short-term use by plant and equipment is considered to be low.

Placement of Spoil on Land

The spoil has been categorised as suitable for unconfined water-based disposal as well as land-based disposal. The spoil would be transported and placed at the Old Cascade Quarry. Land-based sediments and rock may be mobilised at the Old Cascade Quarry during construction via some disturbance of existing grasses, remnant shrubs and habitat to allow for stockpiling.

Earthworks at Old Cascade Quarry would provide effective runoff through grading from south-west to north-east at a grade of -0.8%, allowing rainwater to runoff towards the north-east of site. The earthworks design would ensure good surface drainage in the long term. Therefore, it is considered that the earthworks design would effectively mitigate potential marine water quality impacts to Cascade Bay. In addition, it is expected that appropriate erosion and sediment controls would be implemented around the spoil stockpiles to minimise the potential for sediment-laden runoff.

NIRC will be responsible for the ongoing management of the area. NIRC currently lease the land from a private owner. NIRC have a responsibility to rehabilitate the site prior to ending the lease. The placement of spoil is to assist with the rehabilitation of the site where a stable earth platform would be provided suitable such as for grazing life stock. Engineering assessment has been undertaken in relation to the stability of the material, placement profile, and drainage. The placed material would be vegetated with primary vegetation.

3.4.1.2 Potential Operational Impacts

Increased Use of Kingston Pier

The Project would support the potential for greater use of Kingston Pier by various vessel operators although, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic would be minimal. Nevertheless, this increases the risk of contaminants entering the harbour and potentially contaminating marine sediments and rock. Potential contaminants include accidental spills of fuels and oils, general waste material from passenger and commercial vessels. Any liquid spills would remain on the surface of the water or become entrained in the water column and subsequently dispersed through wave and current action, while some may settle on the seabed and lead to potential contamination of marine sediments and rock. The likelihood for contamination of marine sediments and rock during operation is considered to be low given the scale of port operations at Kingston Pier and the existing wave climate in the harbour.

Future Channel Maintenance

The channel is not expected to require ongoing maintenance as the area is surrounded by rocky reef and is not fed by a nearby sediment source. Marine sediments that are deposited within the channel would typically not build up to levels that would potentially impact on navigation as it would be flushed as a result of wave action.

Placement of Spoil on Land

Any spoil that is stockpiled for an extended period of time, albeit unlikely, would be vegetated and moved to flat ground. This would help to stabilise the stockpiles and minimise any potential impacts on sediment and marine water quality. DITRDCA is not responsible for the final rehabilitation of the area, as this will sit with NIRC.

3.4.2 Likely impacts on coastal landscapes and processes resulting from the proposed action

3.4.2.1 Potential Construction Impacts

Construction activities that may have potential impacts on coastal processes include augmentation and general vessel operation.

Augmentation and Sediment Plumes

Augmentation works would generate sediment plumes in the harbour adjacent to Kingston Pier.

A Dredge Plume Modelling Study (**Appendix H**) was undertaken to assess the potential for spread of remobilised sediments outside of the immediate construction area in the harbour. The results of this study has been described previously in Section3.3.4.1. Importantly, no sediment plume was detected for the lagoon and coral reef areas for both the 80th and 95th percentile for the typical (most likely) scenario, or for the real world, worst case scenario.

The study also showed that sedimentation would be confined within Kingston Harbour around the proposed dredging area. No sedimentation was detected for the nearby lagoon and coral reef areas for any scenario.

Jack-up Barge

The jack-up barge would sit above sea level on four legs and would only interact with the waves when it is being repositioned within the channel to access the full extent of the channel, during which the waves and underlying swell would likely pass underneath it. The Jack-up barge would be relocated to more sheltered waters as required when relevant storm events are forecast.

General Vessel Operation

Vessel operations during construction are not expected to impact the wave climate.

3.4.2.2 Potential Operational Impacts

The existing wave climate at Kingston Pier for the various offshore conditions was derived from a SWAN model (refer **Appendix H**). The SWAN model was run for all design options for the south-west offshore waves, which represent the worst-case for wave penetration into the harbour; refer to Case No. 2 and Case No. 6.

It was found that significant wave height generally decreased within the channel but increased to the north and west of the channel, for both Case No. 2 and Case No. 6. There was a small area of wave focusing on Case No. 6 at Point D within the channel.

There was also found to be a decrease in significant wave height in front of the existing rock revetment along the foreshore west of Kingston Pier, predicted at approximately 10%. The orientation and shape of the channel results in refraction of much of the wave energy to the north, away from the channel. The refraction of wave energy to the north was predicted to result in an increase in wave energy at the nearby cliffs of around 5% – 10%.

3.4.3 Likely impacts on water resources resulting from the proposed action

The main sources of potential marine water quality impacts during construction are described below:

- Sediment plumes generated during augmentation works
- Accidental spills of fuel, oil and other harmful substances from construction vessels, plant and equipment into the harbour adjacent to Kingston Pier
- Incorrect disposal of general waste and construction waste into the harbour.

Other sources of potential marine water quality impacts during construction include:

- Sediment spills occurring from transfer of the sediment box from the seabed to Kingston Pier
- Sediment spills occurring from the transfer of marine sediments and rock from the jack-up barge to Kingston Pier via floating hopper or flat topped barge and/or skip bins
- Dewatering activities at Kingston Pier.

The Project would also support the potential for greater use of Kingston Pier by various vessel operators. Potential impacts would be largely associated with vessel operators and include the following:

- Accidental spills of fuel, oil and other harmful substances

- Run-off from washing the topside of vessels leading to contamination of the local water column with potential pollutants such as oils, detergents and plastics
- Increased levels of suspended sediments resulting from propeller wash from vessels disturbing sediments on the seabed upon entry and exit from the harbour and accumulating on nearby marine habitats
- Pollution of the harbour with general waste.

Compared to the existing use of Kingston Pier by various vessel operators, the potential impacts on marine water quality during operation are considered to be negligible.

3.4.4 Likely impacts on air quality and greenhouse gas emissions during construction

The main air quality and greenhouse gas issues during construction include the following:

- Exhaust emissions from plant and equipment
- Fugitive emissions during refuelling activities
- Dust emissions from trucks, plant and equipment.

Potential dust emissions are not expected to be a major issue given that augmentation works would be undertaken beneath the water surface and the spoil would remain moist following dewatering activities. In addition, dust emissions during the mobilisation and demobilisation of local plant and equipment would be minimal as trucks and smaller excavators would be transported along sealed roads and these activities would be short-lived.

Following the completion of construction, the Project would support the potential for greater use of Kingston Pier by various vessel operators. However, given the transient nature and typical lay time of vessel activities such as loading and unloading, it is considered that increased use would have negligible impact on air quality and greenhouse gas emissions.

3.4.5 Likely impacts on native flora and fauna species resulting from the proposed action

Potential impacts on marine flora and fauna have been described in the ensuing Section 3.3.5. Impacts on terrestrial flora and fauna are covered below.

Terrestrial Ecology

Terrestrial Habitats and Plants

The potential impacts during construction on terrestrial habitats are described below.

The construction activities occurring on land include:

- Movements from the land-based Contractor's working area
- Truck movements transporting spoil from Kingston Pier to the Old Cascade Quarry
- Trucks, plant and equipment at the Old Cascade Quarry

- Habitat removal at the Old Cascade Quarry
- Screening of spoil for archaeological artefacts.

The surface of Kingston Pier as well as sealed local roads would be used for land-based construction activities. Therefore, it is expected that direct impacts on terrestrial habitats can be avoided. This includes kikuyu grasses at areas around the KAVHA buildings as well as kikuyu grassed fields and Norfolk Island pines. The grassed area located above the existing rock revetment would not be used for any construction activities due to the reported presence of subsurface convict drains. This location would be established as a no-go zone during construction.

The land-based disposal site at the Old Cascade Quarry is a previously disturbed area with plans for future rehabilitation works that would make use of the spoil. There would be some disturbance of existing grasses, remnant shrubs and habitat. However, there would be no significant impact on terrestrial flora and fauna.

For further detail on potential impacts on terrestrial habitats and plants refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

Terrestrial Protected Areas

The Norfolk Island National Park and Bumbora Reserve are not located within the Project boundary. Therefore, there would be no impact.

The Kingston Common Reserve is located in the vicinity of the Project. It is comprised of historic buildings and structure with contribute to the heritage significance of the KAVHA. Considering the proximity of the Kingston Common Reserve to the Project, there is the potential for direct and/or indirect impacts on vegetation and fauna. However, it is expected that potential impacts can be minimised through appropriate mitigation measures and the establishment of no-go zones during construction.

Critical Habitats

There are no listed areas of terrestrial critical habitat under the EPBC Act that occur within the study area. Therefore, there is expected to be no impact.

Terrestrial Fauna

In consideration of the nature and location of the Project, direct impacts on terrestrial fauna are very unlikely to occur. However, minor and temporary indirect impacts such as from noise or lighting may be similar to those reported for marine fauna. Potential impacts on terrestrial fauna include:

- Entanglement and/or ingestion of marine debris may be a risk for terrestrial fauna occurring near the marine study area. However, this is expected to be very uncommon and can be mitigated effectively
- Impacts of water pollution from spills of fuel, oil and other harmful substances which may be ingested by terrestrial fauna such as coastal seabirds or cover them. This impact can be mitigated effectively
- Lighting impacts relating to artificial lighting on coastal and migratory birds. Artificial lighting may influence the behaviour of these birds. However, no construction work will occur at night and there will be negligible change during operation on lighting of the facility

- Fauna mortality from vehicle and plant movements at Kingston Pier and Old Cascade Quarry.

Taking into account the very minor and short-term potential impact on terrestrial fauna, and the mitigation measures available for the Project, the proposal (construction or operation) will not be inconsistent with the following:

- Australia's obligations under the Biodiversity Convention, the Convention on Conservation of Nature in the South Pacific (Apia Convention), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- A recovery plan or threat abatement plan or conservation advice documents
- The Bonn Convention
- China-Australia Migratory Bird Agreement
- Japan-Australia Migratory Bird Agreement
- International Agreement – Republic of Korea-Australia Migratory Bird Agreement
- Any other international agreement approved under subsection 209(4) of the EPBC Act.

For further detail on potential impacts on terrestrial fauna refer to the Marine and Terrestrial Ecology Assessment (Advisian 2021a) (**Appendix F**).

3.4.5.1 Potential Construction Impacts

Terrestrial Ecology

Increased Use of Kingston Pier

The Project would support the potential for greater use of Kingston Pier by various vessel operators, however, vessels on Norfolk Island are limited. Therefore, the increase in vessel traffic and any associated impacts on terrestrial fauna would be minimal.

Terrestrial Fauna

The following potential impacts on terrestrial fauna during operation are expected to be negligible, localised, and short term in nature:

- Entanglement and/or ingestion of marine debris
- Impacts of water pollution
- Lighting impacts.

3.4.5.2 Potential Operational Impacts

No operational impacts on terrestrial ecology outside of those which already occur would be associated with the Project.

3.4.6 Likely impacts on people and communities resulting from the proposed action

3.4.6.1 Potential Construction Impacts

Potential socio-economic impacts during construction to the land and waterway include:

- Temporary reduction in local amenity due to noise and vibration, visual and air quality impacts
- Temporary disruption to vehicular and pedestrian access and hardstand area parking
- Temporary impact to water-based vessel traffic, navigation and access including commercial charter and fishing vessels
- Temporary impact to the continuation of existing uses at Kingston Pier
- Construction would have a positive impact on the local economy by making use of local plant and equipment such as smaller excavators and heavy vehicles. The use of local labour and resources, where possible and appropriate, is a key objective of the Project.

Noise and Vibration

The main sources of noise and vibration during construction are likely to include the following:

- Mobilisation and demobilisation of local plant and equipment
- Mobilisation and demobilisation of off-island plant and equipment
- Movements from the land-based Contractor's working area
- Piling, installation and repositioning of the jack-up barge
- Operation of land-based and water-based plant and equipment
- Piling and installation of a channel navigation aid
- Truck movements for disposal of spoil.

Air Quality and Greenhouse Gases

The main air quality and greenhouse gas issues during construction include:

- Exhaust emissions from plant and equipment
- Fugitive emissions during refuelling activities
- Dust emissions.

The assessment indicated that dust emissions and plumes are not expected to be a major issue given that augmentation works would be undertaken beneath the water surface and the spoil would remain wet following dewatering activities. Dust emissions during the mobilisation and demobilisation of local plant and equipment would be minimal as trucks and smaller excavators would be transported along sealed roads and these activities would be short-lived.

Visual Amenity

During construction, maritime vessels, water-based plant and equipment as well as trucks and land-based plant and equipment would be visible at and in the vicinity of Kingston Pier.

Construction works would be visible to locals, tourists or visitors in the context of existing port operations at Kingston Pier and Cascade Pier. Lighting from maritime vessels and construction plant and equipment would be visible during construction works.

Augmentation works would generate sediment plumes in the harbour adjacent to Kingston Pier. The potential temporary visual impact of the sediment plumes would be minimised with the implementation of mitigation measures.

Traffic, Transport and Access – Land

The existing access route to Kingston Pier via Pier Street is considered to be sufficient for local plant and equipment. The existing hardstand area at Kingston Pier would allow for car parking for construction personnel and provide an adequate turning circle for light and heavy construction vehicles. It is expected that overflow parking adjacent to the site would not be required.

All land-based plant and equipment would be stationed and/or stored at the Contractor's working area and all traffic movements would be coordinated by the Contractor. Trucks would transport spoil to the land-based disposal site at the Old Cascade Quarry via Pier and/or Bounty Streets, Middlegate Road and Cascade Road. Truck movements are not expected to have an impact on the surrounding local road network.

During construction, it is expected that available car parking at the hardstand area and pedestrian access may be temporarily limited. The combination of private vehicle use and construction traffic is not considered to have an impact on the surrounding local road network.

Access to existing buildings and structures would be maintained during construction, including the Pier Store (Museum) and Royal Engineers Office (Museum shop and information).

Traffic, Transport and Access – Water

It is expected that existing vessel operators at Kingston Pier may be temporarily restricted at some point during construction, particularly in terms of altered navigation and access to the existing channel. Consequently, access and use of existing maritime facilities including Kingston Pier, the boat ramp and stairs would be limited. The Contractor would coordinate the movement of all vessel operators in the harbour to ensure minimal impact on existing port operations and structures at Kingston Pier during construction.

Scheduled vessel arrivals associated with cargo vessels and cruise ship tenders would be pre-planned in advance to be accommodated during construction, if needed, and appropriate provisions would be made to accommodate other users as far as practicable.

There are no swing moorings located in the harbour adjacent to Kingston Pier that would potentially impact any mooring licence holders.

Non-Aboriginal Heritage

Kingston Pier is of high social value and cultural significance. It is expected that there would be temporary impacts on the continuation of existing port operations as well as temporary disruptions to vehicular and pedestrian access to Kingston Pier during construction.

Stabilisation works to Kingston Pier and Rock Revetment and Slaughter Bay Seawall repair works would be carried out during augmentation to improve structural integrity. As a result, the fabric would be protected and the existing uses that occur, and are dependent on Kingston Pier and surrounding areas, would be able to continue.

Overall, the Project including augmentation works, would likely have a significant impact on the underwater cultural archaeological potential of the KAVHA and HMS Sirius which are of World and/or National Heritage significance. The KAVHA and HMS Sirius are inextricably linked. According to the Commonwealth Heritage List, the KAVHA demonstrates social value which directly contributes to heritage significance.

3.4.6.2 Potential Operational Impacts

Socio-economic impacts expected during operation are as follows:

- Positive socio-economic benefits to the Norfolk Island economy through the potential for greater use of Kingston Pier for minor freight operations and transfer of cruise ship passengers
- Negligible impact on visual amenity from the channel navigation aid.

Property acquisition is not required. In addition, local residents and/or businesses would not be relocated. There would also be no impact on historic buildings and structures within the KAVHA nor the Kingston Common Reserve which provides for public activities and other uses, and which contributes to the visitor experience at the KAVHA.

Socio-economic Benefits

Based on an understanding of the strategic planning context, the Project would contribute towards key outcomes for port facilities and realisation of the overarching vision. It would also provide increased opportunities for tourism as well as community and economic development on Norfolk Island.

The key beneficiaries associated with operation of the Project would include:

- Vessel operators, who would benefit through improved navigation, access and safety in the transfer of freight and cruise ship passengers. These benefits would encourage potential greater use of Kingston Pier, thereby increasing potential growth opportunities in tourism and trade which would directly contribute to the economic development of Norfolk Island
- The DITRDCA and NIRC, as it would contribute to the strategic outcomes for port facilities in the context of tourism and economic development
- the Norfolk Island community, who would benefit through tourist and construction-related spending on Norfolk Island and cultural uses at Kingston Pier.

Visual Amenity

In consideration of the scale, frequency, transient nature and typical lay time of vessel activities, it is considered that an increase in the number of maritime vessels using Kingston Pier would not have an impact on visual amenity during operation.

The channel navigation aid would provide for the safe navigation of vessels entering and existing the harbour and would have negligible visual impact on viewpoint locations. The channel navigation aid would be relatively discrete in size and appearance when viewed from afar. Furthermore, any temporary buoy markers are intended to be in use when vessels are entering and exiting the harbour only.

3.4.7 Likely impacts on heritage matters resulting from the proposed action

Refer to earlier Sections 3.1 and 3.2 for discussion on potential construction and operation impacts.

3.5 Likely Duration of Impacts to MNES

The Project, including mobilisation and demobilisation, is expected to occur from early June 2023 to early March 2024. This includes an allowance of 7 weeks of weather delays. Without any weather delays, all dredging activities would be completed by mid-November 2023 (refer to Table 3-5).

The in-water channel works are proposed to occur between October and December to avoid the larger winter swells (that would result in more down time), stronger winds from the North and West (that present conditions that are more difficult in containing any sediment plume). This timing has also been planned to avoid the known coral spawning season on Norfolk Island. The coral spawning season in Norfolk Island is reported to commence as early as late December and anecdotally continue through to late February, occurring after the respective full moons. For summer 2023/2024 the first full moon will occur on 27 December and coral spawning at this time is possible based on previous coral spawning event timing on Norfolk Island. The next full moon occurs on 26 January 2024.

The Proposed schedule that includes seven weeks of weather delay is presented in Table 3-5.

Table 3-5 Proposed Schedule.

Activity	Duration	Start Date	Finish Date
Mobilisation	6 weeks	05 Jun 2023	14 Jul 2023
Site set-up	4 weeks	17 Jul 2023	11 Aug 2023
Dredging of sediments	2 weeks	02 Oct 2023	13 Oct 2023
Dredging of Calcarenite	2 weeks	16 Oct 2023	27 Oct 2023
Dredging of Tuff	3 weeks	30 Oct 2023	17 Nov 2023
Weather delays	7 weeks	20 Nov 2023	01 Jan 2024
Onshore handling operations	18 weeks	16 Oct 2023	16 Feb 2024
Pier Stabilisation	8 weeks	14 Aug 2023	03 Nov 2023

Activity	Duration	Start Date	Finish Date
Demobilisation	6 weeks	08 Jan 2024	16 Feb 2024
Make good and site clean-up	2 weeks	16 Feb 2024	02 Mar 2023
Total Duration	**28 weeks**	**05 Jun 2023**	**02 Mar 2023**

Potential impacts on the World heritage and Natural Heritage values of KAVHA and the National Heritage values of the *HMS Sirius* Shipwreck are mainly expected to occur within active construction periods, which would be intermittent over the schedule shown above, only during suitable weather conditions, and during daylight hours only. Minor impacts to KAVHA may also occur during mobilisation and demobilisation periods for the land-based construction ancillary facilities.

Potential impacts on the Commonwealth Marine Environment (including on flora and fauna) and Commonwealth Agency are expected only within active construction periods, which would be intermittent over the schedule shown above, only during suitable weather conditions, and during daylight hours only. Overall, it is considered that the increases in turbidity and/or sedimentation from construction activities including augmentation and pier stabilisation are likely to be very short-lived and highly localised with the implementation of the proposed mitigation measures to contain sediment plumes. The works are not expected to result in extended periods of impact on coral survival adjacent to Kingston Pier or in Slaughter Bay. Furthermore, increases in turbidity are not expected to result in any significant impacts on sessile marine flora and fauna in areas of subtidal rocky reef, for example through clogging of pores or filter feeding apparatus. While the Preliminary Dredge Plume Modelling (Advisian 2021c) has shown that the likelihood of significant turbidity impacts in Slaughter Bay or Emily Bay is low during the majority of oceanic and meteorological conditions, it is recommended that caution be applied in the use of threshold limits for turbidity and sedimentation considering the sensitivity of corals in these areas.

3.6 Cumulative Impacts

This section assesses the potential cumulative impacts of the Project, in particular land and water based works proposed at Kingston Pier and land based works proposed at Old Cascade Quarry, concurrent with other existing or proposed developments on Norfolk Island.

3.6.1 Existing Environment

The most recent known major development at Kingston Pier was the 2007 refurbishment of the structure. The preferred options for the refurbishment of key structural elements (Patterson Britton & Partners, 2005) are outlined below:

- Eastern face – fill cavities in face of wall
- Western face (south end) – stabilisation of wall with mini-piles
- Western face (central) – retain existing sheet piling and provide new sheet piling
- Western face (north end) – fill cavities in face of wall
- Southern face – stabilise wall with mini-piles and provide new concrete facing

- Deck and core of pier – concrete deck on compacted fill
- Boat ramp – fill the voids under the boat ramp and repair the wearing surface.

Existing and proposed developments in the vicinity of Kingston Pier are described in Table 3-6 according to media release statements published by the DITRDC (2020a):

Table 3-6 Proposed developments in the vicinity of Kingston Pier (Source: DITRDC, 2020a).

Development	Status
February 2019: Upgrade to the surface of the elbow shaped road between the Crank Mill and Lions Club	It is expected that this project has been completed.
February 2019: Installation of safety barriers at Emily Bay Road and car park, Arthur's Vale Retaining Wall below the Civil Hospital and the southern side of the road between the Crank Mill and the Lions Club. In addition, modification of the existing barriers between the Pier Store and the Settlement Guard House	It is expected that this project has been completed.
January 2020: Preservation of the Bounty Street Bridge	This project is ongoing. Inspection of the foundations was planned for January 2020. The findings will inform a structural design solution. A number of technical reports into the condition of the bridge have strongly recommended restricting weight and volume of traffic. The bridge is currently closed to traffic.
April 2020: Restoration of the Sirius Museum and the Settlement Guard House	It is expected that this project is ongoing. The works include removal of renders and plasters to expose the structure for selective repair.
November 2020: Inspection of the *HMS Sirius* wreck site to assess its condition	The inspection was completed in November 2020.
April 2021: Repairs and conservation works to the Royal Engineers' Office including portico and columns	The project is ongoing and may take several months.
Beyond: Remediation of Pier Street Bridge	This project would likely commence after completion of the Kingston Pier Channel Construction Project.

In addition, proposed developments in the vicinity of Old Cascade Quarry are described in Table 3-7.

Table 3-7 Developments in the vicinity of Old Cascade Quarry.

Development	Timing
March 2021: Cascade Port temporary groyne	Detailed design and approvals works are underway for a temporary groyne, or landing structure, at Cascade Pier to increase Norfolk Island's sea freight capacity.

Development	Timing
2022-23: Youngs Road Quarry Extension (DA 36/2021)	Quarry blasting and rock removal for 6 months.

Photographs (Hogan, n.d.) taken during and following the 2007 refurbishment are shown in Figure 3-1 and Figure 3-2.

Figure 3-1 Installation of steel sheet piling.

Figure 3-2 Bounty Day 2006.

3.6.2 Potential Construction Impacts

The Project is expected to commence in the second quarter of 2023. The estimated duration for the Project is five to six months (including over the summer period) including mobilisation, demobilisation and any weather delays.

In consideration of the nature, scale, location and likely scheduling of other existing and proposed developments, it is expected that there would be no significant cumulative impacts. However, it is considered that the Project may have minor interactions with the following projects:

- Remediation of Pier Street Bridge (minor non-structural works) – the structure would support the main access road for heavy vehicle haulage to and from Kingston Pier
- Preservation of Bounty Street Bridge (structural works) – the structure would support the secondary access road for heavy vehicle haulage to and from Kingston Pier. The bridge is currently closed to traffic
- Repairs and conservation works to the Royal Engineers' Office – the structure is located in the vicinity of land-based works at Kingston Pier
- Cascade Port Temporary Groyne – construction works may overlap with future rehabilitation works at the Old Cascade Quarry
- Youngs Road Quarry Extension - Quarry blasting.

In addition, the Project would have the following positive outcomes:

- Early refusal was encountered during the installation of some of the steel sheet piles during the 2007 refurbishment of Kingston Pier, leaving some piles relatively high with the potential

to undermine the pile wall through future augmentation. To minimise potential impacts, the Project design includes stabilisation works to improve the structural integrity of Kingston Pier including the existing steel sheet pile wall on the western face. The removal of material at the base of Kingston Pier would be carefully undertaken using hand tools to avoid undermining the structure.

- Future rehabilitation works are proposed at the Old Cascade Quarry. The allocation of spoil from the channel at Kingston Pier for the purposes of this future project would represent the beneficial reuse of the material.

3.6.3 Potential Operational Impacts

Existing and proposed developments may be completed concurrently with the Project. However, it is expected that there would be no significant cumulative impacts of these proposals/projects.

4 Avoidance and Mitigation Measures

4.1 Mitigation Measures

A consolidated list of mitigation measure to prevent, minimise or compensate for the relevant impacts on MNES as outlined in Section 3 are presented in Table 4-1.

A Construction Environmental Management Plan has been prepared for adherence by the Contractor and is included at **Appendix L.**

Table 4-1 Consolidated list of mitigation measures.

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
In calmer sea conditions (i.e. offshore wave height less than 1 m), which are suitable for deployment of a silt boom and curtain, this will be implemented around any active work areas that may disturb the seabed (e.g. when removing tuff material). The silt curtain will be suitable to accommodate the active coastal marine environment within Kingston Harbour. The silt curtain may be a robust floating system such as a flexible floating hose curtain, or a fixed silt curtain attached to barge. The installation of the silt curtain/boom may be progressive to contain areas of current works; however, before construction, a Plan of Deployment and Progression will be prepared to align with the schedule of works. The Plan will implement the following measures: • Installation of the silt curtain/boom will occur before starting physical works. • Installation will be undertaken during high tide periods from a boat. The device will be designed to rise and fall with the tide to prevent disturbance. • The silt boom/curtain will extend from a minimum of 100 mm above the water line	Contractor	Pre-Construction and During-Construction	Very effective in calm seas. Will not be as effective in rough seas, however in-water works will not be possible under these conditions.	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
to 2.5 m below the water line (where water depth permits) before starting work. Note the bottom of the silt curtain is to be kept 0.5 m from the bottom to prevent snagging. • Inspection of the device will be undertaken on a daily basis after ebbing tides, with additional inspection following storm events. Visual monitoring of turbidity inside and outside of the device will occur regularly during the day. • Results of daily observations of the integrity of the silt curtain will be required to be recorded and maintained. Records will be required to be kept on the site and will be made available for inspection by persons authorised by the DITRDCA. • Decommissioning will be carried out by boat during a high tide period. • Decommissioning will only be undertaken once construction activities are above seabed level (that is, no activities which disturb the seabed will occur without the silt curtain in place). Before removing the device, turbidity conditions within the silt curtain will be assessed both visually and by using a hand held water quality meter to confirm that						

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
turbidity levels (measured as NTU) inside and outside the device are similar. This will verify that sediment has settled, resulting in similar water turbidity within the work zone to that outside the curtain. The silt curtain will not be decommissioned until the water inside and outside correspond both visually and this is also confirmed using a hand held device.						
Bubble curtains comprise perforated air hoses anchored to the sea floor that shoot walls of air bubbles into the water column. The purpose of the bubble curtains is to form a barrier to underwater noise and deflect sediment debris from travelling past the bubble curtain. A bubble curtain will be implemented across the entrance channel in conjunction with a silt curtain/boom to assist in control of the spread of suspended sediments. A bubble curtain will also have benefits in reducing noise impacts on marine fauna and does not restrict vessel navigation.	Contractor	Pre-Construction and During-Construction	Effective in calmer sea conditions. Not as effective in rougher conditions.	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA
A Baseline Water Quality Monitoring Program will be developed and implemented prior to construction. Site-specific trigger values for Water Quality Monitoring for turbidity and other potential contaminants of concern (including physico-chemical parameters and	DITRDCA or Contractor	Pre-Construction	NA	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
hydrocarbons) will be determined prior to construction through an appropriate Baseline Water Quality Monitoring Program over a suitable time period which uses a combination of in-situ and lab-based testing. A Baseline Water Quality Report providing site-specific trigger values will be prepared.						
The Contractor will undertake Water Quality Monitoring during construction to identify any potential spills or deficient silt curtains or erosion and sediment controls. The requirements of Water Quality Monitoring will be outlined in the Construction Environmental Management Plan (CEMP) for the Project. Water Quality Monitoring will be implemented with other mitigation measures to manage potential impacts on the marine environment and aquatic ecology. This will include regular observations of the site for any visible indications of sediment plumes or pollution (for example, hydrocarbon spills or slicks), continuous monitoring of turbidity within Slaughter Bay and Emily Bay to ensure that turbidity levels are within site-specific trigger values (during augmentation activities).	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
A Spill Management Plan will be implemented during construction and will be communicated to all staff working on site. The Plan will include information on the following: • An emergency spill kit will be kept on site and maintained throughout the construction work and going forward. The spill kit will contain adequate quantities of material and will be suitable for the specific project application and site use. • All construction workers and regular users of Kingston Pier will be advised of the location of the spill kit and trained in its use. • Emergency contact details will be kept in an easily accessible location in vehicles, vessels, plant and site office. All workers will be advised of these contact details and procedures. • Procedures on vehicle, vessel and plant maintenance and inspection for fluid leaks will be implemented. • Vehicle wash-down and re-fuelling will not occur on site. • Refuelling of plant and equipment and storage of hazardous materials on land	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
and on barges will occur within a double-bunded area. If an incident (e.g. spill) occurs, the following incident responses will be implemented: • The Contract Manager will be notified as soon as practicable. • In the event of a maritime spill, the Spill Management Plan will be implemented.						
The number of jack-ups/anchor points during construction will be minimised where possible. The locations will be selected to avoid areas of sensitive natural rocky reef habitats that have not yet been disturbed by historical excavation.	Contractor	During-Construction	Effective	EPBC Act 1999	NA	DITRDCA
Work positioning barges and excavation of seafloor material during construction will be scheduled to occur during calm conditions wherever possible to prevent excessive and non-contained sedimentation and minimise any safety risks.	Contractor	Pre-Construction and During-Construction	Effective	EPBC Act 1999 ANZG (2018)	NA	DITRDCA
A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of a CEMP for the Project. The SWMP will identify all reasonably foreseeable risks relating to erosion, sediments and water pollution and	Contractor	Pre-Construction and During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
describe how these risks will be addressed during construction. Erosion and sediment control measures will be implemented and maintained (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)) to: • Prevent sediment moving off-site and sediment-laden water entering any water course, drainage lines, or drain inlets. • Reduce water velocity and capture sediment on site. • Minimise the amount of material transported from site to surrounding pavement surfaces. Divert clean water around the site.						
The Contractor, NIRC (Port Manager) and users of Kingston Pier will implement the following measures to minimise potential impacts on marine water quality, including (but not limited to): • All machinery and equipment will be maintained in good working order and regularly visually inspected for leaks. • All construction equipment and vessels will be inspected by qualified personnel prior to the commencement of work to	Contractor, NIRC and Port Users	Construction and Operation	Effective	EPBC Act 1999 ANZG (2018)	TBD	DITRDCA NIRC

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
reduce the risk of hydrocarbon spills or leaks. • All visiting vessels will also adhere to the above two measures. • Portable toilets (if required) will be positioned securely within approved compound areas and emptied on a regular basis using a licenced service provider and human waste disposed of at a local sewerage treatment plant. • No sewage will be released into the local waterway from vessel holding tanks. • Non-toxic/biodegradable environmentally friendly/water-based chemicals will be used, where required and available. • The lowest volume of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site. • Chemical and fuel storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS) and AS 1940 on board construction vessels and land-based construction areas only. • Vessels (self-propelled and unpowered) will have adequate on-board communication, containment, drainage,						

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
bunding and monitoring systems to prevent discharges of unauthorised effluents.						
The Contractor's spill containment, chemicals handling, and emergency response procedures must be demonstrated to be appropriate and adequate for the proposed plant and operations. Both land and specialised marine spill booms shall be kept on site at all times and be easily accessible to the immediate working area so they can be deployed quickly as needed.	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA
The Contractor's procedures will describe processes for general waste handling and disposal.	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA
The NIRC as Port Manager will provide appropriate marine spill kits at Kingston Pier in case of accidental spills during operation.	NIRC	Operation	Effective	EPBC Act 1999 ANZG (2018)	TBC	NIRC
Dredging should occur between October and May to avoid the possible energetic meteorological conditions, with a higher chance of larger wind forcing from northern and western sectors (noting the coral spawning season generally occurs from late December to February for a few months and would need to be avoided).	Contractor	Operation	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA

Mitigation Measure – Water Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Dredging is allowed only during the daylight hours with a break to unload spoil onshore per day for six days per week (half a day Saturday).	Contractor	Operation	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Sediment Quality	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor's spill containment, chemicals handling and emergency response procedures will be appropriate and adequate.	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
The Contractor's procedures will describe processes for general waste handling and disposal.	Contractor	Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
The NIRC as Port Manager will provide appropriate marine spill kits at Kingston Pier in case of accidental spills during operation.	NIRC	Pre-Construction During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Terrestrial Flora and Fauna	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
To minimise damage to sensitive terrestrial habitats in the study area (i.e. the terrestrial habitats of the Kingston Common Reserve) and the fauna they support, all habitats beyond the approved footprint will remain no-go zones for the duration of construction. No vehicle movements, materials stockpiling, or other construction-related activities are permitted outside the approved land-based footprint during construction. At all times, vehicles transporting construction-related materials, equipment or trailers pulling vessels will remain on the available sealed roadways and not on any grassed areas of the Kingston Common Reserve. To minimise unnecessary damage to habitats and the fauna they support which occur within the construction footprint during construction, the Contractor will limit any unnecessary and/or temporary construction (i.e. through selection of the most appropriate construction methods) and materials stockpiling.	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Terrestrial Flora and Fauna	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
To minimise damage to sensitive terrestrial habitats in the study area (i.e. the terrestrial habitats of the Kingston Common Reserve) and the fauna they support, all habitats beyond the approved footprint will remain no-go zones for the duration of construction. No vehicle movements, materials stockpiling, or other construction-related activities are permitted outside the approved land-based footprint during construction. At all times, vehicles transporting construction-related materials, equipment or trailers pulling vessels will remain on the available sealed roadways and not on any grassed areas of the Kingston Common Reserve.	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC
To minimise damage to sensitive terrestrial habitats in the study area (i.e. the terrestrial habitats of the Kingston Common Reserve) and the fauna they support, all habitats beyond the approved footprint will remain no-go zones for the duration of construction. No vehicle movements, materials stockpiling, or other construction-related activities are permitted outside the approved land-based footprint during construction.	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Terrestrial Flora and Fauna	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
At all times, vehicles transporting construction-related materials, equipment or trailers pulling vessels will remain on the available sealed roadways and not on any grassed areas of the Kingston Common Reserve. To minimise unnecessary damage to habitats and the fauna they support which occur within the construction footprint during construction, the Contractor will limit any unnecessary and/or temporary construction (i.e. through selection of the most appropriate construction methods) and materials stockpiling.						
All construction works will be undertaken by a suitably qualified, experienced and site-specific trained Contractor to reduce the risk of error and accidental environmental damage and flow-on effects on habitats and fauna in a safe manner.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
To reduce the potential for lighting-related impacts on terrestrial fauna during construction the following measures will be implemented: • Limit the need for construction activities to be undertaken during the evening and night time to reduce the	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Terrestrial Flora and Fauna	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
overall need for construction-related artificial lighting (on vessels and the jack-up barge) and associated impacts • Use downward-directed and dimmed lighting on Kingston Pier (ensuring that it is still in accordance with navigation requirements).						
All sediment and erosion controls, marine water quality and waste management mitigation measures described in this EA will be implemented.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
To minimise damage to sensitive marine habitats in the study area (i.e. intertidal and subtidal rocky reefs) and the fauna they support, all construction vessels are to remain within the site boundary when working, or moored/anchored within 250m offshore of the site. No marine traffic is permitted outside of this marine footprint unless shelter is being sort from adverse weather events. No vehicle movements,	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
materials stockpiling, or other construction-related activities are permitted outside the approved land-based footprint during construction. During operation, vessels will stay within the designated channel area and not move over nearby shallow areas of sensitive marine habitat.						
To minimise unnecessary damage to habitats and the fauna they support which occur within the construction footprint during construction, the Contractor will limit any unnecessary and/or temporary construction (i.e. through selection of the most appropriate construction methods) and materials stockpiling and limit any anchoring which is required by vessels.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
All construction works will be undertaken by a suitably qualified, experienced and site-specific trained Contractor to reduce the risk of error and accidental environmental damage and flow-on effects on habitats and fauna in a safe manner.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
All sediment and erosion controls, marine water quality and waste management mitigation measures described in this PER will be implemented.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Surface level inspections for marine mammals or other large marine fauna entangled in the silt curtains must occur regularly (i.e. dedicated hourly visual observations should be maintained). If a marine mammal or other fauna is identified as being entangled in the silt curtain, the following procedures should be undertaken: • Immediate stop of all water-based construction activities. • Contact appropriate environmental office to arrange for freeing of fauna. This may entail decommissioning of the curtain. • Water based construction activities will not commence until 30 minutes after marine mammal(s) have left the area.	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC
To reduce the potential impacts of adverse marine water quality on marine habitats and the fauna they support during construction and operation, mitigation measures proposed for marine water quality impacts will be implemented as well as the following additional measures: • Construction vessels will maintain their septic tanks and pumps so that they do	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
not leak. No release of sewage into the waterway is allowed • Both oil and sewage spill response kits will be readily available at Kingston Pier for use during construction and operation in the event of a spill. Regular users of Kingston Pier will be trained in their use.						
To enhance the potential for the Contractor to be able to assist in the protection of marine habitats and the fauna they support during construction, all personnel, in particular skippers, will be made aware of the areas of sensitive habitat within the study area during the general site induction, and of the potential impacts that construction works may have on these areas. Records of training will be retained.	Contractor	Pre-Construction During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
To reduce the spread of suspended sediments generated during excavation and the potential for sedimentation and/or smothering of nearby sensitive marine habitats and associated flora and fauna, silt curtains/booms and bubble curtains will be used around the immediate excavation area.	Contractor	During-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC

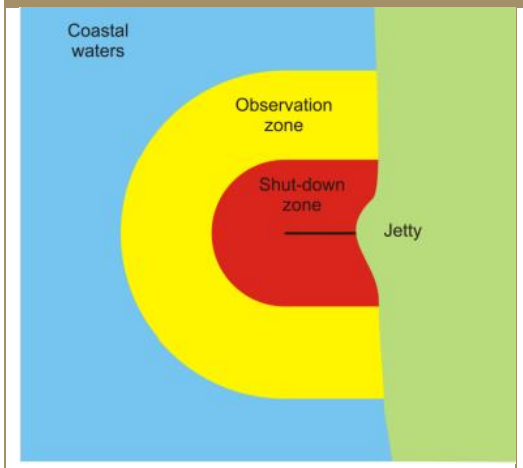
Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Monitoring of water quality (particularly turbidity) during water-based construction activities with the potential to disturb the seafloor (i.e. during excavation and piling activities) will be undertaken and construction activities ceased if levels of suspended sediment become higher than site-specific trigger values developed for the Project.	Contractor	Construction				
At the completion of construction, a seabed inspection (seabed clearance survey) and clean-up will occur to remove any construction waste and general debris from the seafloor. All waste will be removed and disposed of at a licenced facility.	Contractor	Post-Construction	Effective	EPBC Act 1999 ANZG (2018)	TBC	DITRDCA NIRC
To reduce the potential impacts of marine debris on fauna during construction and operation, the mitigation measures proposed for waste management will be implemented.	Contractor	During-Construction and Operation	Effective	EPBC Act 1999	TBC	DITRDCA NIRC
During operation, Kingston Pier and the channel navigation aid will be examined regularly to ensure that they are not in need of repair or have any loose parts that may fall into the waterway and cause harm to marine fauna.	Contractor	Operation	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
To reduce the potential for lighting-related impacts on marine fauna during construction the following measures will be implemented: • Limit the need for construction activities to be undertaken during the evening and night time to reduce the overall need for construction-related artificial lighting (on vessels and the jack-up barge) and associated impacts • Use downward-directed and dimmed lighting on Kingston Pier (ensuring that it is still in accordance with navigation requirements).	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC
If possible, the risk of overhead cable strike on marine fauna during construction will be minimised by placing any floating plant on a swing mooring, where space permits and it is deemed safe to do so rather than leaving plant in a fixed mooring configuration as the reliance on a single swing mooring line will minimise cable oscillation.	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC
The risk of vessel strike impacting on marine fauna, specifically marine mammals, during construction and operation will be reduced through the implementation of the following measures:	Contractor	During-Construction Operation	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
• All vessels associated with construction will travel at speeds no higher than 10 knots in nearshore coastal waters • Awareness of the presence of marine fauna in the local waterway by vessel operators so that they can adopt appropriate speeds and clearance when cetaceans are nearby. • Variable or zoned (time and place) speed limits for visiting vessels during operation, particularly in relation to peak marine mammal migrating periods. • All moving vessels will adhere to the vessel approach distance requirements when travelling to and from site and while undertaking construction works as outlined in *Table 2 – summary of vessel approach distances and operation* in the Australian National Guidelines for Whale and Dolphin Watching (2017). These requirements are also in accordance with the EPBC Act Regulations Part 8 - Interacting with cetaceans and whale watching. These are included following this table.						
To reduce the potential for noise-related impacts on marine fauna (specifically marine mammals) during excavation and piling (if	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving

any) work the following measures will be implemented:
• Arrange piling and excavation work outside of the main marine mammal migration period, if feasible.
• Implement the following observation zone and shutdown zones for marine mammals during seabed augmentation works:
  ○ Observation zone: 500 m
  ○ Shutdown zone: 100 m
These zones have been suggested with consideration of the zones outlined in Table 5 of the SA Underwater Piling Noise Guidelines (Department of Planning, Transport and Infrastructure, 2012) noting that noise impacts associated with augmentation are likely to be much less than for piling activities and there are no guidelines for dredging).						

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
 • Implement the following piling and excavation operation procedures: o Piling and Excavation Operation Procedures: a) *Pre-Start Observation:* Marine mammal observers will visually monitor observation and shut-down zones for whales for a minimum of 30 minutes before the commencement of piling and/or excavation b) *Soft-Start Procedure:* If, after the 30 minute pre-start observation, no whale/s have been spotted						

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
within the observation or shutdown zone a soft start procedure will commence with a gradual increase in piling impact energy of no more than 50% of full impact energy for 10 minutes. The soft start procedure will be implemented after breaks in piling driving of 30 minutes or more c) *Stand By Procedure:* If a whale is spotted within the observation zone during the soft start procedure, the operator of the piling or excavation equipment will be placed on standby to shut-down the equipment and a trained crew member will continuously monitor the whale/s in sight at all times d) *Normal Procedure:* If no whale/s has been sighted during the soft-start procedure, full impact piling or excavation may commence. • The use of bubble curtains around the entrance channel will also be implemented to reduce noise impacts on marine fauna.						

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
To reduce the potential for noise impacts on marine fauna (specifically marine mammals) during piling and/or excavation, the following Shut-Down requirements will be implemented: • Shut-Down requirements: a) If visibility is poor and the marine mammal observer is unable to clearly identify objects to the full observation zone distance, a vessel or aircraft search will be conducted, or the action postponed until visibility has improved b) Piling and excavation are not permitted between 6.00 pm and 7.00 am c) If any whales are spotted within the shut-down zone, piling or excavation will cease immediately or as soon as safe to do so until the whale/s has moved outside of the shut-down zone d) All piling or excavation will cease for a minimum of 1 hour after the last sighting of a whale within the observation zone. Piling or excavation will recommence at the	Contractor	During-Construction	Effective	EPBC Act 1999	TBC	DITRDCA NIRC

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
pre-start observation after the 1 hour shutdown has elapsed.						
All Contractors will undertake a Vessel Risk Assessment (VRA) prior to mobilisation to the site. The VRA may be undertaken by the vessel owner and/or operator. All vessels, floating plant and other marine-based construction equipment mobilised to the site from any place inside or outside of Australia will be subject to the VRA. The VRA will determine if a vessel inspection is required. The Contractor(s) will provide the VRA to the Principal four (4) weeks prior to mobilisation. The Contractor(s) will undertake an Invasive Marine Species (IMS) inspection of all vessels assessed in the VRA as uncertain or high risk for introduction of invasive marine species. The Contractor(s) will arrange for IMS inspections for all vessels considered high and/or uncertain risk prior to the commencement of construction either within seven days of mobilisation to the site (directly) or within 48 hours of entry to the harbour. Any construction vessels mobilised from outside of Norfolk Island will be considered high risk and will be inspected. Construction vessels entering the site from international	Contractor	Pre and During Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
waters will be inspected and cleaned prior to entering the site. Following inspection, the Contractor(s) will submit a revised VRA and if the vessel is classified as low risk it will be permitted to enter the waterway and begin operations. The IMS inspection will be undertaken by appropriately qualified personnel with experience in biosecurity of marine vessels, floating plant and marine-based construction equipment. The Contractor(s) is responsible for arranging the IMS inspection by suitably qualified personnel.						
The antifouling of construction and visiting operational vessels will be maintained to avoid the attachment and potential translocation of invasive species into Norfolk Island waters.	Contractor and Port Users	Construction and Operation	Effective	NA	TBD	DITRDCA

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Ballast water management will include the following measures: • Ballast water exchange by domestic vessels will be avoided • Domestic vessels will manage ballast water in accordance with the *Australian Ballast Water Management Requirements* (Department of Agriculture, Water and the Environment 2020). Any ballast water exchange from international vessels will be undertaken in accordance with *the International Convention for the Control and Management of Ships' Ballast Water and Sediments* (BWM) (IMO 2016) – i.e. "whenever possible, conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 metres in depth, taking into account Guidelines developed by IMO" and "in cases where the ship is unable to conduct ballast water exchange as above, this should be as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth".	Contractor and Port Users	Construction and Operation	Effective	*Biosecurity Act 2015*, *Australian Ballast Water Management Requirements*	TBD	DAFF, DITRDCA

Mitigation Measure – Aquatic (Marine) Ecology	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
For all construction vessels and/or barges, piling or other equipment mobilised to the site from overseas, the processes of the Australian Government Department of Agriculture, Fisheries and Forestry for pre-arrival, arrival and inspection, and post-arrival will be followed.	Contractor	Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA
Monitoring and inspection and/or surveillance of all construction vessels and/or barges will be undertaken in accordance with the *Biosecurity Act 2015*. The Contractor will be responsible for understanding their obligations under the *Biosecurity Act 2015* in regard to monitoring, inspection and surveillance of construction vessels and/or barges.	Contractor	Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA

Table 2—summary of vessel approach distances and operation.

Requirements	Distance to an adult whale	Distance to an adult dolphin
No approach zone • a zone of total vessel exclusion • no waiting in front of direction of travel • no following directly behind	**Within** **100 metres to the side** **300m in front and to the rear**	**Within** **50 metres to the side** **150m in front and to the rear**
Caution zone • speed must be no more than 6 knots • maximum of 3 vessels • do not enter caution zone if animals are injured, stranded, entangled or distressed • **do not enter the caution zone if a calf is present** • do not enter if operating a prohibited vessel	**Between** **300 and 100 metres**	**Between** **150 and 50 metres**
Bow riding • do not deliberately encourage bow riding • when animals are bow riding - do not change course or speed suddenly • if there is a need to stop – reduce speed gradually		

Mitigation Measure – Air Quality and Greenhouse Gases	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will prepare and implement measures to minimise air quality impacts during construction such as: • all trucks used for the transportation of spoil will be securely covered to contain the material • any temporary stockpiling of spoil will be securely covered and located in an area not exposed to high winds • construction works will be reduced or stopped during strong winds and other adverse weather conditions.	Contractor	Pre-Construction and Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Coastal Processes	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The condition of the existing rock revetment will be further investigated to determine whether maintenance works are required to safeguard the structure. This will typically involve topping up the revetment with additional rock armour.	Designer	Detailed Design	Effective with further investigation to be undertaken	NA	TBD	DITRDCA
Rock armour will be placed at the base of the nearby cliffs under Flagstaff Hill to	Contractor	Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Coastal Processes	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
reduce wave impacts, and therefore, slow the rate of erosion of the cliffs.						

Mitigation Measure - Biosecurity	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
All Contractors will undertake a Vessel Risk Assessment (VRA) prior to mobilisation to the site. The VRA may be undertaken by the vessel owner and/or operator. All vessels, floating plant and other marine-based construction equipment mobilised to the site from any place inside or outside of Australia will be subject to the VRA. The VRA will determine if a vessel inspection is required. The Contractor(s) will provide the VRA to the Principal four (4) weeks prior to mobilisation. The Contractor(s) will undertake an Invasive Marine Species (IMS) inspection of all vessels assessed in the VRA as uncertain or high risk for introduction of invasive marine species. The Contractor(s) will arrange for IMS inspections for all vessels considered high and/or uncertain risk prior to the commencement of construction either	Contractor	Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA

Mitigation Measure - Biosecurity	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
within seven days of mobilisation to the site (directly) or within 48 hours of entry to the harbour. Any construction vessels mobilised from outside of Norfolk Island will be considered high risk and will be inspected. Construction vessels entering the site from international waters will be inspected and cleaned prior to entering the site. Following inspection, the Contractor(s) will submit a revised VRA and if the vessel is classified as low risk it will be permitted to enter the waterway and begin operations. The IMS inspection will be undertaken by appropriately qualified personnel with experience in biosecurity of marine vessels, floating plant and marine-based construction equipment. The Contractor(s) is responsible for arranging the IMS inspection by suitably qualified personnel.						
The antifouling of construction and visiting operational vessels will be maintained to avoid the attachment and potential translocation of invasive species into Norfolk Island waters.	Contractor and Port Users	Construction and Operation	Effective	NA	TBD	DITRDCA
Ballast water management will include the following measures:	Contractor and Port Users	Construction and Operation	Effective	*Biosecurity Act 2015*,	TBD	DITRDCA

Mitigation Measure - Biosecurity	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
• ballast water exchange by domestic vessels will be avoided • domestic vessels will manage ballast water in accordance with the *Australian Ballast Water Management Requirements* (Department of Agriculture, Water and the Environment 2020). Any ballast water exchange from international vessels will be undertaken in accordance with the *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (BWM) (IMO 2016) – i.e. "whenever possible, conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 metres in depth, taking into account Guidelines developed by IMO" and "in cases where the ship is unable to conduct ballast water exchange as above, this should be as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth".				*International Convention for the Control and Management of Ships' Ballast Water and Sediments, Australian Ballast Water Management Requirements*		
For all construction vessels and/or barges, piling or other equipment mobilised to the site from overseas, the processes of the	Contractor	Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA

Mitigation Measure - Biosecurity	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Australian Government Department of Agriculture, Fisheries and Forestry for pre-arrival, arrival and inspection, and post-arrival will be followed.						
Monitoring and inspection and/or surveillance of all construction vessels and/or barges will be undertaken in accordance with the *Biosecurity Act 2015*. The Contractor will be responsible for understanding their obligations under the *Biosecurity Act 2015* in regard to monitoring, inspection and surveillance of construction vessels and/or barges.	Contractor	Construction	Effective	*Biosecurity Act 2015*	TBD	DAFF, DITRDCA

Mitigation Measure – Underwater Heritage	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
An archaeological test excavation has been carried out over the proposed channel footprint to provide additional information on the nature, extent, variety, frequency and condition of the underwater cultural archaeological resource. The information has informed the Kingston Pier Underwater	Project Archaeologist **Appendix I** (Cosmos Archaeology (2022).	Detailed Design	Effective – Completed	*Underwater Cultural Heritage Act 2018*	NA - Completed	Parks Australia, DCCEEW, NIRC

Mitigation Measure – Underwater Heritage	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Archaeological Management Plan (KPUAMP) (refer to **Appendix I**).						
An abbreviated KPUAMP will be prepared and implemented for the archaeological test excavation.	Project Archaeologist **Appendix I (**Cosmos Archaeology (2022).	Pre-Construction	Effective – Completed	*Underwater Cultural Heritage Act 2018*	NA - Completed	Parks Australia, DCCEEW, NIRC
The KPUAMP for the Project will be prepared and implemented which covers all aspects of the underwater archaeological investigation, including the recovery, recording and management of artefacts. The KPUAMP will be prepared in consultation with key stakeholders including the NIRC, the KAVHA Project Manager, Norfolk Island Museum as well as the Norfolk Island Community.	Project Archaeologist and Contractor **Appendix I (**Cosmos Archaeology (2022).	Pre-Construction and Construction	Effective noting that mitigation would be successful with a well-prepared plan covering all aspects of the archaeological investigation	*Underwater Cultural Heritage Act 2018*	TBD	DCCEEW, DITRDCA
The Old Cascade Quarry will be inspected and surveyed to determine whether any above-ground archaeological potential exists that may be associated with Knight's Farm (Item No. 79) or Fredick's Aege (Item No. 83).	Project Archaeologist	Pre-Construction	Effective	*Heritage Act 2002 (NI)*	TBD	DITRDCA, NIRC
A no-go zone will be established at the grassed area above the existing rock	Contractor	Pre-Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Underwater Heritage	Responsibility for Implementation	Timing/Phase	Expected/ Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
revetment to protect the reported presence of subsurface archaeology.						
Screening for maritime artefacts will be carried out by a qualified maritime archaeologist to determine whether they are associated with the shipwreck of the *HMS Sirius* or other historic shipwrecks in the area as identified in the KPUAMP.	Project Archaeologist and Contractor	Construction	Effective	*Underwater Cultural Heritage Act 2018*	TBD	DITRDCA
In the event that land-based archaeological artefacts are discovered, all works will cease. A qualified archaeologist will be engaged to determine and document the nature of the unexpected archaeological finds and the Commonwealth Heritage Officer contacted immediately.	Contractor	Construction	Effective	EPBC Act 1999, *Heritage Act 2002 (NI)*	TBD	DITRDCA

Mitigation Measure – Noise and Vibration	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will prepare and implement measures in a Construction Environmental Management Plan (CEMP) to manage potential construction noise and vibration impacts which are reasonable and feasible and in line with	Contractor	Pre-Construction and Construction	Effective	EPBC Act 1999, *Planning Act 2002* (NI)	TBD	DITRDCA, NIRC

Mitigation Measure – Noise and Vibration	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
relevant NSW or other best-practice guidelines. This will include the measures identified below in relation to source controls, administrative controls, community management and construction vibration management.						
Source Controls • Use the most suitable equipment necessary for the construction works at any one time and modify methods of construction, where feasible • Avoid/limit simultaneous operation of noisy plant and equipment within discernible range of sensitive receivers where practicable • Where feasible and practicable, the noisiest works will be carried out during recommended standard hours • Plant and equipment including trucks will be turned off when not used or idle • Noisy plant and equipment will be located furthest away from sensitive receivers.	Contractor	Construction	Effective	NA	TBD	DITRDCA
Administrative Controls	Contractor	Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Noise and Vibration	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
• Brief workers on the noise sensitivity of the neighbouring properties to the work sites • Respite periods will be adopted for construction activities that are to be undertaken for extended periods of time such as augmentation • Trucks will drive to and from the site in a forward motion to avoid the use of reversing alarms.						
Community Management • Sensitive receivers will be informed of scheduled construction works at least one week prior to the commencement of construction • Sensitive receivers will be informed prior to the commencement of potentially noise intensive activities such as piling • Sensitive receivers will be informed of any construction works occurring outside recommended standard hours • A complaints handling procedure, including a dedicated email and contact phone number, will be	Contractor	Pre-Construction and Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Noise and Vibration	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
established for enquiries during construction works.						
Construction Vibration Mitigation • Lower impact equipment or methodologies will be investigated were possible, for example driven and bored piling • Construction works will be sequenced so that vibration-causing activities do not occur simultaneously.	Contractor	Pre-Construction and Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Traffic, Transport and Access	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will prepare and implement measures in a Construction Environmental Management Plan (CEMP) to manage the potential impacts of construction on traffic, transport and access. This will include measures to coordinate the movements of land-based and water-based traffic. For water-based traffic, this may include the installation of temporary buoy markers to demarcate navigable waters for existing vessel operators.	Contractor	Pre-Construction and Construction	Effective	EPBC Act 1999, *Planning Act 2002* (NI)	TBD	DITRDCA, NIRC

Mitigation Measure – Traffic, Transport and Access	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will consult with the NIRC as Port Manager during construction to minimise potential impacts on existing port operations.	Contractor	Construction	Effective	NA	TBD	DITRDCA, NIRC
Where feasible and practical, the Contactor will arrange for one truck at any point in time to transport spoil from Kingston Pier to the land-based disposal site.	Contractor	Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Utilities and Services	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will undertake investigations to ensure that all appropriate measures are implemented to minimise potential risk to existing utilities and services prior to construction.	Contractor	Pre-Construction	Effective with investigations undertaken	NA	TBD	DITRDCA, NIRC
The Contractor will consult relevant service providers, owners, the NIRC and/or the Administration of Norfolk Island to verify the location of all existing utilities and services and to determine any potential impacts of the Project. This will include requirements for the protection, relocation	Contractor	Pre-Construction	Effective	NA	TBD	DITRDCA, NIRC

Mitigation Measure – Utilities and Services	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
or decommissioning of existing utilities and services both above and below water.						
The Contractor will verify the location of all existing utilities and services on and in the vicinity of the site and protect existing utilities and services, as necessary. This will include a Before You Dig Australia (BYDA) enquiry and survey of both above and below water utilities and services.	Contractor	Pre-Construction and Construction	Effective	NA	TBD	DITRDCA, NIRC

Mitigation Measure – Waste Management	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The method of disposal of liquid waste from dewatered spoil including capture and treatment will be confirmed.	Designer	Detailed Design	Effective	NA	TBD	DITRDCA
The Contractor will prepare and implement measures in a Construction Environmental Management Plan (CEMP) to manage the key waste streams.	Contractor	Pre-Construction and Construction	Effective	EPBC Act 1999, *Planning Act 2002* (NI)	TBD	DITRDCA, NIRC
During construction, at a minimum the following mitigation measures will be implemented:	Contractor	Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Waste Management	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
• The jack-up barge, floating hopper, flat-topped barge and skip bins will not be overloaded with spoil to prevent spillage during transfer to Kingston Pier • Domestic waste will be disposed of at appropriate receptacles or designated places such as a Waste Management Centre or a waste management facility on Norfolk Island • All trucks transporting spoil to the Old Cascade Quarry will be covered to prevent material spillage • Oils and lubricants will be recycled at an appropriate recycling waste facility on Norfolk Island.						
Waste management, littering and general tidiness during construction will be monitored during routine site inspections.	Contractor	Construction	Effective	NA	TBD	DITRDCA
All waste generated by water-based vessels during construction and operation will be stored in appropriate on-board waste holding facilities for disposal at licenced land-based facilities.	Contractor and Port Users	Construction and Operation	Effective	NA	TBD	DITRDCA
Appropriate measures to avoid and minimise waste generation during	Contractor and the NIRC	Construction and Operation	Effective	NA	TBD	DITRDCA, NIRC

Mitigation Measure – Waste Management	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
construction and operation will be investigated and implemented, where practicable. In addition, suitable waste receptacles will be provided on-site for users of Kingston Pier.						
All general waste will be classified before being disposed of to an appropriately licenced facility in accordance with Waste Classification Guidelines: Part 1 Classifying Waste (EPA 2014). Where necessary, this will include sampling and analysis, and separating wastes for potential recycling or reuse in accordance with the waste management hierarchy.	Contractor and the NIRC	Construction and Operation	Effective	NA	TBD	DITRDCA, NIRC

Mitigation Measure – Property and Land Use	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will prepare and implement measures in a Construction Environmental Management Plan (CEMP) to manage the potential impacts of construction on property and land use.	Contractor	Pre-Construction and Construction	Effective	EPBC Act 1999, *Planning Act 2002* (NI)	TBD	DITRDCA, NIRC

Mitigation Measure – Socio-Economic	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
Prepare a Contingency Plan to document the level of access various port users will have to the Kingston Pier during the channel construction works. The Plan is to be presented to Stakeholders for consultation and input prior to finalisation.	DITRDCA	Pre-Construction and Construction	Effective	NA	TBD	DITRDCA
The Contractor will prepare and implement measures in a Construction Environmental Management Plan (CEMP) to manage the potential environmental impacts of construction.	Contractor	Pre-Construction and Construction	Effective	EPBC Act 1999, *Planning Act 2002* (NI)	TBD	DITRDCA, NIRC
The Contractor will consult with the NIRC as Port Manager during construction to minimise potential impacts on existing port operations.	Contractor	Construction	Effective	NA	TBD	DITRDCA, NIRC

Mitigation Measure – Cumulative Impacts	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will consult NIRC to ensure that there are no significant construction timing overlaps between the Project and other existing and proposed developments to minimise cumulative impacts.	Contractor	Pre-Construction	Effective	NA	TBD	DITRDCA

Mitigation Measure – Cumulative Impacts	Responsibility for Implementation	Timing/Phase	Expected/Predicted Effectiveness	Statutory/ Policy Basis	Cost	Agency Responsible for Endorsing/ Approving
The Contractor will explore the potential to modify the construction methodology to minimise cumulative impacts.	Contractor	Pre-Construction	Effective	NA	TBD	DITRDCA

5 Other Requirements

5.1 Other approvals and conditions

5.1.1 Norfolk Island Regional Council

The Project was declared as 'significant development' under the *Planning Act 2002* (NI) and *Planning Regulation 2004* (NI) by the Administrator of Norfolk Island as the Commonwealth Minister's delegate on 12 May 2021 in accordance with Section 28C(5)(a) of the *Planning Act 2002* (NI).

An Environmental Impact Statement (EIS) (Advisian, 2021d) was prepared to accompany the Development Application (DA) for land-based works. The *Planning Act 2002* (NI) and *Norfolk Island Plan 2002* (NI) apply to land-based works located above the mean high water mark and are subject to environmental assessment and planning approval from the NIRC.

The EIS was prepared in accordance with Schedule 2 of the *Planning Regulation 2004* (NI) and the directions received from the Chief Executive Officer (General Manager) of the Norfolk Island Regional Council (NIRC) (letter dated 15 February 2021), pursuant to Section 45(6) of the *Planning Act 2002* (NI).

The EIS considered the relevant parts of the *Norfolk Island Plan 2002* (NI), which provides the strategic and statutory framework for land management and the future development of Norfolk Island including Part A – Strategic Plan and the following in Part B – Planning Requirements:

- B1 – Zoning Scheme (land zoning and permissibility)
- B2 – Overlay Provisions (Heritage Map Overlay)
- B3 – General Provisions (clauses relating to use, character, amenity, environment, heritage, access and parking, infrastructure and services and social interest).

DA.BA 48/2021 was lodged with NIRC on 21 December 2021. The DA was placed on public exhibition by NIRC between 22 December 2021 and 28 January 2022. The DA was approved with conditions by the Minister's Delegate on 1 July 2022 (a copy of the approval is attached in **Appendix M**).

Condition 13 of the approval requires that prior to the commencement of any site works that the following must be in place:

- Commonwealth approvals – all approvals required in relation to the EPBC Act
- Licence/Permit – all licences that may be required from the relevant authorities including Australian Federal Government agencies and NIRC
- Pier Street Bridge Certification – Pier Street Bridge must be certified by a suitably qualified engineer and certified that it is capable of withstanding the loadings that are proposed during the Project.

Condition 16 requires that the CEMP is to be submitted to the NIRC General Manager, prior to the commencement of site works.

5.1.2 Other Required Approvals, Permits and Licences

Other approvals, permits and/or licences required for the Project are:

- *Underwater Cultural Heritage Act 2018* – permit(s) pursuant to Section 23 for works to protected underwater cultural heritage
- Authorisation from the Director of National Parks for works in the Norfolk Marine Park unless is subject to the Management Plan's class approval for any approval issued under Part 9 of the EPBC Act. The Norfolk Marine Park is protected under the EPBC Act
- Approval from the Office of the Administrator (for the land-based works).

5.1.3 Monitoring, Enforcement and Review Procedures

A range of regulatory monitoring, enforcement and review procedures would apply to the Project. A CEMP has been prepared for the Project (refer to **Appendix L**) which would also be required to comply with Conditions 14 and 15 and is to be approved by the NIRC General Manager prior to the commencement of site works as required in Condition 16.

Compliance with the mitigation measures in this PER and the EIS and all approvals, permits and licences during construction would be mandated and enforced by DITRDCA on behalf of the Australian Government through the contractual arrangements to be established with the appointed Contractor.

5.2 Consultation

DITRDCA is committed to continuing consultation and engagement with stakeholders and the Norfolk Island community throughout the environmental assessment phase of the Project. Additional stakeholder and community consultation activities would be undertaken during public exhibition of the PER. This continuity is important to retain the confidence of the participants to facilitate the realisation of the Project as it would provide increased opportunities for tourism as well as community and economic development on Norfolk Island.

Details of consultation undertaken to date for the Project is described in the following sections.

5.2.1 Identification of Key Stakeholders

This section describes stakeholder and community consultation activities undertaken for the Project.

The deepening and widening of the existing channel was previously raised with The Hon Nola Marino MP, the then Assistant Minister for Regional Development and Territories during her visit to Norfolk Island in late 2019. The Project was highlighted as being important to port users and the broader community. This represents early engagement with stakeholders and the community.

A Stakeholder Engagement Plan was prepared by Advisian for the Project in-line with the DITRDCA's Norfolk Island Community Engagement Framework to enable effective two-way consultation for the Project. The Plan outlines planned engagement activities to facilitate effective community and stakeholder consultation, use of local knowledge and expertise, and the development of a preferred design option to meet the needs of port users and vessel operators.

During the planning phase for the Project and preparation of the EA, the following key stakeholders were identified in Table 5-1.

Table 5-1 Key stakeholders.

Key stakeholders	
Office of the Administrator	Norfolk Island Museums
NIRC	Norfolk Island National Park and Botanic Garden
NIRC Mayor and Councillors	Norfolk Island Flora and Fauna Association
Norfolk Island Volunteer Rescue Squad	Commonwealth Heritage Manager – KAVHA
Transam Argosy Pty Ltd	KAVHA Advisory Committee and Community Advisory Group
Norfolk Forwarding Services	Burnt Pine Travel
Norfolk Island Fishing Association	DITRDCA (Norfolk Island)
Lighterage and Stevedores	DITRDCA (Canberra)
Norfolk Island Wa'a Outrigger Club	DCCEEW
Norfolk Island Chamber of Commerce	DCCEEW (Parks Australia)

5.2.2 Engagement with Stakeholders

Stakeholders have been formally engaged on three occasions during the Project:

- Prior to the commencement of the Project concept design
- Upon completion of the 30% Project concept design
- Upon completion of the 80% Project concept design.

The first round of stakeholder engagement was held from 17 – 21 February 2020 on Norfolk Island between the Project Team and key stakeholders and community groups to inform them of the Project and provide the opportunity for early feedback on the direction of the Project concept design and EA.

The second round of stakeholder engagement was held virtually from 27 May – 3 June 2020 between the Project Team and key stakeholders and community groups. It served to inform stakeholders of the key channel design options developed during concept design and to gain an understanding of each stakeholder's preference on which option would be most suitable.

The third round of stakeholder engagement was held virtually from 27 November – 4 December 2020 between the Project Team and key stakeholders and community groups to inform them of project developments such as the preferred design option and to provide the opportunity for feedback.

The outcomes of the stakeholder engagement from has confirmed high levels of support for the Project. The engagement has also identified information that has been taken into consideration in the Project design.

Furthermore, the DITRDCA has provided media releases, updates and fact sheets on their website to inform stakeholders and community groups of the Project.

5.2.3 Summary of Consultation Activities

A summary of the key matters raised by stakeholders during the first round of stakeholder engagement from 17 – 21 February 2020 is provided below:

- Future proofing of the existing channel to allow for the larger future vessel fleet
- Potential impact of the Project on wave behaviour in the harbour
- Beneficial reuse of spoil
- Need for a turning radius for vessels (swing area)
- Potential impact of the Project on the end of the ramp
- Design considerations including pitching of vessels, channel widths and wave height
- Consideration of the removal of the existing bombora near Kingston Pier
- Consideration of the existing structural integrity of Kingston Pier
- Consideration of the provision of channel navigation aids.

Notwithstanding the above, Table 5-2 describes specific matters raised by stakeholders during the first round of stakeholder engagement.

Table 5-2 Summary of specific matters raised by stakeholders during the first round of stakeholder engagement.

Specific matters raised
Design
Need for a swing area adjacent to the berth in addition to channel widening.
Design considerations including pitching of vessels, channel widths, navigation depth and wave height.
Designing the channel for the future vessel fleet of larger barges.
Feasibility of the construction of a temporary rock working platform alongside Kingston Pier to facilitate construction works.
Removal of bombora near Kingston Pier as well as Cascade Pier.
Permanent piled channel markers and/or temporary buoy markers and navigation lights.
Potential land-based disposal sites and the beneficial reuse of spoil.
Beneficial reuse of spoil for Cascade Pier apron raising.
Improvements to the existing rock revetment.
Retention of the bombora near Kingston Pier would reduce wave climate and is a marker for boat owners approaching Kingston Pier.

Specific matters raised
Removal of the bombora near Cascade Pier at the same time as the Project given high cost of mobilisation of plant and equipment and given appropriate plant and equipment would be available.
Borehole investigation on the skate harbour side of the channel.
Numerical modelling of the wave climate at Kingston Pier.
Potential strengthening of Kingston Pier to support a deeper channel.
Potential for including fendering upgrade into the Project.
Condition of the existing rock revetment as well as the hole in the sandstone flagging of the existing seawall below Flagstaff Hill.
Larger vessels and a more efficient channel. Biggest cost to increasing freight is demurrage.
Increasing availability of cargo ships to Norfolk Island.
Yachts being able to berth at Kingston Pier.
Construction
Not doing construction works during winter months due to southern swell.
Continuation of existing port operations during construction.
Impact to fishing off Kingston Pier.
Use of local labour during construction.
Screening of spoil for potential maritime archaeology.
Augmentation limited to smaller swells to help contain sediment plumes.
Environment
Potential impact of channel deepening on the end of the ramp.
Worsened wave climate impacting the Pier Store (Museum).
Impact of augmentation on the structure of Kingston Pier.
Impact of augmentation on the wave climate focusing wave action towards the existing rock revetment.
Impact of wave climate on further erosion of the cliff next to the existing rock revetment.
Potential impact of sediment plumes. Settlement testing recommended.
Impact of sediment plumes, particularly in Slaughter Bay. Plumes may be easier to contain at low tide.
Ecology (marine) adjacent to the western side of Kingston Pier is not unique to the area.
Operation
Potential issues of vessel navigation at night.

Specific matters raised
Having Kingston Pier available in the week leading up to Australia Day for the Norfolk Ocean Challenge.
Channel navigation aids would be dangerous for towed lighters, detract from aesthetics and may encourage inexperienced skippers to launch boats and risk injury due to hazardous conditions at Kingston Pier.
Ongoing requirements for channel maintenance.

In addition, a summary of the key matters raised by stakeholders during the second round of stakeholder engagement from 27 – 29 May 2020 is provided below:

- Consideration of the location of channel navigation aids
- Consideration of the land-based disposal sites and artefacts management
- Potential impact of the channel design options on wave behaviour affecting Kingston Pier, the existing rock revetment and nearby cliff under Flagstaff Hill
- Potential impact of sediment plumes on the marine environment
- Suitability of spoil for rehabilitation of the Old Cascade Quarry at the land-based disposal site.

Notwithstanding the above, Table 5-3 describes specific matters raised by stakeholders during the second round of stakeholder engagement.

Table 5-3 Summary of specific matters raised by stakeholders during the second round of stakeholder engagement.

Specific matters raised
Design
Permanent piled channel markers and/or temporary buoy markers and navigation lights.
Future-proofing the design channel to cater for larger vessels whilst construction equipment is mobilised.
Potential land-based disposal sites and rehabilitation of the Old Cascade Quarry.
Stabilisation of Kingston Pier to ensure no undermining of the structure.
Potential maintenance of the existing rock revetment.
Construction
Accessibility of Kingston Pier for cargo and cruise ships.
Accommodation of existing vessel operators during construction.
Land-based Contractor's working area at Kingston Pier.
Management and storage of artefacts
Grassed area next to the Pier Store (Museum) is sensitive due to hidden building footings.
Environment

Specific matters raised
Environmental assessment of all land-based activities submitted to the Norfolk Island Regional Council.
Impact of wave climate on Kingston Pier.
Impact of wave climate on the existing rock revetment and nearby cliff, and mitigation measures.
Management of sediment plumes during construction. Potential impact of sediment plumes and the wave climate on the marine environment including habitats and corals.
Impact to marine habitat and fishing off Kingston Pier.
Vehicular loadings on Pier Street Bridge on the main access road to Kingston Pier.
Potential impact on the World, National and/or Commonwealth Heritage listings of the KAVHA and *HMS Sirius*, and the potential impact on the Norfolk Marine Park values.
Operation
Sediment allowance in the channel over time.
Ongoing requirements for channel maintenance.

Finally, a summary of the key matters raised by stakeholders during the third round of stakeholder engagement from 27 November – 4 December 2020 is provided below:

- Installation of either a West or North Cardinal Marker
- Cruise ship arrivals provided full access to Kingston Pier during construction
- Description of the timing and duration of construction works
- Maintain access and entry to the Pier Store during construction
- Maintain access to Kingston Pier during the annual Norfolk Ocean Challenge Event in January.

5.3 Environmental record of person(s) proposing to take the action

DITRDCA has a satisfactory record of responsible environment management. There are no known past or present proceedings under any law for the protection of the environment or the conservation and sustainable use of natural resources that have been taken against the Proponent.

The DITRDCA through the Australian Government administers the territory of Norfolk Island and has overall responsibility for the management of the KAVHA. The Contractor to be appointed by the Proponent, DITRDCA, would be suitably qualified and experienced in undertaking the construction works whilst minimising potential environmental impacts.

5.4 Economic and social matters

A desktop review of potential economic and social impacts has been undertaken. The assessment draws upon the other assessments and findings from the PER to understand and assess the potential

impacts including noise and vibration, traffic, transport and access, air quality and greenhouse gases, visual amenity, non-Aboriginal heritage and property and land use. Given the context for the Project, it is expected that all identified impacts would primarily relate to the local level (Norfolk Island) only.

The assessment includes:

- A general overview of the existing and expected future social profile of Norfolk Island
- Identification of key socio-economic benefits and impacts
- Identification of impacts on existing utilities, services and facilities.

No economic cost/benefit analysis or similar quantitative studies have been undertaken for the Project. Section 1.3 confirms that the only alternative to the Project is the 'Do Nothing' Scenario and due to the location and nature of the existing Kingston Pier channel, there are no alternatives to constructing this Project elsewhere.

5.4.1 Existing Environment

Social Values

Key social values associated with the Project at Kingston Pier relate to the port's role as critical infrastructure for both minor freight operations and transfer of cruise ship passengers, for various vessel operators such as commercial charter, fishing vessels and emergency responders and for other public users who use Kingston Pier for fishing and other recreation activities. Similarly, the values of the Norfolk Marine Park includes fishing, boating, shipping, tourism and recreation activities within the coastal waters surrounding Norfolk Island. The sheltered coral lagoon of Emily Bay located east of Kingston Pier is used for swimming, snorkeling and tourism.

Kingston Pier is culturally significant to the Norfolk Island community and the KAVHA, which is of World and National heritage significance. It also has an important role in annual Anniversary Bounty Day Celebrations commemorating the arrival of the Pitcairn Islanders on 8 June 1856. Therefore, the continuation of existing uses at Kingston Pier is of high social value.

Social Characteristics

A review of available statistics including Australian Bureau of Statistics (ABS) Census data was undertaken to understand the social characteristics of Norfolk Island.

The total population of Norfolk Island in 2021 was 2,188 persons which is an increase from the 1,748 persons recorded in 2016, although is still less than the 2,601 persons recorded in 2001. Median age has risen from 49 years in 2016 to 50 years in 2021. 16% of the total population was aged between 0-14 years whilst 24.9% were aged 65 years or older. Aboriginal and/or Torres Strait Islander people made up 1.1% of the total population and 15.9% of the total population of Norfolk Island was born in Norfolk Island. 48.4% of the total population was male and 51.6% was female.

For the ABS 2021 Census, the following additional key social characteristics were recorded:

- Total private dwellings – 1,084 with 83.1% occupied

- Occupied private dwellings – 95.5% separate house, 1.2% semi-detached and 1.1% flat or apartment
- Tenure – 41.1% owned outright, 23.7% owned with a mortgage, 29% rented, 3.7% other tenure type and 2.8% tenure type not stated
- Household size – average 2.1 persons per household
- Number of registered motor vehicles – 37.1% of occupied private dwellings had one vehicle garaged, 37.1% two vehicles and 20.3% had three or more vehicles.

Economic Characteristics

KPMG (2019) prepared a report to establish an economic baseline for Norfolk Island which would be used to assist in monitoring economic performance and trends and to help guide policy and decision-making. The findings of the report have been used for the economic profiling of Norfolk Island to understand past and recent performance of the general economy and local sectors.

In 2021, the unemployment rate on Norfolk Island was 2.8%, which is an increase of 1.2% since 2016. The Island appears to be operating at a high rate of employment with significantly lower unemployment rates compared to mainland Australia at 6.9% at the time of ABS 2016 Census (Figure 5-1) and 5.1% for the ABS 2021 Census.

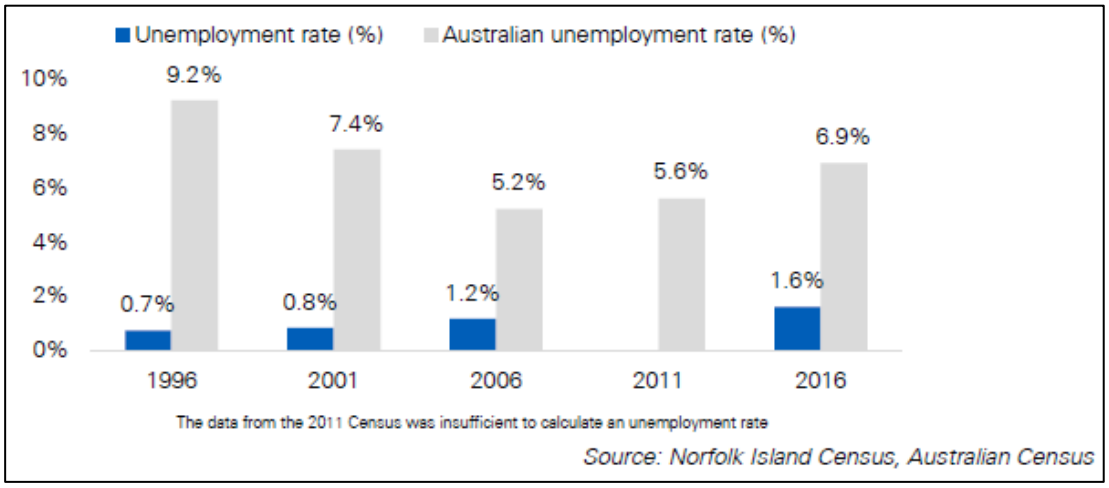


Figure 5-1 Unemployment rate by Census year (Source: KPMG 2019).

The Norfolk Island economy is dependent on tourism and related industries such as wholesale and retail trade and the accommodation and food services sectors (Figure 5-2). These two local sectors have contributed to approximately 40% of all industry employment on Norfolk Island over the past 25 years. Conversely, employment in the agriculture, forestry and fishing industry has been declining.

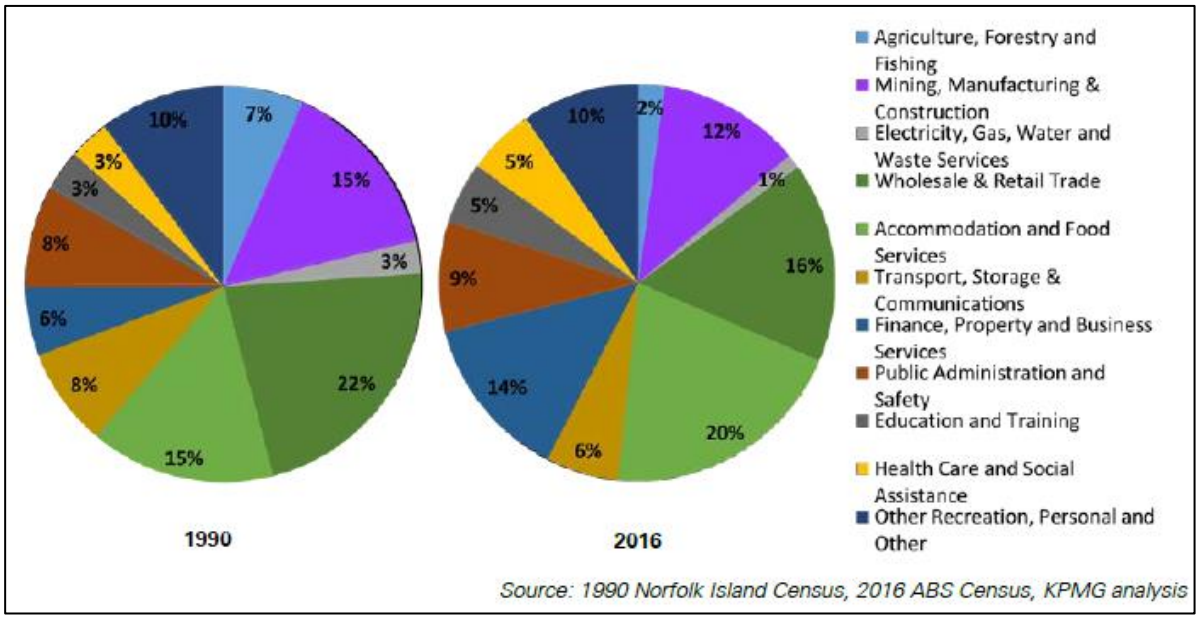


Figure 5-2 Employment by industry on Norfolk Island in 1990 and 2016 (Source: KPMG 2019).

The key components of the economy of Norfolk Island are tourism, domestic demand and merchandise trade (KPMG, 2019). These factors provide an indication of Norfolk Island's Gross Territory Product (GTP) which illustrates the current baseline of economic activity. The GTP can also be compared with population and employment data to assist in establishing future economic performance and trends. Norfolk Island's GTP was $81.8 million in Financial Year 2016 (FY2016). Small year-to-year fluctuations were experienced by the economy from FY2014 to FY2016 (Figure 5-3). An increase in GTP was considered largely a result of an improvement in net exports, whereas contraction in GTP appeared to be due to a combination of an increase in imports offset, to an extent, by an improvement in both tourist exports and government expenditure.

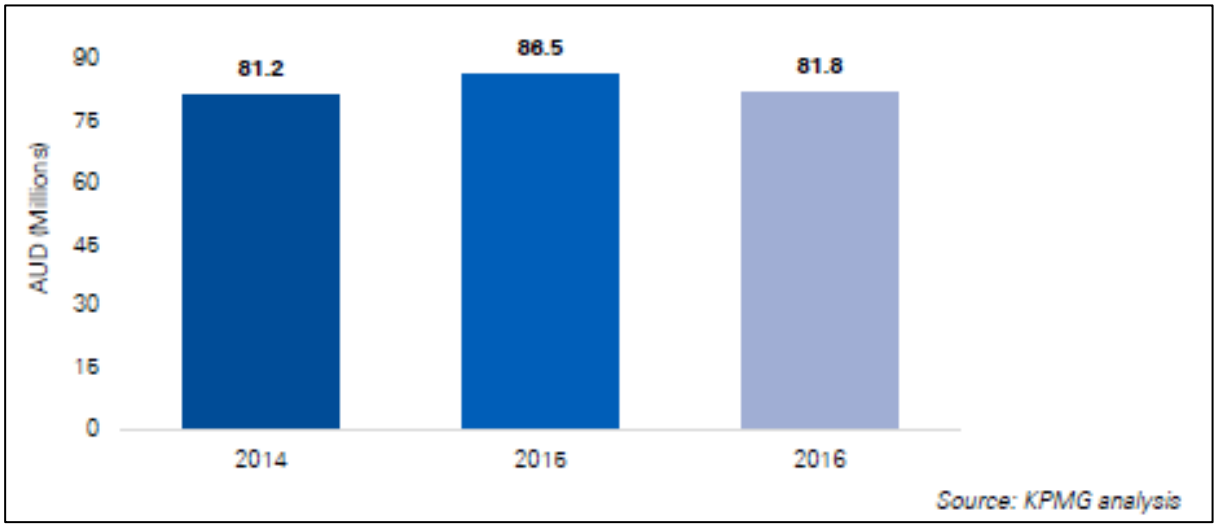


Figure 5-3 Gross Territory Product (excluding investment) for Norfolk Island (Source: KPMG 2019).

Tourism Industry

Tourism is the key industry for Norfolk Island. The busiest months for tourism are in autumn and spring; March and April being the largest number of visitor arrivals. Tourism activity such as spending on accommodation, transport, food and drink arises from a demand outside the Norfolk Island economy, and is therefore, considered to be an export.

Generally, over 25,000 visitors arrive in Norfolk Island each year. Based on the components of Norfolk Island's tourist exports, a large proportion of improvements in tourist-related spending was enabled by growth in visitor volumes (KPMG, 2019) (Figure 5-4 and Figure 5-5). The Island's nearly 30,000 visitors in FY2016 generated approximately $33 million in tourist exports.

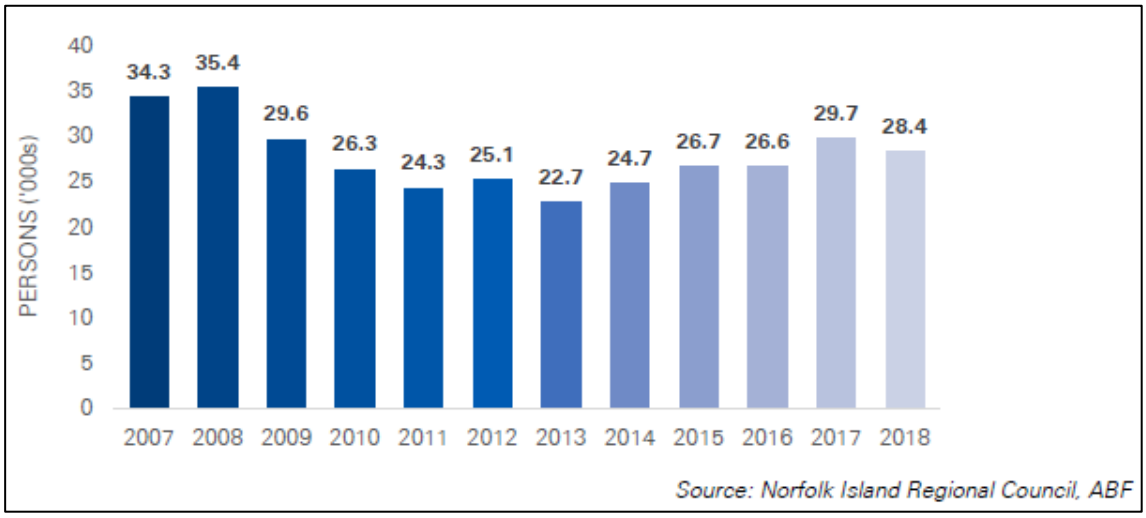


Figure 5-4 Total visitor arrivals per calendar year (Source: KPMG 2019).

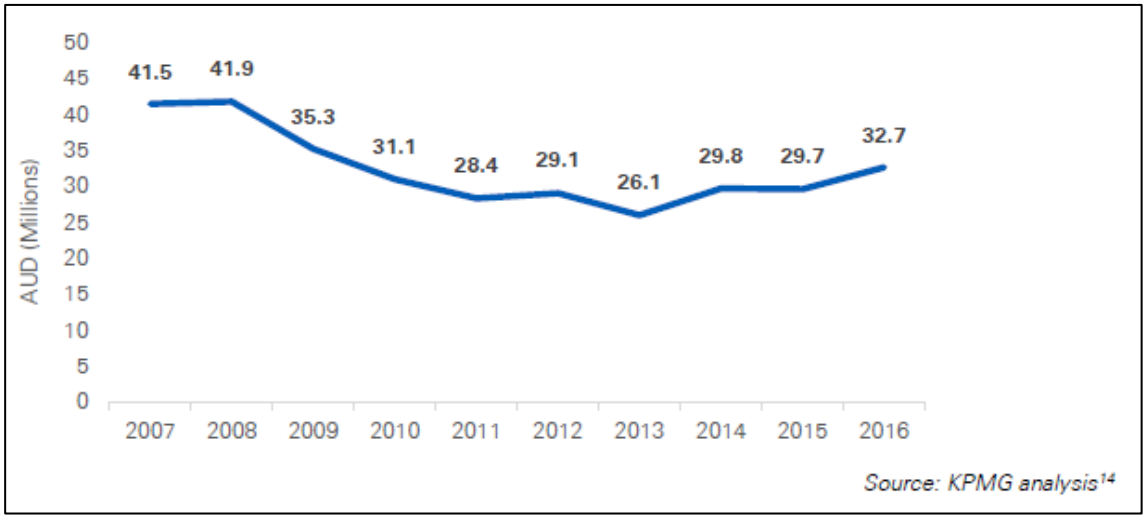


Figure 5-5 Tourist exports per financial year (Source: KPMG 2019).

Growth in visitor volumes has been enabled by establishing links between Norfolk Island and major tourist source markets. It is considered that the aviation and cruise ship industries are key enablers.

Transport and Access

On Norfolk Island at the ABS 2021 Census, the methods of travel to work for employed people were Car, as driver 63.4%, Truck 7% and Walked 5.8%. Other common responses were Worked at Home 7.3% and Car, as passenger 2.7%. On the day, 67.3% by car (either as driver or as passenger).

Norfolk Island is located in the Pacific Ocean. The *Norfolk Island Legislation Amendment Act 2015* abolished self-government on Norfolk Island. Kingston is the capital and is located on the southern coast of Norfolk Island. Kingston Pier is serviced by local roads with Pier Street and Bay Street providing the access route from Kingston Pier to Quality Row, the principal thoroughfare through the KAVHA.

The hardstand area at Kingston Pier provides for public car parking and is generally used by vehicles for port-related activities as well as visitors to the KAVHA. Cruise ship shuttle bus services and taxi services are available to transport cruise ship passengers and other visitors to and from and/or near Kingston Pier.

It is understood that there is no public transport system on Norfolk Island. There is no known dedicated footpath along Pier Street providing pedestrian access to Kingston Pier.

Social Infrastructure

Social infrastructure refers to community facilities, services, shopping, transport and access networks which help individuals, groups and communities meet their social needs, maximise their development potential and promote community wellbeing.

Social infrastructure at Kingston Pier and in the vicinity includes:

- Existing historic buildings and structures including the Pier Store (Museum) and the Royal Engineers Office (Museum shop and information) as well as maritime facilities
- Kingston Common Reserve in the vicinity of Kingston Pier to the north, east and west. The Reserve allows for a range of public activities. It also contains historic buildings and structures which are involved in commercial uses and recreation
- Government House, Norfolk Island Golf Club, and museums and ruins on Quality Row
- Norfolk Island Central School on Cascade Road.

5.4.2 Public Consultation Activities

The DITRDCA has engaged key stakeholders and the Norfolk Island community in the development of the Project, in advising of the status and updates and in managing requirements and expectations of its scope. A Stakeholder Engagement Plan was prepared by Advisian for the Project in-line with the DITRDCA's Norfolk Island Community Engagement Framework. It has been effective in identifying key stakeholders and facilitating two-way consultation for the Project.

Stakeholder consultation undertaken to-date has confirmed high levels of support for the Project. Engagement has also identified information that has been taken into consideration in the Project design, in particular the design options.

Refer to Section 5.2 for further detail of stakeholder and community engagement activities that have been undertaken for the Project.

5.4.3 Potential Construction Impacts

Potential socio-economic impacts during construction to the land and waterway include:

- Temporary reduction in local amenity due to noise and vibration, visual and air quality impacts
- Temporary disruption to vehicular and pedestrian access and hardstand area parking
- Temporary impact to water-based vessel traffic, navigation and access including commercial charter and fishing vessels
- Temporary impact to the continuation of existing uses at Kingston Pier
- Construction would have a positive impact on the local economy by making use of local plant and equipment such as smaller excavators and heavy vehicles. The use of local labour and resources, where possible and appropriate, is a key objective of the Project.

Noise and Vibration

The main sources of noise and vibration during construction are likely to include the following:

- Mobilisation and demobilisation of local plant and equipment
- Mobilisation and demobilisation of off-island plant and equipment
- Movements from the land-based Contractor's working area
- Piling, installation and repositioning of the jack-up barge
- Operation of land-based and water-based plant and equipment
- Piling and installation of a channel navigation aid
- Truck movements for disposal of spoil.

Air Quality and Greenhouse Gases

The main air quality and greenhouse gas issues during construction include:

- Exhaust emissions from plant and equipment
- Fugitive emissions during refuelling activities
- Dust emissions.

The assessment indicated that dust emissions and plumes are not expected to be a major issue given that augmentation works would be undertaken beneath the water surface and the spoil would remain wet following dewatering activities. Dust emissions during the mobilisation and demobilisation of local plant and equipment would be minimal as trucks and smaller excavators would be transported along sealed roads and these activities would be short-lived.

Visual Amenity

During construction, maritime vessels, water-based plant and equipment as well as trucks and land-based plant and equipment would be visible at and in the vicinity of Kingston Pier.

Construction works would be visible to locals, tourists or visitors in the context of existing port operations at Kingston Pier and Cascade Pier. Lighting from maritime vessels and construction plant and equipment would be visible during construction works.

Augmentation works would generate sediment plumes in the harbour adjacent to Kingston Pier. The potential temporary visual impact of the sediment plumes would be minimised with the implementation of mitigation measures.

Traffic, Transport and Access – Land

The existing access route to Kingston Pier via Pier Street is considered to be sufficient for local plant and equipment. The existing hardstand area at Kingston Pier would allow for car parking for construction personnel and provide an adequate turning circle for light and heavy construction vehicles. It is expected that overflow parking adjacent to the site would not be required.

All land-based plant and equipment would be stationed and/or stored at the Contractor's working area and all traffic movements would be coordinated by the Contractor. Trucks would transport spoil to the land-based disposal site at the Old Cascade Quarry via Pier and/or Bounty Streets, Middlegate Road and Cascade Road. Truck movements are not expected to have an impact on the surrounding local road network.

During construction, it is expected that available car parking at the hardstand area and pedestrian access may be temporarily limited. The combination of private vehicle use and construction traffic is not considered to have an impact on the surrounding local road network.

Access to existing buildings and structures would be maintained during construction, including the Pier Store (Museum) and Royal Engineers Office (Museum shop and information).

Traffic, Transport and Access – Water

It is expected that existing vessel operators at Kingston Pier may be temporarily restricted at some point during construction, particularly in terms of altered navigation and access to the existing channel. Consequently, access and use of existing maritime facilities including Kingston Pier, the boat ramp and stairs would be limited. The Contractor would coordinate the movement of all vessel operators in the harbour to ensure minimal impact on existing port operations and structures at Kingston Pier during construction.

Scheduled vessel arrivals associated with cargo vessels and cruise ship tenders would be pre-planned in advance to be accommodated during construction, if needed, and appropriate provisions would be made to accommodate other users as far as practicable.

There are no swing moorings located in the harbour adjacent to Kingston Pier that would potentially impact any mooring licence holders.

Non-Aboriginal Heritage

Kingston Pier is of high social value and cultural significance. It is expected that there would be temporary impacts on the continuation of existing port operations as well as temporary disruptions to vehicular and pedestrian access to Kingston Pier during construction.

Stabilisation works to Kingston Pier and Rock Revetment and Slaughter Bay Seawall repair works would be carried out during augmentation to improve structural integrity. As a result, the fabric would be protected and the existing uses that occur, and are dependent on Kingston Pier and surrounding areas, would be able to continue.

Overall, the Project including augmentation works, would likely have a significant impact on the underwater cultural archaeological potential of the KAVHA and *HMS Sirius* which are of World and/or National Heritage significance. The KAVHA and *HMS Sirius* are inextricably linked. According to the Commonwealth Heritage List, the KAVHA demonstrates social value which directly contributes to heritage significance.

Socio-economic Benefits

Construction would have a positive impact on the local economy by making use of local plant and equipment such as smaller excavators and heavy vehicles. The use of local labour and resources, where possible and appropriate, is a key objective of the Project. The estimated workforce is yet to be confirmed. However, the presence of a construction workforce will have a short-term positive socio-economic impact on the local economy by providing employment opportunities, and likely short-term increased trade for retail outlets on Norfolk Island.

Capital expenditure for construction of the Project will contribute directly to maintaining the historical function of Kingston Pier and its contribution to KAVHA as a source of economic activity (The Centre for International Economics 2017).

5.4.4 Potential Operational Impacts

Socio-economic impacts expected during operation are as follows:

- Positive socio-economic benefits to the Norfolk Island economy through the potential for greater use of Kingston Pier for minor freight operations and transfer of cruise ship passengers
- Negligible impact on visual amenity from the channel navigation aid.

Socio-economic Benefits

Based on an understanding of the strategic planning context, the Project would contribute towards key outcomes for port facilities and realisation of the overarching vision for KAVHA, in particular for conserving its heritage values and enhancing its contribution to the local economy as described in the KAVHA Economic Feasibility Study (The Centre for International Economics 2017). It would also provide increased opportunities for tourism as well as community and economic development on Norfolk Island. This may include the generation of new employment opportunities; however the number of jobs is not able to be quantified for the Project.

The key beneficiaries associated with operation of the Project would include:

- Vessel operators, who would benefit through improved navigation, access and safety in the transfer of freight and cruise ship passengers. These benefits would encourage potential greater use of Kingston Pier, thereby increasing potential growth opportunities in tourism and trade which would directly contribute to the economic development of Norfolk Island, as tourism is Norfolk Island's main area of economic activity
- The DITRDCA and NIRC, as it would contribute to the strategic outcomes for port facilities in the context of tourism and economic development
- The Norfolk Island community, who would benefit through tourist and construction-related spending on Norfolk Island and cultural uses at Kingston Pier.

Property acquisition is not required. In addition, local residents and/or businesses would not be relocated. There would also be no impact on historic buildings and structures within the KAVHA nor the Kingston Common Reserve which provides for public activities and other uses, and which contributes to the visitor experience at the KAVHA.

Visual Amenity

In consideration of the scale, frequency, transient nature and typical lay time of vessel activities, it is considered that an increase in the number of maritime vessels using Kingston Pier would not have an impact on visual amenity during operation.

The channel navigation aid would provide for the safe navigation of vessels entering and existing the harbour and would have negligible visual impact on viewpoint locations. The channel navigation aid would be relatively discrete in size and appearance when viewed from afar. Furthermore, any temporary buoy markers are intended to be in use when vessels are entering and exiting the harbour only.

5.5 Information sources provided in the PER

All information sources within this PER are referenced throughout the document and full references are provided in Section 7. These references include the publication dates. The most recent data available was sourced to inform the EA, EIS and this PER.

Key information sources include a number of recent surveys and studies undertaken by consultants specifically engaged for the Project including Advisian and Cosmos Archaeology. A number of these are provided as full reports in the PER's appendices. These studies have been undertaken between 2020 and 2022 and externally reviewed by DITRDCA, NIRC and DCCEEW (previously DAWE).

Recent marine and terrestrial ecological data has been obtained through a review of peer reviewed published literature (e.g. peer reviewed journal articles) and both Australian and local government reports and webpages/databases.

The reliability of all information sources used to prepare the PER are considered to be high based on their sources including peer reviewed journal articles, government publications and databases and recent studies undertaken by Advisian reviewed by DITRDCA, NIRC and DCCEEW.

Uncertainties in data sources may include:

- Inherent uncertainties in ecological data, which most often requires long term monitoring to be undertaken, which is not always available. Almost all published articles identify the need for more data to be collected over time.
- No dedicated studies have been undertaken to determine the full duration of coral spawning season in Norfolk Island including information on which species and what proportion of colonies are spawning on each occasion.
- The wave and dredge plume models have been developed by experienced and suitability qualified coastal engineers following best practice, using offshore wave and local wind data. The models have not been verified with local wave and current measurement data that is not available however, the accuracy of the model results are considered appropriate for the application.
- The underwater archaeological text excavation was carried out to refine the original predictions made with regard to the extent, condition, frequency and variety of potential archaeological remains. The results have informed the development of the KPUAMP methodology and archaeological mitigation.

6 Conclusion

This PER has been prepared to identify the existing environmental values and assess the potential impacts of the Project and recommend mitigation measures to manage potential environmental impacts. The PER also includes consideration of matters raised by stakeholders and community during development of the Project.

The construction of the Project could likely have a significant impact on the underwater cultural archaeological potential of the KAVHA and *HMS Sirius* which are of World and/or National Heritage significance as well as the heritage values of the Norfolk Marine Park which is a Commonwealth marine area. There is not likely to be a significant impact on any other MNES protected under the EPBC Act as a result of the Project.

There is a clear need for the Project. The existing channel within the harbour adjacent to Kingston Pier is inadequate for safe navigation during all tides and does not meet required navigation standards and guidelines. In addition, the existing limited water depth in the channel at lower tides is a safety risk for users due to inadequate under-keel clearance. This has the effect of limiting the use of Kingston Pier by vessels, particularly at lower tides. Stakeholder consultation has confirmed high levels of support for the Project.

The Project is considered to be an appropriate response to existing issues and would allow for the safe navigation of vessels at Kingston Pier. It would also provide increased opportunities for tourism as well as community and economic development on Norfolk Island. The Project is consistent with the principles of ecologically sustainable development (ESD) and the objects of the EPBC Act (refer Sections 6.1 and 6.2, respectively).

The Project will be developed in a manner to limit any potential impacts on environmental values associated with the Project. Mitigation measures have been prepared for the Project and provided that the measures specified in the PER are implemented during the detailed design, construction and operational phases, the identified potential environmental impacts would be acceptable. On balance, the action is considered justified.

6.1 Principles of ESD

The Project has been developed in consideration of the five principles of ESD listed under Section 3A of the EPBC Act. The assessment against the principles of ESD is summarised in Table 6-1.

Table 6-1 EPBC Act principles of ESD.

Principle	Assessment approach	Relevant sections of the PER
(a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.	An assessment of the feasible alternatives for the action and relevant environmental outcomes has been undertaken during the development of the Project. The assessment integrated both the long term and short term economic, environmental, social and equitable	▪ Section 1.3 – Feasible alternatives

Principle	Assessment approach	Relevant sections of the PER
	considerations to determine the preferred options.	
(b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	Environmental assessment of potential impacts are understood with a high degree of scientific certainty. No threats of serious or irreversible environmental damage have been identified, providing appropriate impact avoidance and mitigation measures are employed. The Project is therefore considered to be consistent with the precautionary principle.	▪ Section 3 – Relevant impacts ▪ Section 4 – Avoidance and mitigation measures
(c) The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	Driven by the existing condition of the channel, the Project will support the potential for greater use of Kingston Pier by various vessel operators and provide increased opportunities for tourism as well as community and economic development. The preparation of a CEMP and the implementation of avoidance and mitigation measures would minimise environmental impacts. The Project would not adversely affect future generations.	▪ Section 1.2 – Description of the action ▪ Section 4 – Avoidance and mitigation measures
(d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.	A Marine and Terrestrial Ecology Assessment has been undertaken to assess potential impacts on threatened species, habitats and biological diversity. The assessment found that no significant impact on habitats or species, particularly on threatened species, are likely to occur if the proposed mitigation measures are adopted. The Project has been designed in consideration of potential ecological impacts and to minimise impacts to nearby ecologically sensitive areas.	▪ Section 3 – Relevant impacts ▪ Section 4 – Avoidance and mitigation measures ▪ Appendix F – Marine and Terrestrial Ecology Assessment
(e) Improved valuation, pricing and incentive mechanisms should be promoted.	The implementation of avoidance and mitigation measures would reduce potential adverse impacts to the environment and potentially result in economic costs to the construction of the Project. This indicates the value of environmental resources and pricing and incentive mechanisms have been considered when designing and developing environmental management requirements.	▪ Section 4 – Avoidance and mitigation measures ▪ Section 5.4 – Economic and social matters

6.2 Objects of the EPBC Act

The Project has been assessed against the objects of the EPBC Act, as summarised in Table 6-2.

Table 6-2 Objects of the EPBC Act.

Object	Assessment approach	Relevant sections of the PER
(a) To provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance.	Impact assessments undertaken for the development of the PER (and similarly the approved DA and its accompanying EIS for the land-based works) provides a mechanism for protecting the environment prior to any works commencing.	▪ Section 3 – Relevant impacts ▪ Section 4 – Avoidance and mitigation measures
(b) To promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.	The PER has assessed the action against the principles of ESD and sets out avoidance and mitigation measures to minimise potential impacts on natural resources.	▪ Section 4 – Avoidance and mitigation measures ▪ Section 6.1 – Principles of ESD
(c) To promote the conservation of biodiversity.	The PER has assessed the potential impacts on biodiversity and provides avoidance and mitigation measures which promote conservation.	▪ Section 3 – Relevant impacts ▪ Section 4 – Avoidance and mitigation measures ▪ Appendix F – Marine and Terrestrial Ecology Assessment
(ca) To provide for the protection and conservation of heritage	The PER has assessed the potential impacts on cultural heritage (including underwater), and proposed avoidance and mitigation measures which provide for its protection.	▪ Section 3 – Relevant impacts ▪ Section 4 – Avoidance and mitigation measures ▪ Appendix I – Kingston Pier Underwater Archaeological Management Plan
(d) To promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples.	Extensive stakeholder and community consultation have been undertaken for the Project. Keeping stakeholders and the community informed of the Project through consultation activities has been important in retaining the confidence of the participants to facilitate the realisation of the Project.	▪ Section 5.2 - Consultation
(e) To assist in the co-operative implementation of Australia's international	The PER has been prepared to identify the existing environmental values and assess the potential impacts of the Project and recommend mitigation	▪ Section 3 – Relevant impacts

Object	Assessment approach	Relevant sections of the PER
environmental responsibilities.	measures to manage potential environmental impacts.	▪ Section 4 – Avoidance and mitigation measures
(f) To recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity.	Not applicable.	Not applicable.
(g) To promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.	Not applicable.	Not applicable.

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Appendix A
Public Environment Report (PER) Guidelines

Appendix B Drawings

Appendix C Underwater Archaeology Test Excavation Report

Appendix D KAVHA National Heritage Listing from the Australian Heritage Database

Appendix E HMS Sirius Shipwreck National Heritage Listing from the Australian Heritage Database

Appendix F Marine and Terrestrial Ecology Assessment

Appendix G Sediment Quality Assessment

Appendix H Wave Modelling Report & Dredge Plume Modelling Report

Appendix I Kingston Pier Underwater Archaeology Management Plan

Appendix J

Contact details for the proponent and the names of the persons involved in preparing the PER and work done by each

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Kristie McDowell (KM) – Graduate Marine Environmental Consultant

Section	Personnel
Executive summary	CJ, KN
Introduction	BM, CJ, KN
Matters of national environmental significance	CJ, KN, KM
Relevant impacts	CJ, KN, KM
Avoidance and mitigation measures	CJ, KN, KM
Other requirements	BM, CJ, KN, KM
Conclusion	BM, CJ, KN

Appendix K
Maritime Incident Response Plan

Appendix L Construction Environmental Management Plan

Appendix M NIRC Planning Approval

Appendix N Underwater Cultural Heritage Statement of Heritage Impact

Appendix O Heritage Impact Statement