Transport
for NSW

Central Coast Highway Upgrade Wamberal to Bateau Bay

Minor works review of environmental factors

Archaeological test excavations

July 2022

NSW GOVERNMENT

transport.nsw.gov.au

Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which the archaeological test excavations are proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Document review tracking

Draft No.	Date	Authored by	Reviewed by	Comments
RevA	23 May 2022	Bernadette Quirk	Philip Burns	
RevB	29 July 2022	Bernadette Quirk	Philip Burns	
RevC	17 August 2022	Bernadette Quirk	Philip Burns	Final

MW REF Authorisation

Approved by:	Josh Alce, Project Development Manager
Signed	
Date:	17 August 2022

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Tables

1. Introduction

The purpose of the Minor Works review of environmental factors (REF) is to describe the proposal, to document the likely impacts of the proposal on the environment, to detail mitigation measures to be implemented and to determine whether or not the proposal can proceed. For the purposes of this work Transport for NSW (Transport) is the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The description of the proposed works and assessment of associated environmental impacts has been undertaken in the context of section 171 of the *Environmental Planning and Assessment Regulation 2021,* Guidelines for Division 5.1 Assessments (DPE, 2022), the *Biodiversity Conservation Act 2016 (NSW)* (BC Act), the *Fisheries Management Act 1994* (FM Act) and the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)* (EPBC Act).

In doing so the REF helps to fulfil the requirements of section 5.5 of the EP&A Act including that Transport examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act.
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report.
- The potential for the proposal to significantly impact a matter of national environmental significance, including nationally listed threatened biodiversity matters, or the environment of Commonwealth land. Where a significant impact is considered likely on nationally listed biodiversity matters, either the proposal must be reconsidered or a Project REF must be prepared.

2. The proposal

2.1 Description

2.1.1 Proposal location details

Table 2-1 Proposal location details

Location details	
Title	Central Coast Highway upgrade – Wamberal to Bateau Bay Archaeological Test Excavations
File number	N/A
Road name and number	Central Coast Highway (HW30)
Closest crossroad(s):	Area 1 – Maas Parade, Forresters Beach Area 2 – Longs Road, Bateau Bay Area 3 – Cresthaven Avenue, Bateau Bay.
Chainage of works:	N/A
Local government area:	Central Coast Council
Transport for NSW region:	Sydney and surrounds

2.1.2 Proposal location description

Transport for NSW proposes to undertake archaeological test excavations (the proposal) as part of preparation of the Review of Environmental Factors (REF) for the proposed upgrade of the Central Coast Highway between Wamberal and Bateau Bay (the project).

The proposal would involve completion of archaeological test excavations to be carried out at locations adjacent to the existing Central Coast Highway. The archaeological test excavations are being completed as part of completion of an Aboriginal Cultural Heritage Assessment Report (ACHAR).

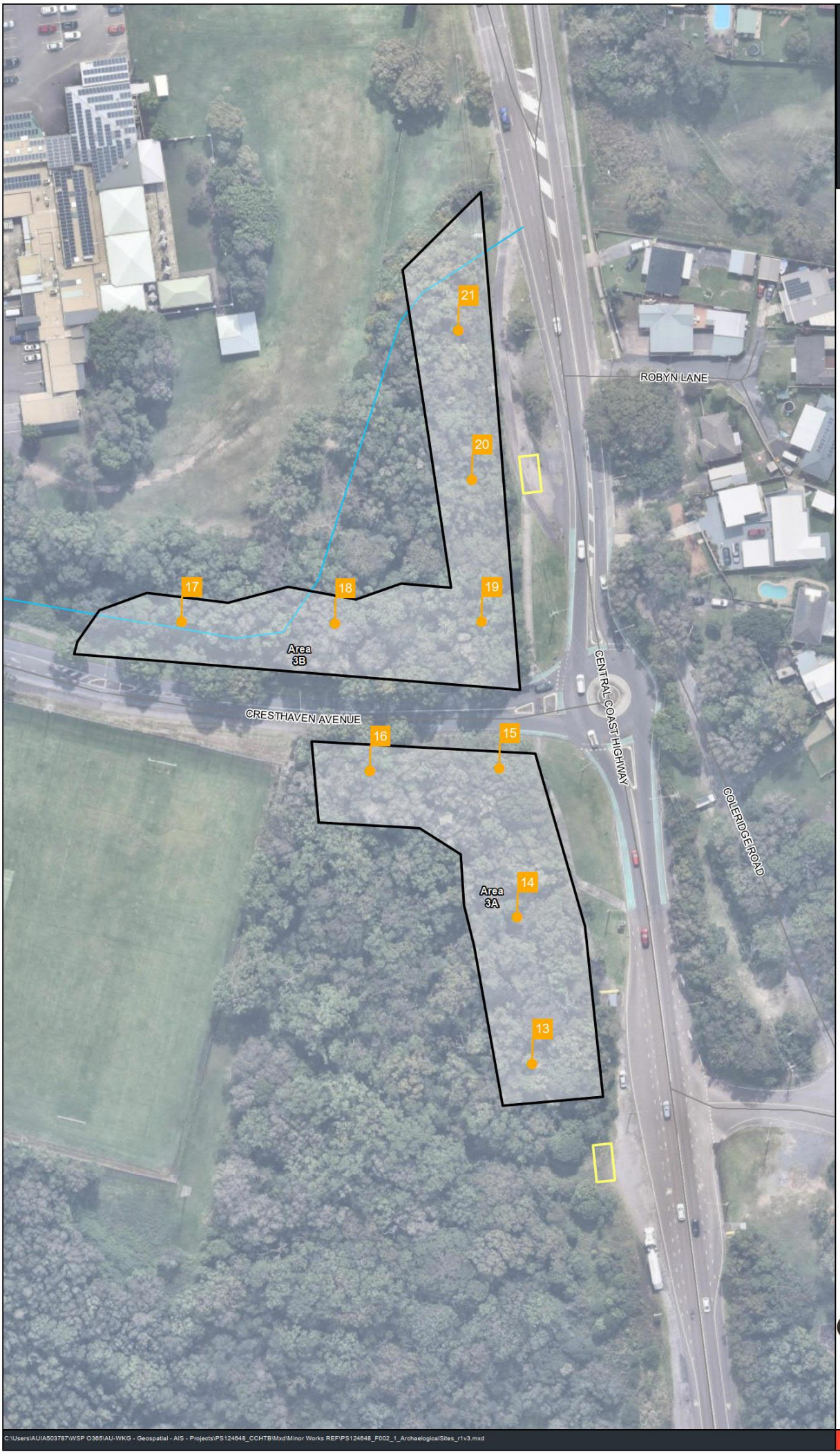
Key features of the proposal include:

- Survey of archaeological test excavation locations
- Completion of archaeological test excavations, including clearing of any surface vegetation
- Sieving for Aboriginal artefacts, potentially including wet sieving via use of a water cart
- Backfilling and site reinstatement.

Archaeological test excavations would occur at three archaeologically sensitive areas identified during an Aboriginal Heritage Due Diligence Assessment (and Stage 2 PACHI) prepared by Heritage Now in 2021.The locations and extent of these areas of sensitivity are shown in Figure 2-1.

Access to archaeological test excavation locations would be from the Central Coast Highway. Where required, some locations may be accessed from adjoining local roads.

Minor modifications to the location and methodology of excavations may be implemented by work crews on arrival at each individual investigation site to deliver the required investigation outcomes and minimise environmental impacts.



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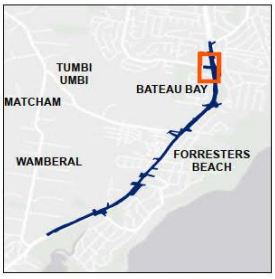
Central Coast Highway

Figure 2-1

Location of Proposed Archaeological Test Excavations

Legend

- Proposed test pit locations
- Roads
- Watercourse
- Area of potential archaeological sensitivity
- Proposed wet sieve areas (if required)



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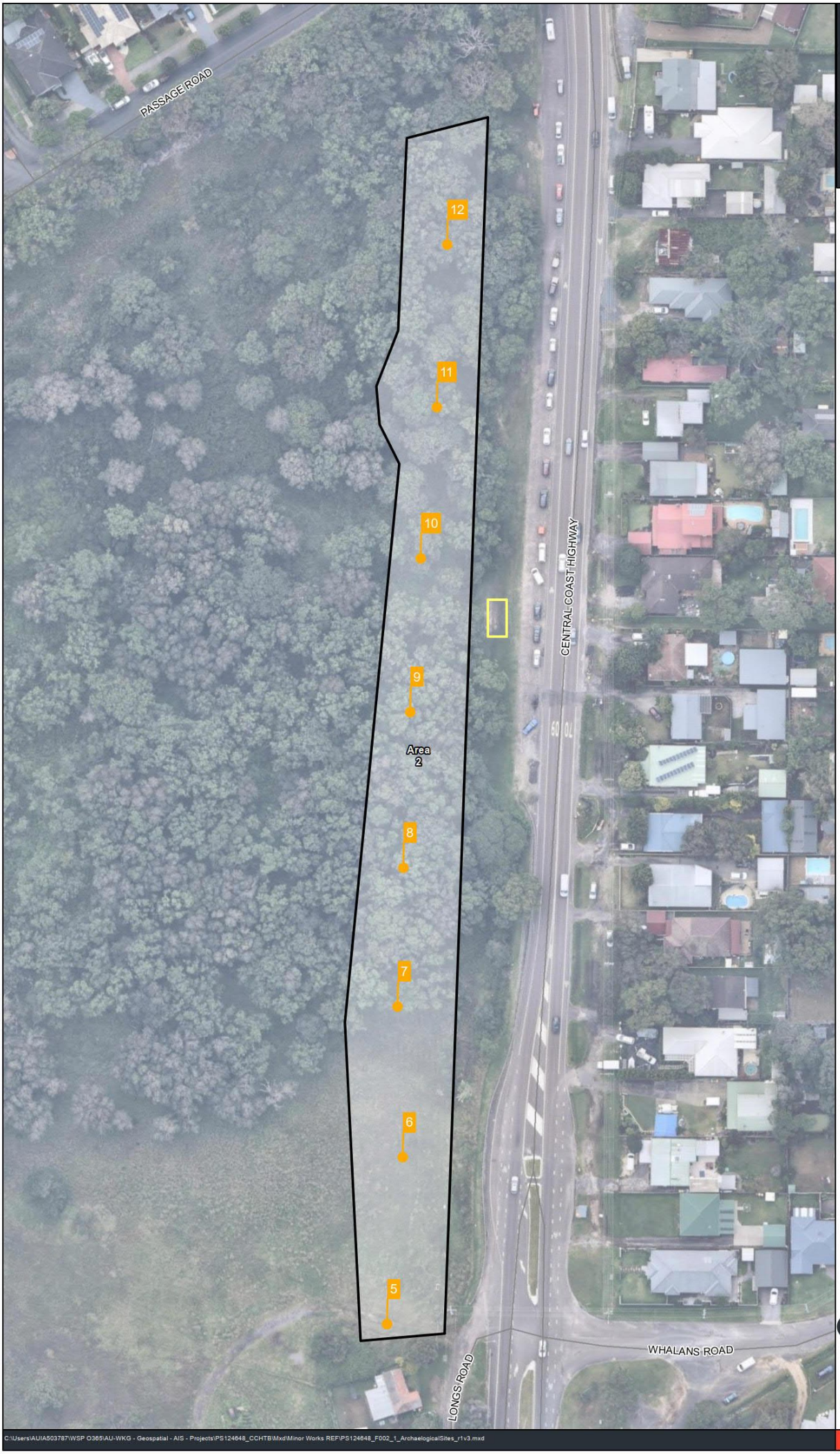

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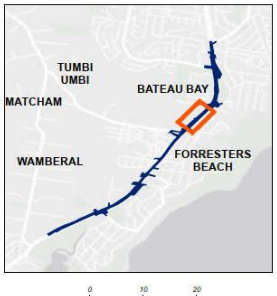

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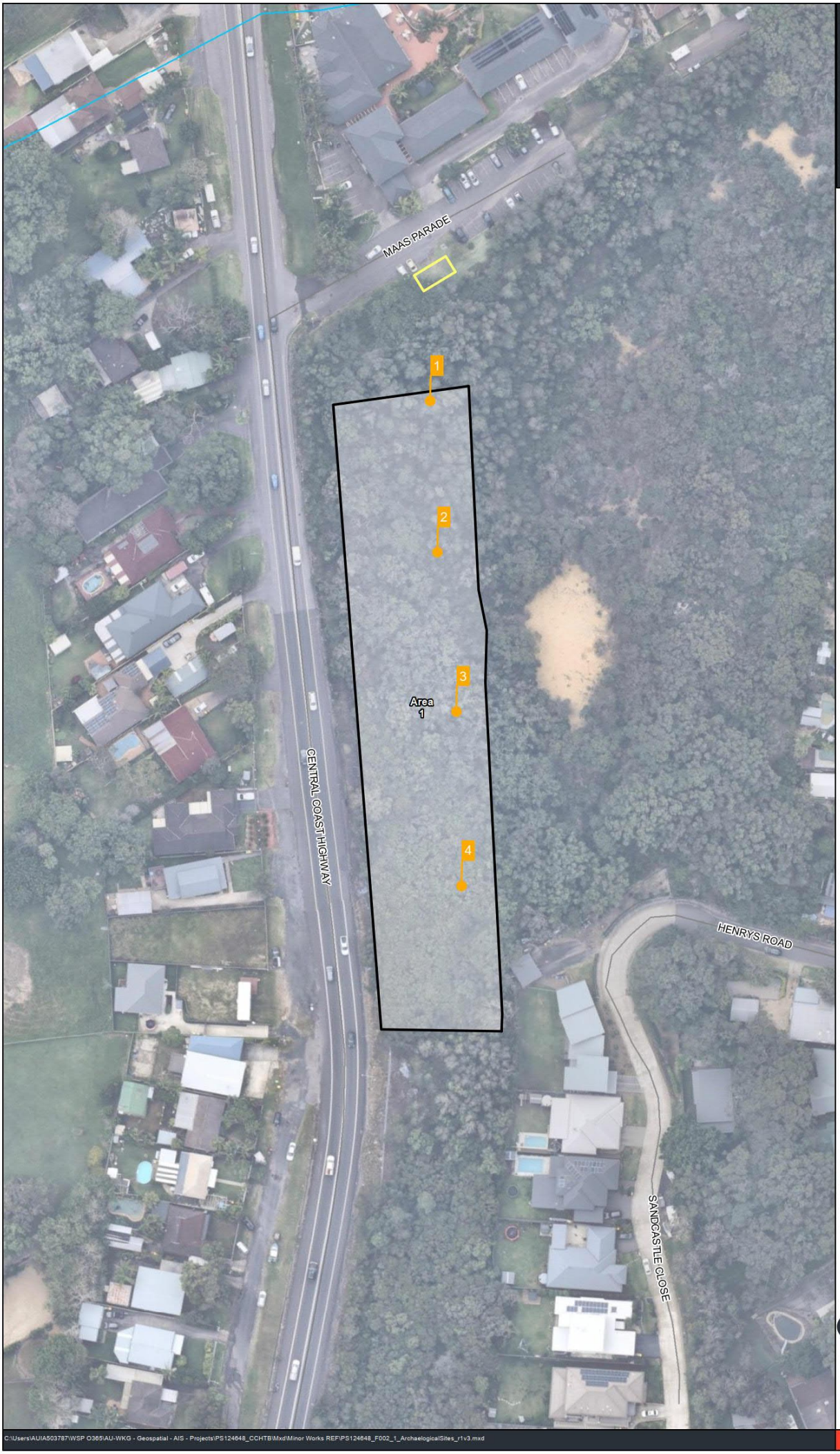

Central Coast Highway

Figure 2-1

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- Roads
- Watercourse
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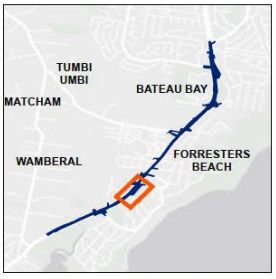

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Archaeological test excavations

Archaeological test excavations aim to determine whether Aboriginal objects are present within the area of archaeological sensitivity, and characterise objects present, without having a significant impact on the archaeological value of the area.

Test excavations would initially involve the excavation of 21 test pits (to be 0.5 metres x 0.5 metres in dimension), across the three identified areas of sensitivity, with an estimated 40 metres spacing between each test pit (Figure 2-1). Depending on site conditions and following discussion with Registered Aboriginal Parties (RAPs), the location of these test excavations may be adjusted onsite. Further test pits may be proposed to understand the archaeological characteristics of the area. As such, the area of potential disturbance includes provision of an additional six test pits at 0.5 metres x 0.5 metres in dimension, if required. To conservatively assess the potential impact of archaeological test excavations on groundcover vegetation, it has been assumed that up to three additional test pits would be required in each area mapped as an Endangered Ecological Community (EEC) under the BC Act. The total area of groundcover to be disturbed by the test pits is 6.75 square meters (m^2).

The first test pit opened would be hand-excavated, 5 centimetres deep at a time (5 centimetre spits), with the remainder of test pits being hand-excavated 10 centimetres deep at a time (10 centimetre spits), depending on the characteristics of the first test pit. Test pits would be hand-excavated to clay or to the base of Aboriginal object-bearing soil horizons, which are expected to occur at a depth of around 40 centimetres at this location. Additional spits (up to an extra 20 centimetres in depth) would be excavated to confirm the sediment is culturally sterile for a selection of pits. Photo 2-1 provides an example of a test pit excavated to a depth classified as cultrually sterile at the location. Excavated soil would then be sieved.

Following excavation, the test pits would be documented, which includes photographic and scale-drawn records, and recording stratigraphy features, soil profile features and other relevant detail. Test pits would then be backfilled. Prior to site demobilisation, a qualified surveyor would mark out the backfilled test pit locations at the northwest corner of each test pit.

Archaeological test excavations would cease if suspected human remains are encountered, or if enough information has been recovered to adequately characterise the site with regards to its nature and significance.

If artefacts are encountered, artefact attributes would be recorded to document raw material, colour, reduction type, identification of core/tool, core type, platform type, termination type, length, width, thickness, cortex and weight. The test excavation would be reported on and would be used to identify if archaeological salvage is required.

Photo 2-1 Example of a test pit

Sieving

Soil excavated from the test pits would be dry or wet sieved (depending on soil characteristics) to identify if subsurface artefacts are present. Dry sieving is the preferred option for this excavation, to avoid the requirement of a water cart onsite, to minimise potential environmental impacts and to simplify backfilling of the test pits (see below).

Dry sieving involves the passing of excavated soil through a hand-held 5 millimetres mesh sieve. This occurs at each test pit location, with one person excavating, while another dry sieves the excavated soil. The sieved soils are captured in a bucket to be used for backfilling, and Aboriginal objects can be captured in the sieve mesh.

Wet sieving involves the use of water (usually from a water cart) to aid the sieving process to wash soil and separate retrieved artefacts. In place of small hand-held mesh sieves, one large mesh sieve would be set up on a frame near the water cart (a 'sieving station') and excavated soils are carried to the sieving station in buckets sorted according to test pit location and excavation layer.

Disturbance of an area of up to 10 metres by 5 metres would be required for the setup of the wet sieving area, including footprint of a water cart, washing areas, and stockpiling of spoil. This would include partial disturbance of 200m^2 of groundcover vegetation, however, the wet sieving locations have been selected to avoid areas of native vegetation.

Proposed wet sieving stations for each area of potential archaeological sensitivity, if required, are shown in Figure 2-1. It is expected that up to 5 kilolitres would be required per day to complete wet sieving for the proposal. A water cart would be required to deliver water to the site once a day.

Sediment laden water would be produced and collected in the area below and surrounding the sieving station. Collection of sediment laden water would involve using empty buckets placed below the sieve to collect and slow runoff. Appropriate sediment controls including sandbag berms (or similar) would be placed down slope of the sieving station to collect and direct runoff. Spoil remaining after wet sieving would be used for backfilling, although runoff produced would mean that bags of sand would be required, in addition to soil, to backfill the test pits. Photo 2-2 provides an example of a wet sieving area.

Photo 2-2 Example of a wet sieving area

Backfilling and site reinstatement

At the completion of excavation and sieving, the test pits would be backfilled with soil collected during sieving. If wet sieving is required, some of the soil from the sieving station would be used as backfill. However, due to runoff, additional clean sand would be imported to the site from a verified source and used to backfill the test pits.

Following excavation and dry or wet sieving, the disturbed test pit areas would be recompacted to pre-existing levels. Where backfilling with wet spoil and imported sand is required after wet sieving, the test pits would appear as small muddy pools, and would settle and dry following warm weather. Photo 2-3 shows an example of test pit backfilled with wet sieving spoil and imported sand, following dry weather.

Dry and wet sieving areas would be left to regenerate following completion of sieving activities. It is anticipated that the disturbed areas would naturally re-establish with vegetation from the surrounding area, however, it's not anticipated that any re-seeding or planting would be undertaken.

Photo 2-3 Example test pit after dry weather following backfill with wet sieving spoil and imported sand

The proposal is anticipated to involve the following work methodology:

- Site mobilisation, beginning in the southern portion of Area 1
- Marking out of excavation areas at 40 metre intervals
- Removal of vegetation (ground cover) at each archaeological test excavation location
- Completion of the archaeological test excavation, including hand excavation to the required depth, and sieving of excavated soil
- Backfilling following completion of the archaeological test excavation and recording
- Recording of final test unit locations by a qualified surveyor
- Demobilisation from site.

Plant and equipment

The following are the likely plant and equipment required to perform archaeological test excavations:

- Light vehicles
- Hand tools stored in a Heritage Now light vehicle
- Water cart, including pump (if required).

Final plant and equipment required would be confirmed prior to commencement of the archaeological test excavations.

Construction workforce, hours and duration

The proposal would require a team of two archaeologists and two representatives from RAP groups (four personnel in total), to be present onsite at any one time. An additional one to two staff may be onsite periodically to complete inspections of the work. The proposed archaeological test excavations would be carried out during standard construction hours Monday to Friday, 7am to 6pm.

Work is not anticipated to be carried out outside of standard working hours, however if required, out-of-hours work would be carried out in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016). When out-of-hours works are required, the proposal would not proceed without written approval from Transport (refer to Section 3.3).

Earthworks

The proposal includes minor earthworks, and it is estimated that up to 2.1 cubic metres (m^3) of spoil (0.1 m^3 of spoil per test pit) would be excavated as part of the test excavations.

Excavated spoil would be managed onsite, and would remain within the area of each archaeological test excavation location. It is not anticipated that any waste material would be generated for disposal. However, where required, all waste would be disposed of at an appropriately licenced facility, in accordance with the *Waste Classification Guidelines – Part 1 (NSW EPA, 2014).*

Vegetation clearance

Minor disturbance of native vegetation would be required for the completion of archaeological test excavations. Dry artefact sieving would also result in the coverage of a small area of vegetation for the storage of spoil which would occur next to each test pit. Soil would be accumulated in buckets directly adjacent to each pit, to be used for backfilling after recording. Wet sieving would be undertaken at wet sieving stations only, and not in areas of native vegetation.

The archaeological test excavations would occur at various locations, within areas of native vegetation. The proposal would result in a minor impact to native vegetation, including removal of groundcover (where present) for the completion of excavations, and minor disturbance to groundcover for sieving. Access to the test pits would be via foot, and vehicle access would be limited to parking in suitable areas in surrounding roads. Some trimming of dense or overhanging vegetation may be required for the proposal for access, however, test pit locations would be flexible to avoid impact to shrubs and trees. Potential impacts to biodiversity from the proposal are discussed further in Section 3.7.

Traffic management and access

The proposal would require up to five light vehicles and potentially one heavy vehicle where wet sieving is required (i.e. water cart and delivery of clean fill material) to access the sites and transport site personnel, equipment and materials.

Access to archaeological test excavation locations would be from the Central Coast Highway, or adjoining local roads. Options for off-site parking for vehicles required for the archaeological test excavations would be explored, and a meeting point agreed on for personnel to park and share vehicles to site. Where off-site parking is not feasible, access to the archaeological test excavation locations would be from the Central Coast Highway verge at Area 2 and Area 3. Access to Area 1 would be from Maas Parade, and no parking would be permitted along the Central Coast Highway at this location.

Vehicles would not be required to drive into the areas of potential archaeological sensitivity, and as such the construction of additional access tracks would not be required.

The final selection of site access would avoid sensitive areas of vegetation, and it is not anticipated that significant impacts to biodiversity would occur as a result of the proposal.

Property access would be identified prior to the commencement of investigation in consultation with the relevant landowners.

2.1.3 Proposal objectives

The objectives of the proposal are to:

- Complete archaeological test excavations as part of completion of an Aboriginal Cultural Heritage Assessment Report (ACHAR) being prepared as part of the REF for the proposed upgrade of the Central Coast Highway between Wamberal and Bateau Bay. Inform the concept design development process for Central Coast Highway upgrades by providing comprehensive survey information
- Minimise environmental impacts
- Minimise disruptions to road users.

2.1.4 Ancillary facilities

Table 2-2 Ancillary facilities

Ancillary facilities		
Will the proposal require the use or installation of a compound site?	☐ Yes	☒ No
Will the proposal require the use or installation of a stockpile site? The proposal would include the temporary stockpiling of spoil as a result of sieving activities. Stockpiles would be located within the archaeological test excavation area at each location. Spoil stockpiles would not be located within ancillary sites.	☐ Yes	☒ No
Are any other ancillary facilities required (e.g., temporary plants, parking areas, access tracks)? Where required, wet sieving would include the parking and use of a water cart next to the wet sieve. The wet sieve and water cart would be located in a cleared area nearby each area of potential archaeological sensitivity. The proposal would also require temporary parking for personnel and plant. It is anticipated that parking areas would be off-site (preferred) or located nearby archaeological test excavation locations, including on street parking along the Central Coast Highway at Area 2 and Area 3, and off Maas Parade at Area 1. The proposal would not require the establishment of access tracks.	☒ Yes	☐ No

2.1.5 Proposed date of commencement

Archaeological test excavations are expected to commence in late July or early August 2022, subject to weather conditions, and approval of the MWREF.

2.1.6 Estimated length of construction period

The archaeological test excavations are expected to take up to ten days to complete, additional days may be required due to inclement weather, or where additional investigation requirements are triggered.

2.2 Need and options

The archaeological test excavations are required to consider the environmental impacts of the Central Coast Highway upgrade between Wamberal and Bateau Bay. The assessment of Aboriginal heritage is a critical part of assessing potential impacts of the project under the EP&A Act.

The assessment of Aboriginal heritage completed for the proposal to date has identified areas of potential Aboriginal sensitivity which require further investigation to quantify the archaeological resources present. In accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010), archaeological test excavations are proposed to further investigate the Aboriginal heritage significance of the area, and to inform the environmental assessment of the Central Coast Highway upgrade project.

The scope of the proposal has been developed in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010) guidelines, which outline standards for selecting the location and density of archaeological investigations. The proposal would also allow the formulation of targeted mitigation for the Central Coast Highway upgrade project, including the avoidance of significant areas of Aboriginal heritage where possible, to minimise any potential impacts.

2.2.1 Options considered

The options considered for the proposal included:

Option 1: Do nothing

The 'do nothing' option would involve not carrying out archaeological test excavations in order to assess potential environmental impacts of the upgrade to the Central Coast Highway between Wamberal and Bateau Bay. The 'do nothing' option would be unsuitable and inadequate as it would not meet the requirements of section 5.5 of the EP&A Act, which requires Transport to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment relating to the project.

Furthermore, failure to adequately consider the Aboriginal heritage values within the area could result in poor community and social outcomes of the project.

Option 2: Undertake archaeological test excavations described in this Minor Works REF (preferred option)

Option two would involve carrying out the proposal. The proposal would be carried out to adequately investigate the Aboriginal heritage values of the area, and to inform the environmental impact assessment being completed for the project. Option two has been selected as the preferred option as it would allow Transport to investigate the Aboriginal heritage values in the area, assess potential impacts of the project on Aboriginal heritage values, and would help develop measures to minimise potential impacts of the project.

2.2.2 Justification for the proposal

The archaeological test excavations are required to consider the environmental impacts of the upgrade to the Central Coast Highway between Wamberal and Bateau Bay. The assessment of Aboriginal heritage is a critical part of assessing potential impacts of the proposed Central Coast Highway upgrade to fulfil the requirements of section 5.5 of the EP&A Act, which include that Transport examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. Investigation would also provide adequate information on Aboriginal heritage in the area and assist to develop management measures for the project.

Completion of the archaeological test excavations would result in minor, short-term, impacts as identified in Chapter 3. However, these impacts would be adequately minimised and controlled through implementation of the safeguards and management measures detailed in Chapter 5. Additionally, the proposal would inform the design of the Central Coast Highway upgrade project, including avoidance of impact to Aboriginal heritage (where feasible).

2.3 Statutory and planning framework

2.3.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 'SEPP (Transport and Infrastructure)' aims to facilitate the effective delivery of infrastructure across the state. Clause 2.109 of the Transport and Infrastructure SEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is being completed to inform the assessment of the Central Coast Highway upgrade project, which is development for the purposes of a road or road infrastructure facilities, and the proposal is to be carried out by or on behalf of Transport, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposed archaeological test excavations are not located on land reserved under the *National Parks and Wildlife Act 1974* and do not require development consent or approval under State Environmental Planning Policy (Planning Systems) 2021, or State Environmental Planning Policy (Precincts—Regional) 2021.

Chapter 2 of the SEPP (Transport and Infrastructure) contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by the Transport and Infrastructure SEPP (where applicable) is discussed in Section 2.4 of this REF.

2.3.2 Other relevant legislation and environmental planning instruments

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act, a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land'. These are considered in Section 4.2 of this REF.

The assessment has found that the proposal is not likely to have a significant impact on matters of national environmental significance and the environment of Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment.

State Environmental Planning Policy (Resilience and Hazards) 2021

Chapter 2 of the State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) gives effect to the objectives of the *Coastal Management Act 2016* from a land use planning perspective by specifying how development proposals are to be assessed if they fall within the coastal zone. The Wamberal Lagoon Coastal Wetland is listed within the Resilience and Hazards SEPP a Coastal Wetland, and is located in the vicinity of the proposal, about 550 metres south-west of the nearest archaeological test excavations.

Archaeological test excavations would not occur within the coastal wetland of the Wamberal Lagoon Coastal Wetland, or the wetland's proximity area. Due to the nature and scale of the proposal, it is not expected that the archaeological test excavations would impact on the biophysical, hydrological and ecological values of the coastal wetland. Measures to prevent impacts of the proposal on the environment are discussed further in Sections 3.1, 3.2 and 3.7.

Roads Act 1993

Under section 138 of the *Roads Act 1993* (the Roads Act), approval from the relevant roads authority is required to disturb, erect a structure, or carry out a work in, on or over a public road. However, Clause 1 of Schedule 2 of the Roads Act, specifies that section 138 does not require a public authority to obtain a roads authority's consent to the exercise of the public authority's or network operator's functions in, on or over an unclassified road other than a Crown Road.

The proposed archaeological test excavations and associated plant and equipment would be located at a sufficient distance from public roads within the area to avoid any potential impacts to the road network. As the proposal would not impact the operational flow of traffic, or require lane closures, a road occupancy licence would not be required for the work. Measures to prevent impacts of the proposal on the local road network are discussed further in Section 3.9.

Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to protect and preserve items of non-Aboriginal heritage significance. The Heritage Act provides for the protection of items of local, regional and State heritage significance. It establishes a list of State Heritage Items and outlines processes for approval of development which may impact items of heritage significance.

The Wamberal Cemetery is listed on the Gosford Local Environment Plan (LEP) 2014 as being of local significance and is located about 1.4 kilometres south-west of the proposal. The Wamberal Cemetery would not be impacted by the proposal. Potential impacts on non-Aboriginal heritage are discussed further in Section 3.5.

Protection of the Environment Operations Act 1977

The *Protection of the Environment Operations Act 1997* (POEO Act) aims to protect, restore and enhance the quality of the environment, to reduce risk to human health and provide information to the public about environmental protection and pollution. The POEO Act is administered by the Environment Protection Authority (EPA) and provides for the regulation and authorisation of discharges to the environment through issuing of an environment protection licence (EPL) for scheduled developments and activities, as listed on Schedule 1 of the POEO Act. The proposal is not a scheduled activity under the POEO Act and therefore an EPL is not required.

The POEO Act would also require work be managed to prevent and avoid the potential to cause water, noise and/or air pollution, and includes requirements in relation to the management of waste. This would be achieved through implementing the mitigation and management measures identified in Chapter 5.

Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) lists threatened species and ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened species, ecological communities, or their habitats. The proposal would not result in significant impacts to threatened species, ecological communities or their habitats, and a species impact statement is therefore not required. Potential impacts on biodiversity are discussed further in Section 3.7.

Crown Land Management Act 2016

The *Crown Land Management Act 2016* (Crown Land Act) is intended to ensure that Crown land is managed for the benefit of the people of NSW and to provide for the proper assessment and management of Crown land in accordance with the principles of the Crown Land Act. The Act sets out the conditions under which Crown land is permitted to be occupied, used, sold, leased, licensed or otherwise dealt with. In accordance with the Crown Land Act, work carried out on Crown Land may require a permit from the NSW Department of Planning and Environment - Crown land.

The proposed archaeological test excavations occur on Crown land in the areas of potential archaeological sensitivity Area 1 and Area 3. Consultation with the Crown land department confirmed a permit is not required for the archaeological test excavations.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) was established for the establishment, preservation and management of national parks, historic sites and certain other areas and the protection of certain fauna, native plants and Aboriginal objects.

Under the NP&W Act, all Aboriginal objects and places are protected. All persons are therefore responsible for taking reasonable precautions and exercising their due diligence to ensure that their actions would not harm Aboriginal objects. The proposal is for the purposes of the investigation of Aboriginal heritage and is being carried out in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010). As such, the proposal is excluded from the definition of harm and would not comprise an offence of harm to an Aboriginal object.

Local Environmental Plans

T The proposal is located across two local government areas (LGAs). The northern test excavation locations at Area 2 and Area 3 (Bateau Bay) are located within the Wyong LGA and the principal relevant local environmental planning instrument under the EP&A Act is the Wyong Local Environmental Plan 2013 (Wyong LEP 2013). The southern test excavation locations at Area 1 (Forresters Beach) are located within the Gosford LGA and the principal relevant local environmental planning instrument under the EP&A Act is the Gosford LEP 2014.

Under the Wyong LEP 2013 archaeological test excavations would be located within the existing road corridor zoned:

- C2 – Environmental Conservation
- RE1 – Public Recreation
- R1 – General Residential
- IN2 – Light Industrial.

Under the Gosford LEP 2014 archaeological test excavations would be located within land zoned:

- RE1 – Public Recreation
- C2 – Environmental Conservation
- R2 – Low Density Residential.

The proposal is for temporary excavations and is therefore consistent with the subject land zoning, however the Transport and Infrastructure SEPP operates to remove the otherwise applicable consent requirements. Notwithstanding, Transport would endeavour to incorporate measures that are in keeping with the relevant LEP requirements in each LGA.

2.4 Community and agency consultation

2.4.1 SEPP (Transport and Infrastructure) consultation

Chapter 2, Division 1 of the Transport and Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. This is detailed below:

Table 2-3 Consultation required with Council

Is consultation with Council required under sections 2.10 - 2.12 and 2.14 of the SEPP (Transport and Infrastructure)?		
Are the works likely to have a substantial impact on the stormwater management services which are provided by council?	☐ Yes	☒ No
Are the works likely to generate traffic to an extent that will strain the capacity of the existing road system in a local government area?	☐ Yes	☒ No
Will the works involve connection to a council owned sewerage system? If so, will this connection have a substantial impact on the capacity of the system?	☐ Yes	☒ No
Will the works involve connection to a council owned water supply system? If so, will this require the use of a substantial volume of water?	☐ Yes	☒ No
Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a minor or inconsequential disruption to pedestrian or vehicular flow?	☐ Yes	☒ No
Will the works involve more than a minor or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	☐ Yes	☒ No
Is there a local heritage item (that is not also a state heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential? The nearest heritage item is the Wamberal Cemetery located on Ulumba Avenue. The local heritage item is listed on the Gosford LEP 2014, and is located around 1.4 kilometres to the south-west of the proposal. The heritage item is outside the proposal area and would not be affected by the works.	☐ Yes	☒ No
Is the proposal within the coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land? Note: See interactive map at Coastal management - (nsw.gov.au). Note the coastal vulnerability area has not yet been mapped. Note: a certified coastal zone management plan is taken to be a certified coastal management program.	☐ Yes	☒ No
Are the works located on flood liable land? If so, will the works change flooding patterns to more than a minor extent? Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the Floodplain Development Manual: the management of flood liable land (nsw.gov.au). Some of the proposed archaeological test excavations would be located on land mapped as being impacted to a minor extent in a one per cent annual exceedance probability (AEP) flood event (WMA Water, 2020). Due to the temporary nature and small scale of the proposal, the proposed test excavations would not change flooding patterns of the area.	☐ Yes	☒ No

Table 2-4 Consultation with other public authorities

Is consultation with a public authority (other than Council) required under clause 15 and 16 of the SEPP (Transport and Infrastructure)?		
Are the works located on flood liable land? (to any extent) (SEPP (Transport and Infrastructure) s2.13) If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the Floodplain Development Manual: the management of flood liable land (nsw.gov.au). Some of the proposed archaeological test excavations would be located on land mapped as being impacted to a minor extent in a one per cent AEP flood event (WMA Water, 2020). However, the proposal would not involve alterations to, or demolition of, a building, emergency works or routine maintenance.	☐ Yes	☒ No
Are the works adjacent to a national park, nature reserve or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	☐ Yes	☒ No
Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	☐ Yes	☒ No
Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional facility or group home in bush fire prone land?	☐ Yes	☒ No
Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	☐ Yes	☒ No
Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011).	☐ Yes	☒ No
Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	☐ Yes	☒ No

2.4.2 Other agency and community consultation

Consultation to arrange land access for archaeological test excavations would be undertaken with the relevant landholders, and works would not occur until consent has been provided.

Consultation with the Aboriginal community is being completed in accordance with the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). Specifically, this includes:

- Registration of RAPs and providing RAPs the opportunity to:
  - Review the methodology for the archaeological test excavations, and participation in an Aboriginal Focus Group Meeting (AFG) to discuss the methodology and assessment approach
  - Review the ACHAR and participation in a second AFG to discuss the findings.

3. Environmental assessment

This section provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environmental potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in section 171 of the Environmental Planning and Assessment Regulation 2021.

The matters of national environmental significance under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) are also considered in Chapter 4. Site-specific safeguards are provided to ameliorate the identified potential impacts.

3.1 Soil

Table 3-1 Soil

Description of existing environmental and potential impacts		
Are there any known occurrences of salinity or acid sulfate soils in the area? A review of the Department of Planning and Environment's Planning Portal (ePlanning Spatial Viewer) on 13 April 2022 indicates that there is a low probability for Acid Sulfate Soils (ASS) at archaeological test excavation locations south of Bellevue Road, including those near Maas Parade. These locations occur on Class 5 ASS land, mapped as within 500 metres of likely ASS land. Archaeological test excavation locations located to the north, at Bateau Bay are mapped as having no risk of ASS occurrence. The proposal is considered unlikely to intercept ASS due to the nature of the potential ASS in the area, and due to the relatively shallow depth of archaeological test excavations. The ASS Manual (ASSMAC, 1998) states that only development within Class 5 ASS areas that have the potential to alter the watertable by more than one metre in nearby Class 1,2,3 or 4 ASS areas should be further assessed. The proposal would not result in the lowering of the watertable in surrounding ASS areas and would only involve hand excavation to a maximum depth of one metre below ground level (mBGL). As such, ASS is not anticipated to be intercepted at this depth. In the unlikely event that ASS material is encountered during archaeological test excavations, the material would be managed in accordance with the *Roads and Maritime Services Guidelines for the Management of Acid Sulphate Materials 2005*. Salinity is identified as a soil limitation for the Wyong soil landscapes (Murphy, 1993), including at the southern archaeological test excavation locations. However, due to the small amount of soil to be excavated, this is not anticipated to be a significant risk, and appropriately managed through the mitigation measures identified below.	☒ Yes	☐ No
Does the proposal involve the disturbance of large areas (e.g., >2ha) for earthworks? The total area of disturbance for the proposal is 6.75m^2 of groundcover vegetation. Partial disturbance of an additional 200m^2 area would occur from wet sieving, however this would occur outside mapped native vegetation and would not involve excavation.	☐ Yes	☒ No
Does the site have constraints for erosion and sedimentation controls such as steep gradients or narrow corridors? Some archaeological test excavation locations include areas of moderate to steep slope, particularly associated with Area 1 in Forresters Beach. However, the final location of each test pit would be positioned so that test pits and sieves are located on an area of flat ground.	☐ Yes	☒ No
Are there any sensitive receiving environments that are located in or nearby the likely proposal area or that would likely receive stormwater discharge from the proposal? Sensitive receiving environments that have the potential to be impacted by the proposal would include the Wamberal Lagoon, within the Wamberal Lagoon Nature Reserve, which is located about 500 metres south of the proposal at its closest point. The reserve is also gazetted as the Wamberal Lagoon Coastal Wetland under the Resilience and Hazards SEPP. An additional mapped coastal wetland area is located about 480 metres northwest of Area 2, and over 600 metres southwest of Area 3. Due to its distance from the proposal, it is not expected that this coastal wetland area would be impacted.	☒ Yes	☐ No

Description of existing environmental and potential impacts		
The unnamed watercourses that occur near archaeological test excavation locations are also sensitive environments that have the potential to be impacted by the proposal. This would include the unnamed drainage line at Bateau Bay, within Area 3, and the unnamed drainage line near Longs Road, north of Area 2. These watercourses are minor, with intermittent flow following rain events, and little or poorly defined channels. The proposal would have the potential for minor impacts to receiving environments directly adjacent to some archaeological test excavation locations, for example, nearby unnamed drainage lines. Minor impacts may be associated with erosion and sedimentation from excavation of soils as part of the archaeological test excavations, and disposal of spoil as part of the sieving process. Exposed soils could potentially erode to nearby watercourses or the Wamberal Lagoon, particularly if rain events occur during the proposal, which could impact on local waterways and sensitive environments. However, given the small amount of soil to be disturbed, and the distance at which excavations would occur from the Wamberal Lagoon and other sensitive receiving environments, the potential for significant impacts would be considered very low. There is also potential for runoff of water during wet sieving. However, runoff would be contained and slowed at each archaeological test excavation location, with collection of wet sieving spoil below wet sieves in buckets. Further sediment controls such as sandbag berms (or similar) would also be implemented downslope of wet sieving, where required, to minimise potential sedimentation impacts on local waterways.		
Is there any evidence within or nearby the likely footprint of potential contamination? A search of the EPA's contaminated land record of notices under section 57 of the *Contaminated Land Management Act 1997* (CLM Act) and the list of NSW contaminated site notified to the EPA was carried out on 13 April 2022 for the Central Coast LGA. The searches identified: • One contaminated site is located next to the road corridor, directly west of the archaeological test excavation area at Bateau Bay. The former landfill (Lot 1 DP1050764, Lot 170 DP755263 and Lot 5 DP822127) is the subject of a voluntary agreement under the CLM Act • One additional record in the vicinity of the proposal. The Caltex Service Station (corner Central Coast Highway and Bellevue Road). The former landfill site has been the subject of a voluntary agreement since 2007 and no archaeological test excavations would occur within the footprint of the former landfill site. The site is located directly west of the archaeological test excavations in Area 3 (south of Cresthaven Avenue) at Bateau Bay. The Caltex Service Station is located about 130 metres southwest of the archaeological test excavations in Area 2 at Forresters Beach. Contamination investigations completed for the Central Coast Highway upgrade - Wamberal to Bateau Bay project have not identified significant contamination relevant to the proposal. The proposal is not expected to encounter known areas of contamination, and as such, no impacts from contamination are anticipated for the proposal. If areas of potential contamination are identified, all work in the area would cease, until further assessment is undertaken, and appropriate management measures, including an unexpected finds protocol, would be implemented. Groundwater investigations completed for the Central Coast Highway upgrade - Wamberal to Bateau Bay project have identified that the depth to shallow groundwater in the area ranges from one to eight metres below ground level (mBGL). As such, the archaeological test excavations are not expected to intercept groundwater in the area as test pits would only involve hand excavation to a maximum depth of one mBGL.	☒ Yes	☐ No
Is the likely proposal footprint in or nearby highly sloping landform?	☐ Yes	☒ No
Is the proposal likely to result in more than 2.5ha (area) of exposed soil?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

E1 Where wet sieving is required, erosion and sediment control measures (such as the installation of sandbag berms or similar) are to be implemented and maintained in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004) (The Blue Book) to:

- Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets
- Minimise the amount of material transported from site to surrounding pavement surfaces.

E2 Where wet sieving is required, erosion and sedimentation controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.

E3 Where wet sieving is required, erosion and sediment control measures are not to be removed until the works are complete.

E4 Archaeological test excavations will involve the backfilling of spoil, and the ground surface would be reinstated to levels present prior to excavation. Work areas are to be stabilised progressively during the works.

E5 In the event that a pollution incident or unexpected find occurs onsite, the *Environmental Incident Classification and Reporting Procedure* (Roads and Maritime Services, 2016) is to be followed and Transport's Contract Manager and Environment Manager notified immediately.

E6 Vehicle access will be limited to cleared and disturbed areas of the road reserve, including avoiding vehicle movement through areas of native vegetation.

E7 If any unexpected contaminants, or unexpected finds such as asbestos, acid sulphate soils or salinity issues are encountered during the archaeological test excavations, work will cease and Transport's environmental officer will be contacted for advice, in consultation with a contaminated land specialist, on the appropriate action.

3.2 Waterways and water quality

Table 3-2 Waterways and water quality

Description of existing environmental and potential impacts		
Is the proposal located within, adjacent to or near a waterway? The proposal traverses a minor watercourse within the archaeological test excavation area in the north at Bateau Bay. Other minor, unnamed watercourses occur nearby the proposal, including south of Passage Road, and drainage lines that pass beneath the Central Coast Highway via culvert structures or piped drainage. The Wamberal Lagoon Nature Reserve is located about 500 metres south of the proposal at its closest point. The reserve is also gazetted as the Wamberal Lagoon Coastal Wetland under the Resilience and Hazards SEPP, Chapter 2 Coastal Management. Parts of the Wamberal Lagoon Nature Reserve and coastal wetland are also mapped as Key Fish Habitat in accordance with the *Fisheries Management Act 1994.* Exposed soils could potential erode to nearby creeks and drainage lines, impacting on local waterways. The proposal includes small areas of excavation, which would be completed progressively. As such, the proposal would have the potential for minor impacts to directly adjacent sensitive receivers from erosion and sedimentation from excavation, and management of spoil as part of the sieving process, if adequate controls are not implemented. There is likely a higher potential for runoff of soil laden water during wet sieving, where this is required. However, due to the small amounts of soil to be disturbed, impacts would be considered minor, and localised. To further reduce potential impacts, runoff would be contained and slowed at each archaeological test excavation location by use of buckets below sieves to collect wet sieve spoil. Where wet sieving is required, erosion and sedimentation controls such as sandbag berms (or similar) would be implemented to minimise potential impacts on local waterways.	☒ Yes	☐ No

Description of existing environmental and potential impacts		
Is the location known to flood or be prone to water logging? Some archaeological test excavation locations are identified as flood affected in a 100-year Annual Recurrence Interval (ARI) flood event (WMA Water, 2020). Majority of Area 3 in the north is mapped as flood affected, to a minor depth. Portions of Area 2 and Area 1 are also mapped as flood affected to a minor depth. While there are some parts of the archaeological test excavation locations that may be affected by flooding and flood storage areas, the proposal would be undertaken over a short duration (ten days). Weather forecasts would be reviewed ahead of the planned fieldwork to confirm suitable conditions are forecast, and further fieldwork would be suspended during periods of inclement weather. Considering the short duration of work, and the small area of disturbance at each archaeological test excavation location, the proposal would not alter the movement of flood waters or flood storage.	☒ Yes	☐ No
Is the proposal located within or immediately adjacent to the area managed by WaterNSW covered by chapter 8 of State Environmental Planning Policy (Biodiversity and Conservation) 2021? Note: See map here - *Sydney drinking water catchment map.*	☐ Yes	☒ No
Would the proposal be undertaken on a bridge or ferry?	☐ Yes	☒ No
Is the proposal likely to require the extraction of water from a local water course (not mains)?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

W1 Weather forecasts will be reviewed ahead of planned fieldwork to confirm suitable conditions are predicted.

W2 New works will not commence, and works in progress would be suspended, during periods of heavy or prolonged rainfall.

W3 If an incident (e.g. spill) occurs, the *Environmental Incident Classification and Management Procedure* (Roads and Maritime Services, 2016) is to be followed and Transport's Contract Manager and Environment Manager notified immediately.

3.3 Noise and vibration

Are there any residential properties or other noise sensitive areas near the location of the proposal that may be affected by the work (i.e., church, school, hospital)?

Table 3-3 Noise and vibration

Description of existing environmental and potential impacts		
During construction? Nearby sensitive receivers are predominately residential dwellings located along the Central Coast Highway and the adjoining local road network within the suburbs of Wamberal, Forresters Beach and Bateau Bay. Background noise levels associated at sensitive receivers nearby the proposal would be impacted by traffic and road noise along the Central Coast Highway. [If yes, provide details and include a map showing proximity to proposed works.]	☒ Yes	☐ No
During operation? The proposal would have no operational component. Temporary, minor noise impacts associated with the proposal would cease at the completion of the archaeological test excavations.	☐ Yes	☒ No

Description of existing environmental and potential impacts		
Is the proposal going to be undertaken only during standard working hours? Standard working hours • Monday-Friday: 7:00am to 6.00pm • Saturday: 8.00am to 1.00pm • Sunday and Public Holidays: no work All archaeological test excavations would be carried out during standard working hours. If required, out-of-hours work would be carried out in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016), and would not proceed without written approval from Transport.	☒ Yes	☐ No
Is any explosive blasting required for the proposal?	☐ Yes	☒ No
Would construction noise or vibration from the proposal affect sensitive receivers? Noise generating equipment used during the proposal would be limited to light vehicles, with the potential requirement of one heavy vehicle (a water cart). Both the use and movement of the light and heavy vehicles would result in some noise generation which could adversely impact on existing noise levels at some nearby receivers. However, noise associated with the proposal would be intermittent in nature and consistent with the background road noise from existing traffic on the Central Coast Highway and surrounding roads. The nearest sensitive receiver (residential property) to the proposal is located about 25 metres from Area 1 in Forresters Beach. Other sensitive receivers at Area 2 and Area 3 are located about 40 metres east and 50 metres north (respectively) from the archaeological test excavations. Most sensitive receivers nearby the proposal are located beyond the existing Central Coast Highway, and would likely experience elevated background noise levels associated with traffic and road noise. The water cart, where required, would be located as far as practicable from any neighbouring residences, or other sensitive receivers, in the immediate vicinity of the proposal to further reduce potential noise impacts. The proposal would be carried out during standard working hours. Due to the short-term and minor nature of the work and the background noise levels in the area, noise impacts as a result of the proposal would be minor and short-term.	☒ Yes	☐ No
Would operation of the proposal alter the noise environment for sensitive receivers? This might include, but not be limited to, altering the line or level of an existing carriageway, changing traffic flow, adding extra lanes, increasing traffic volume, increasing the number of heavy vehicles, removing obstacles that provide shielding including changing the angle of view of the traffic, changing the type of pavement, increasing traffic speeds by more than 10km/hour or installing audio-tactile line markings.	☐ Yes	☒ No
Would the proposal result in vibration being experienced by any surrounding properties or infrastructure during operation? No vibration intensive plant is proposed to be used as part of archaeological test excavations. Therefore, it is unlikely that the proposal would have vibration impacts on surrounding properties.	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

N1 All work is to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).

N2 No out-of-hours work will be carried out without written approval from Transport.

N3 All employees, contractors and subcontractors for archaeological test excavations are to receive a site specific prestart/toolbox talk. The talk must at least include:

- permissible hours of work
- location of nearest sensitive receivers

- access and vehicle parking areas
- environmental incident procedures

N4 Behaviour on site will include:

- No swearing or unnecessary shouting or loud stereos/radios on site.

N5 Ensure vehicles that are not being used are turned off.

N6 The water cart, where required, would be located as far as practicable from any neighbouring residences, or other sensitive receivers, in the immediate vicinity of the proposal to further reduce potential noise impacts.

3.4 Air quality

Table 3-4 Air quality

Description of existing environmental and potential impacts		
Is the proposal likely to result in large areas (>2ha) of exposed soils?	☐ Yes	☒ No
Are there any dust-sensitive receivers located within the vicinity of the proposal during the construction period? The majority of the proposal would be located nearby residential receivers. There are some non-residential receivers near the proposal that include accommodation, retail and restaurant, and commercial properties. Schools and places of worship exist within the vicinity of the proposal area. Recreational and environmental reserve areas are also located within the vicinity of the proposal, such as the Wamberal Lagoon Nature Reserve (also a coastal wetland), Pat Morley Oval Coleridge Reserve and Archibold Park. Minor impacts to air quality may result from archaeological test excavations where there are dry soil conditions, however, due to the small quantities of soil to be disturbed, these impacts would be limited to the immediate area surrounding the dry sieve sites. As such, air quality impacts from the proposal would be limited to the potential generation of minor quantities of dust from dry sieving and minor generation of dust from vehicle movements, both of which would only be expected to impact the immediate area surrounding the archaeological test excavation locations.	☒ Yes	☐ No
Is there likely to be an emission to air during construction? The proposal has the potential to result in particulate emissions due to the use of plant and equipment. Dust emissions are anticipated to be minimal and unlikely to impact on surrounding sensitive receivers. Given the small disturbance area and the anticipated short duration of the proposal, any temporary adverse air quality impacts to surrounding sensitive receivers are considered to be negligible. Potential impacts would be adequately managed through the application of safeguards and environmental management measures.	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

A1 The area of soil surface disturbed will be kept to the minimum amount necessary to complete the proposal and disturbed areas will be rehabilitated to prevent long-term dust generation as soon as possible.

A2 Weather conditions will be monitored to ensure adequate dust control measures are implemented where excavation and dry sieving activities are to occur during periods of adverse weather conditions, such as dry, windy conditions or when visible dust emissions are likely to cause localised nuisance impacts.

3.5 Aboriginal heritage

Table 3-5 Aboriginal heritage

Description of existing environmental and potential impacts		
Would the proposal involve disturbance in any area that has not been subject to previous ground disturbances? The proposal includes the completion of archaeological test excavations targeting areas considered to be of Aboriginal significance. This would involve the disturbance of areas which are predicted to be undisturbed.	☒ Yes	☐ No
Has an online Aboriginal Heritage Information Management System (AHIMS) search been completed? An Aboriginal Heritage Information Management System (AHIMS) search was completed as part of the Stage 2 PACHCI assessment completed for the Central Coast Highway upgrade.	☒ Yes	☐ No
Is there potential for the proposal to impact on any items of Aboriginal heritage? In addition to the AHIMS search, an evaluation of landscape features as part of a Stage 2 PACHCI assessment completed for the Central Coast Highway upgrade project indicated the potential existence of archaeology within the archaeological test excavation areas identified as the proposal. The proposal includes the completion of archaeological test excavations targeting areas considered to be of Aboriginal significance. As such, impact to Aboriginal heritage from the proposal is highly likely. However, the proposal is for the purposes of the investigation of Aboriginal heritage and is being undertaken in accordance with Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010). As such, the proposal is excluded from the definition of harm and would not comprise an offence of harm to an Aboriginal object.	☒ Yes	☐ No
Would the proposal involve the removal of mature native trees?	☐ Yes	☒ No
Would the proposal impact on any features that may indicate any potential archaeological remains? An evaluation of landscape features as part of assessments completed for the Central Coast Highway upgrade project indicate the potential existence of Aboriginal objects or places within the archaeological test excavation areas identified as the proposal. The proposal includes the completion of archaeological test excavations targeting areas considered to be of Aboriginal significance. As such, impact to areas that may indicate potential archaeological remains is highly likely. However, the proposal is for the purposes of the investigation of Aboriginal heritage and is being undertaken in accordance with Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010). As such, the proposal is excluded from the definition of harm and would not comprise an offence of harm to an Aboriginal object.	☒ Yes	☐ No
Is the proposal consistent with the requirements of the legacy *Roads and Maritime Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI)? See Section 2.4.2 for detail.	☒ Yes	☐ No

Safeguards

Safeguards to be implemented are:

B1 All works would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010).

B2 If bones or skeletal remains are uncovered during the works, all works in the vicinity of the find must cease. If the bones are identified by a qualified forensic or physical anthropologist as human, the NSW Police should be notified and Transport's Aboriginal cultural heritage officer and/or regional environment manager contacted immediately. Steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* must be followed.

3.6 Non-Aboriginal heritage

Table 3-6 Non-Aboriginal heritage

Description of existing environmental and potential impacts		
Have online heritage database searches been completed? • Transport (including legacy Roads and Maritime) section 170 register. • NSW Heritage database. • Commonwealth Heritage List, established under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). • Australian Heritage Places Inventory. • Local Environmental Plan(s) heritage items. A search of the above registers was carried out on 14 April 2022.	☒ Yes	☐ No
Are there any items of non-Aboriginal heritage or heritage conservation areas listed on relevant heritage databases/registers that are located within the vicinity of the proposal? No items of non-Aboriginal heritage or heritage conservation areas are located within the proposal. The Wamberal Cemetery is listed on the Gosford LEP 2014 as being of local significance and is located around 1.4 kilometres to the southwest of the proposal. The Wamberal Cemetery would not be impacted by the proposal.	☐ Yes	☒ No
Is the proposal likely to occur in or near features that indicate potential archaeological remains?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

H1 If unexpected, non-Aboriginal heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* must be followed. Transport's Senior Environment Specialist - Heritage must be contacted immediately.

3.7 Biodiversity

Table 3-7 Biodiversity

Description of existing environmental and potential impacts		
Have relevant database searches been carried out? Database searches and spatial data reviewed included: • PlantNet (Royal Botanic Gardens, 2021), accessed 08/08/2021 • NSW BioNet Atlas (Environment Energy and Science Group, 2021), accessed 08/08/2021 • EPBC Act Protected Matters Search Tool (Department of Environment and Energy, 2021), accessed 08/08/2021 • DPI Key Fish Habitat Mapping (Department of Primary Industries, 2021) accessed 08/08/2021.	☒ Yes	☐ No
Did the database searches identify any endangered ecological communities, threatened flora and/or threatened or protected fauna, or migratory species in or within the vicinity of the proposed works? Both Commonwealth and State listed matters must be considered. **Vegetation** Desktop vegetation mapping and field survey vegetation mapping indicates that the following Plant Community Types (PCTs) occur within the proposal area: • PCT 1138 – Scribbly Gum – Smooth barked Apple – Red Bloodwood shrubby forest of the Lower Hunter- Sydney Basin Bioregion • PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast • PCT 1716 - Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast • PCT 1725 – Swamp Mahogany – Broad-leave Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast • PCT 1727 – Swamp oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast. Other areas of vegetation within the proposal comprise miscellaneous ecosystems as highly disturbed areas with no or limited native vegetation. Two endangered ecological communities (EECs) were identified within the impact area being: • Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered. • Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions – Endangered. It is noted that, within these areas, the proposal includes small scale works and removal of ground cover. As such, species relevant to this part of the overall vegetation community have been assessed for the purpose of this report. **Threatened flora** No threatened species were recorded within the three areas of sensitivity. However, the proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components within habitat which threatened species have the potential to occur. Given the small scale of the proposal, to remove ground cover only, the following species have been assessed: • Thick-lipped Spider-orchid (*Caladenia tessellate*) • Leafless Tongue-orchid (*Cryptostylis hunteriana*) • Rough Doubletail (*Diuris praecox*) A full list of likelihood of occurrence has been assessed and is included in Attachment A of Appendix A: Biodiversity memorandum.	☒ Yes	☐ No

Description of existing environmental and potential impacts		
Threatened fauna A total of seven threatened species were recorded during field surveys undertaken for the Central Coast Highway Upgrade – Wamberal to Bateau Bay Biodiversity Assessment Report (WSP, 2022). This incorporates the areas nominated for heritage excavations. The recorded threatened fauna include Powerful Owl (*Ninox strenua*), Green and Golden Bell Frog (*Litoria aurea*), Little Bent-winged Bat (*Miniopterus australis*), Southern Myotis (*Myotis Macropus*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis)* and Grey-headed Flying-fox (*Pteropus poliocephalus*). Databases searches identified the following threatened fauna species as having known or potential habitat within the impact area: • Wallum Froglet (*Crinia tinnula*) • Green and Golden Bell Frog • Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) • Bush Stone-curlew (*Burhinus grallarius*) • Gang-gang Cockatoo (*Callocephalon fimbriatum*) • Varied Sittella (*Daphoenositta chrysoptera*) • Little Lorikeet (Glossopsitta *pusilla*) • White-bellied Sea-eagle (*Haliaeetus leucogaster*) • Swift Parrot (*Lathamus discolor)* • Square-tailed Kite (Lophoictinia isura) • Powerful Owl • Eastern Osprey (*Pandion cristatus*) • Eastern False Pipistrelle • Eastern Coastal Free-tailed Bat • Little Bent-winged Bat • Large Bent-winged Bat (*Miniopterus orianae oceanensis*) • Southern myotis (*Myotis macropus*) • Squirrel Glider (*Petaurus norfolcensis*) • Grey-headed flying Fox • Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) • Greater Broad-nosed Bat (*Scoteanax rueppellii*) **Migratory species** Based on EPBC Protected Matters area search and preliminary ecological investigations, 25 migratory species have been recorded or have habitat within the wider locality of the impact area. A full list of species with a likelihood of occurrence have been assessed in Attachment B of Appendix A: Biodiversity memorandum.		

Description of existing environmental and potential impacts		
Is the proposal likely to impact nationally listed threatened species, ecological communities or migratory species? The archaeological test excavations would result in the disturbance of 6.75 m^2 of ground cover vegetation, including 6.25m^2 of native vegetation. Partial disturbance to an additional 200m^2 area would occur from wet sieving, however this would occur outside mapped native vegetation. Impact to mapped PCTs includes disturbance of up to 4.75 m^2 of EEC comprising: • 3.75m^2 of with Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions • 1m^2 of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions. **Threatened flora** Due to the very small area of proposed disturbance, and the implementation of safeguards and management measures which would allow site personal to avoid and minimise impact on any suspected threatened orchid species, the proposal is unlikely to significantly impact groundcover habitat components within habitat which threatened flora species have the potential to occur (see Attachment C of Appendix A for Significance Assessments). **Threatened fauna** A total of seven threatened species were recorded during field surveys completed in the Central Coast Highway project alignment. Although the foraging ecology of these species is diverse, they dedicated at least some of their foraging activity to the ground layer and sheltering amongst ground cover. The proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components, however, due to the very small area of proposed disturbance, the diverse foraging substrates used and their mobility, the proposal is unlikely to significantly impact these species. Excavation would also be via hand, with vehicle access and parking to be within the road reserve, outside areas of native vegetation. Therefore, the risk of impacts to fauna from injury and mortality is considered to be negligible. **Migratory species** As the scale of impact to vegetation communities would include only minor ground disturbance and ground level vegetation removal for the proposal, it is unlikely that any migratory species would be significantly impacted due to the proposal. **Weeds and pests** The proposal would have the potential to further distribute priority weeds which occur in the area through transportation on light and heavy vehicles. No impacts relating to weeds are anticipated with the implementation of safeguards and management measures. The proposal is not likely to result in impacts from pest species due to the minor nature and short duration of the work.	☐ Yes	☒ No
Would the proposal require the removal of any other vegetation? Minor trimming of mid story vegetation (i.e. minor pruning of branches) may be required for access to excavation sites; however no further impact on vegetation is anticipated with the implementation of management measures.	☐ Yes	☒ No
Would the proposal affect any tree hollows or hollow logs? No trees would be removed as part of the proposal.	☐ Yes	☒ No

Description of existing environmental and potential impacts		
Are there any known areas of outstanding biodiversity value or areas mapped as 'littoral rainforest' or 'coastal wetland' under chapter 2 of SEPP (Resilience and Hazards) in or within the vicinity of the proposed work? The Wamberal Lagoon Nature Reserve is located about 500 metres south of the proposal at its closest point. It is also gazetted as the Wamberal Lagoon Coastal Wetland under the Resilience and Hazards SEPP, Chapter 2 Coastal Management. Parts of the Wamberal Lagoon Nature Reserve and coastal wetland are also mapped as Key Fish Habitat in accordance with the *Fisheries Management Act 1994.* As no archaeological test excavations would occur with the Wamberal Coastal Wetland are, impacts from the proposal on biodiversity values within the Wamberal Lagoon Coastal Wetland are not expected. Due to the small area of proposed vegetation disturbance in the three areas of archaeological sensitivity, and the implementation of safeguards and management measures, the proposal is unlikely to significantly the Wamberal Lagoon Coastal Wetland area.	☒ Yes	☐ No
Would the proposal provide any additional barriers to the movement of wildlife?	☐ Yes	☒ No
Would the proposal disturb any natural waterways or aquatic habitat?	☐ Yes	☒ No
Would the proposal disturb any crevices or other locations (such as on bridges and culverts) for potential bat habitat?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

F1 As far as is reasonable and practicable, disturbance to areas of native vegetation (including derived native grassland) should be reduced to that only required to complete the works including safe access.

F2 Final siting of excavation locations will avoid impacts to native vegetation by using previously cleared sites or areas with sparse vegetation.

F3 Tree trimming will be reduced where practical and if unavoidable, will be permitted to the removal of branches <100mm only.

F4 If during excavation works unexpected threatened fauna or flora species are suspected or discovered, works will stop immediately and the site team will follow the Transport for NSW *Unexpected Threatened Species Find Procedure* in the Transport for NSW *Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*. All personnel working onsite will undergo site induction training on identification of the threatened fauna and flora with the potential to occur onsite and the how to implement the Unexpected Threatened Species Find Procedure.

F5 Vehicle and machinery movements, and sieving areas will be placed in areas outside of native vegetation.

F6 Where necessary, work area limits will be identified prior to commencing work to avoid unnecessary vegetation and habitat removal.

3.8 Trees

Table 3-8 Trees

Description of existing environmental and potential impacts		
Does the proposal involve pruning, trimming or removal of any tree/s? Archaeological test excavations would not remove any trees. Where required, the proposal may involve the trimming of native vegetation. This would only occur at necessary locations, and trimming would be carried out using hand held clippers. All pruning and trimming of trees will be in accordance with the *Australian Standard 4373-2007 Pruning of amenity trees.*	☒ Yes	☐ No
Do the trees form part of a streetscape, an avenue or roadside planting?	☐ Yes	☒ No
Have the trees been planted by a community group, Landcare group or by council or is the tree a memorial or part of a memorial group e.g., has a plaque?	☐ Yes	☒ No
Do the trees form part of a heritage listing or have other heritage value?	☐ Yes	☒ No

Safeguards

Refer to biodiversity safeguards in Section 3.7.

3.9 Traffic and transport

Table 3-9 Traffic and transport

Description of existing environmental and potential impacts		
Is the proposal likely to result in detours or disruptions to traffic flow (vehicular, cycle and pedestrian) or access during construction? The surrounding road network is comprised of the Central Coast Highway and local roads within the suburbs of Bateau Bay and Forresters Beach. Access for the proposal would require up to one heavy vehicle (if required) and five light vehicle movements per day to transport personnel, equipment and materials. These additional vehicles would represent a negligible increase in the surrounding traffic volumes on public roads and no impacts are anticipated. Light and heavy vehicles required for the proposal would avoid parking in bus stops, or other restricted parking areas. As such, no impacts access or parking is expected as a result of the proposal. Access to archaeological test excavation locations would be from the Central Coast Highway, or adjoining local roads. Options for off-site parking would be explored, and a meeting point agreed on for personnel to park and share vehicles to site. This would reduce parking impacts nearby the areas of archaeological sensitivity. Where off-site parking is not feasible, access to the archaeological test excavation locations would be from the Central Coast Highway verge at Area 2 and Area 3. Access to Area 1 would be from Maas Parade, and no parking would be permitted along the Central Coast Highway. Vehicles would not be required to drive into the areas of potential archaeological sensitivity. Excavations would be carried out during standard daytime work hours and would not be carried out within the road corridor. As such, the works would not require Road Occupancy Licences (ROL) or Traffic Control Permits (TCP), as the proposal would not disrupt traffic flow on the highway (refer to section 2.3.2).	☐ Yes	☒ No
Is the proposal likely to result in detours or disruptions to traffic flow (vehicular, cycle and pedestrian) or access during operation?	☐ Yes	☒ No

Description of existing environmental and potential impacts		
Is the proposal likely to affect any other transport nodes or transport infrastructure (e.g., bus stops, bus routes) in the surrounding area? Or result in detours or disruptions to traffic flow (vehicular, cycle and pedestrian) or access during operation?	☐ Yes	☒ No

Safeguards

No additional safeguards would be required to manage impacts to traffic and transport from the archaeological test excavations. Safeguards to be implemented are:

T1 Current traffic movements and property accesses are to be maintained during the works. The use of private access tracks, where relevant, will be confirmed with the relevant landholders prior to the commencement of the proposal, and any disturbance is to be minimised

T2 Appropriate signage and supervision will be provided at all times to ensure that all archaeological test excavation locations are controlled and that unauthorised personnel are excluded from work areas

T3 Parking will occur in appropriate areas, and will avoid bus stops or other restricted parking areas. No parking of vehicles is allowed within 1.5 metres of the edge of traffic lanes on the Central Coast Highway

T4 Off-site parking is preferred. Where this is not feasible, light and heavy vehicles required for the archaeological test excavations will not be permitted to park along the Central Coast Highway at Area 1, instead they will be directed to use Maas Parade

T5 Archaeological test excavation pits will not be left open overnight, where practicable. Where pits are to remain open overnight, public access to the pits will be excluded by the establishment of temporary fencing (or similar).

3.10 Socio-economic

Table 3-10 Socio-economic

Description of existing environmental and potential impacts		
Is the proposal likely to impact on local business? The proposal is not expected to impact local businesses along the Central Coast Highway and nearby areas. The proposal may result in short-term amenity impacts resulting from noise and dust impacts, however these impacts would be negligible.	☐ Yes	☒ No
Is the proposal likely to require any property acquisition?	☐ Yes	☒ No
Is the proposal likely to alter any access for properties (either temporarily or permanently)? Property access would be maintained throughout the proposal.	☐ Yes	☒ No
Is the proposal likely to alter any on-street parking arrangements (either temporarily or permanently)? Where off-site parking is not feasible, vehicles required for archaeological test excavations at Area 2 and Area 3 would be required to use on-street parking along the Central Coast Highway, and access to the excavation site would be on foot. Where off-site parking is not feasible for archaeological test excavations at Area 1, vehicles would be required to park in a public car park along Maas Parade, and access the site on foot. The parking of up to five light vehicles in on-street and public parking spaces is expected to result in the short-term loss of parking, for up to four days (maximum) at each location. This would have minor impacts on parking and access, however, due to the scale and nature of the proposal, potential impacts would be temporary. Additionally, vehicles would avoid parking in bus stop or restricted parking areas.	☐ Yes	☒ No

Description of existing environmental and potential impacts		
Is the proposal likely to change pedestrian movements or pedestrian access (either temporarily or permanently)? Wet sieves (if required) would be set up in previously disturbed areas, nearby each area of potential archaeological sensitivity. If required, the wet sieve and water cart would be setup as follows: • Area 1 - within the road reserve on the southern side of Maas Parade. The water cart would park adjacent to the sieving area. There is no pedestrian infrastructure in this location and access can be excluded from the work area. • Area 2 – within the road reserve on the western of the Central Coast Highway on a previously cleared, relatively flat area. The water cart would park adjacent to the sieving area. There is no pedestrian infrastructure in this location and access can be excluded from the work area. • Area 3A – within the road reserve on the western side of the Central Coast Highway in a cleared area, south of Cresthaven Avenue. The water cart would park adjacent to the sieving area. There is no pedestrian infrastructure in this location and access can be excluded from the work area. A bus stop is located around 40 metres north of the proposed wet sieving area, and a footpath extending north to Cresthaven Avenue would not be impacted. • Area 3B - within the road reserve on the western side of the Central Coast Highway, north of Cresthaven Avenue. The water cart would park adjacent to the sieving area. A path is located on the western side of the sieve area, which extends to the north and south. The path would not be directly impacted by the sieve area and access can be excluded from the work area. Field personnel would be required to transport soil by hand to the sieve area from test excavation locations, crossing across the path. As detailed above, the work areas have been arranged to avoid disruption to pedestrian infrastructure, where this occurs. Temporary crossing of paths by field personnel may be required, however this would avoid disruption of pedestrian or cyclist access or safety. The road corridor may also be informally used by pedestrians and cyclists, including for parking and access to bus stops. Where these occur, there is generally sufficient room to allow these movements to continue, and controls (including monitoring on site) would be implemented to ensure the proposal does not impact the movement or safety of pedestrians and cyclists. Controls for the management of spoil and runoff (refer to section 3.1) would ensure that it is sufficiently controlled to not result in potential impacts to pedestrian movements and access.	☒ Yes	☐ No
Is the proposal likely to impact on any items or places of social value to the community (either temporarily or permanently)?	☐ Yes	☒ No
Is the proposal likely to reduce or change visibility of any businesses, farms, tourist attractions or the like (either temporarily or permanently)?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

C1 Specific measures to manage impacts associated with noise, dust, cultural heritage, and traffic and transport are outlined in the following sections:

- Noise and vibration (refer to Section 3.3)
- Air quality (refer to Section 3.4)
- Aboriginal Heritage (refer to Section 3.6)
- Traffic and transport (refer to Section 3.9).

C2 Complaints received are to be recorded and attended to promptly in accordance with the *Community Involvement Practice Notes and Resource Manual.*

C3 Pedestrian access will be excluded from wet sieving areas using pedestrian bollards and flagging tap or similar.

C4 Site personnel would monitor for pedestrian and cyclist movements (including informal movements within the road corridor) to ensure safe access is maintained, where required the work area will be reviewed and adjusted onsite to ensure this.

C5 The work areas will not block existing footpaths or shared paths. Where crossing of existing paths is required by field personnel, this will include monitoring for pedestrians and cyclists to prevent disruptions or potential collisions.

3.11 Landscape character and visual amenity

Table 3-11 Landscape character and visual amenity

Description of existing environmental and potential impacts		
Is the proposed work over or near an important physical or cultural element or landscape? (For example, heritage items and areas, distinctive or historic built form, National Parks, conservation areas, scenic highways etc.)? The Central Coast Highway is surrounded by a modified urban environment which includes a mix of residential, commercial/business, recreational, environmental conservation, industrial and transport related land uses. The area has been substantially changed by development with the natural vegetation modified by past land uses and development. Potential amenity impacts to the landscape would be short-term and minor. Test pits would be backfilled, and the ground surface would be reinstated to reflect conditions prior to investigations.	☒ Yes	☐ No
Would the proposal obstruct or intrude upon the character or views of a valued landscape or urban area? For example, locally significant topography, a rural landscape or a park, a river, lake or the ocean or a historic or distinctive townscape or landmark? The proposal would not include any permanent features that extend above the ground surface level. As a result, there would be no permanent obstruction or intrusions upon the character or views of the nearby landscapes and urban areas.	☐ Yes	☒ No
Would the proposal require the removal of mature trees or stands of vegetation, either native or introduced? The proposal would not involve the removal of mature trees or stands of vegetation. Plant and equipment would steer around larger trees for access. Impacts to vegetation would be limited to the flattening of groundcover and disturbance of groundcover at archaeological test excavation locations. Where required to access some archaeological test excavation locations, some vegetation would be trimmed using hand held clippers. All pruning and trimming of trees will be in accordance with the *Australian Standard 4373-2007 Pruning of amenity trees.*	☐ Yes	☒ No
Would the proposal result in large areas of shotcrete visible from the road or adjacent properties?	☐ Yes	☒ No
Would the proposal involve new noise walls or visible changes to existing noise walls?	☐ Yes	☒ No
Would the proposal involve the removal or reuse of large areas of road corridor, landscape, either verges or medians?	☐ Yes	☒ No
Would the proposal involve substantial changes to the appearance of a bridge (including piers, girders, abutments and parapets) that are visible from the road or residential areas?	☐ Yes	☒ No
If involving lighting, would the proposal create unwanted light spillage on residential properties at night (in construction or operation)? The proposal would not involve lighting as all works would be carried out during standard working hours.	☐ Yes	☒ No
Would any new structures or features to be constructed, result in over shadowing to adjoining properties or areas?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

V1 Specific measures to manage impacts associated with amenity and heritage are outlined in the following sections:

- Waterways and water quality (refer to Section 3.2)
- Noise and Vibration (refer to Section 3.3)
- Non-Aboriginal Heritage (refer to Section 3.5)
- Socio-economic (refer to Section 3.9).

V2 Following the excavations, any disturbed areas impacted by the archaeological test excavations will be backfilled and cover reinstated as far as practical, this cover can be grass or natural mulch litter spread back over the surface.

3.12 Waste

Table 3-12 Waste

Description of existing environmental and potential impacts		
Is the proposal likely to generate >200 tonnes of waste material (contaminated and /or non-contaminated material)? No significant waste would be generated by the proposal, other than minor quantities of general waste from field staff which would be disposed of appropriately.	☐ Yes	☒ No
Is the proposal likely to require a licence from EPA?	☐ Yes	☒ No
Is the proposal likely to require the removal of asbestos?	☐ Yes	☒ No

Safeguards

Safeguards to be implemented are:

M1 The work site would be kept tidy and free of rubbish at all times, a record of site clean-up and restoration would be kept.

M2 All waste material would be securely contained and removed daily from the site and once the activity is complete, and disposed of in accordance with the *Waste Classification Guidelines – Part 1* (NSW EPA, 2014).

4. Consideration of State and Commonwealth environmental factors

4.1 Environmental Planning and Assessment Regulation 2021 checklist

The following factors, listed in section 171(2) of the Environmental Planning and Assessment Regulation 2021, have been considered to assess the likely impacts of the proposal on the natural and built environment. This consideration is required to comply with sections 5.5 and 5.7 of the EP&A Act.

Table 4-1 Consideration of section 171 of the EP&A Regulation factors

Environmental factor	Impact
a) Any environmental impact on a community? The proposal may cause minor short-term environmental impacts to nearby sensitive receivers, associated with noise and dust impacts. However, the potential impacts would be minimised with the implementation of safeguards and environmental management measures as detailed in Section 5. The proposal would have no environmental impact on the broader community in the long-term as heritage test site excavations are small in extent, backfilled and temporary.	Short-term, minor, negative.
b) Any transformation of a locality? The proposal would not transform the locality of works, as works are minor and small in extent, have negligible environmental impacts and any vegetation removal would generally be limited to vegetation for the provision of access to test pits and excavation locations.	Nil
c) Any environmental impact on the ecosystems of a locality? The proposal would result in the minor disturbance of ground cover at each archaeological test excavation location, associated with the digging of test pits and sieving, and when tracking over groundcover to access archaeological test excavation locations. The proposal may also involve the minor trimming of some vegetation. No mature native vegetation would be removed for the proposal and groundcover is able to regrow after backfilling of excavations. Impacts to vegetation would be minimal and it is not anticipated that there would be any impacts to any threatened ecological communities or threatened flora and fauna species. Potential impacts would be managed through the implementation of safeguards and environmental management measures provided in Section 5.	Nil
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? Archaeological test excavations would be minor and limited in area. Vegetation removal for excavation would be minimal, and likely to regrow after backfilling. Additional minor rehabilitation of vegetation would be carried out when required. It is not anticipated that the proposal would cause any long-term reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality. Potential impacts would be managed through the implementation of safeguards and environmental management measures provided in Section 5	Nil
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The potential impacts on archaeological, cultural or historical values have been assessed in Section 3.6 of this REF. Potential impacts would be managed through the implementation of safeguards and environmental management measures provided in Section 5.	Nil

Environmental factor	Impact
f) Any impact on habitat of any protected animals (within the meaning of the Biodiversity Conservation Act 2016)? The proposal would result in the minor disturbance of ground cover at each test excavation location, associated with the digging of test pits and sieving, and when tracking over groundcover to access test excavation locations. The proposal may also involve the minor trimming of some vegetation for access. No mature native vegetation would be removed for the proposal. Impacts to vegetation would be temporary and minimal (see Section 3.7) and would not have any significant impact on the habitat of any protected or endangered fauna. Potential impacts would be managed through the implementation of safeguards and environmental management measures provided in Section 5.	Nil
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would not endanger any species of animal, plant or other form of life, whether living on land, in water or in the air, as no clearing of remnant vegetation or established trees would be required. Archaeological test excavations would result in the temporary disturbance of a small area of groundcover. The proposal may also involve the trimming of some vegetation for access, where required, however, this would not endanger any species.	Nil
h) Any long-term effects on the environment? There are no anticipated negative long-term effects on the environment from the proposal due to the minor scope of the works and the implementation of the safeguards and environmental management measures outlined in Section 5.	Nil
i) Any degradation of the quality of the environment? There would be potential for short-term sedimentation and dust impacts. These would be managed and mitigated with the implementation of appropriate safeguards and environmental management measures outlined in Section 5.	Short-term, minor, negative.
j) Any risk to the safety of the environment? The proposal would not cause any risk to the safety of the environment.	Nil
k) Any reduction in the range of beneficial uses of the environment? The proposal would not result in the range of beneficial uses of the environment.	Nil
l) Any pollution of the environment? The proposal is unlikely to cause any significant pollution to the environment. Minor, short-term noise and localised sedimentation, noise and dust impacts may occur. However the potential impacts are temporary and would be minimised with the implementation of the safeguards and environmental management measures outlined in Section 5.	Short-term, minor, negative.
m) Any environmental problems associated with the disposal of waste? Small quantities of waste that may be generated from the proposal would be contained and removed for disposal at approved recycling facilities or licensed landfill in accordance with the safeguards and environmental management measures outlined in Section 5. No environmental problems are anticipated for the disposal of waste.	Nil
n) Any increased demands on resources, natural or otherwise which are, or are likely to become, in short supply? The proposal would not significantly increase demands on resources, which are, or are likely to become, in short supply. Some fuels and oils would be required to undertake the proposal, however these materials are not in limited supply. Limited water would be used during wet sieving, where required, as described in Chapter 3. The amount of water would be minor and is not considered to impact supply. The safeguards and environmental management measures outlined in Section 5 would be implemented to minimise any potential impacts.	Nil

Environmental factor	Impact
o) Any cumulative environmental effect with other existing or likely future activities? The proposal would have minor impacts and no cumulative environmental effects are determined. The environmental effects of the proposal would be minimal and temporary and would be appropriately addressed by the prescribed safeguards and environmental management measures outlined in Section 5.	Short-term, minor, negative.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would not impact on any coastal processes and coastal hazards including those under projected climate change conditions.	Nil
q) Any impact on applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1? The Central Coast Regional Plan 2036, the Port Stephens Council Community Strategic Plan 2018 – 2028 and the Port Stephens Council Local Strategic Planning Statement all apply to the proposal. These plans seek to enable the delivery of infrastructure in the Central Coast region, and they promote the recognition and inclusion of Aboriginal groups in planning and development. Carrying out archaeological test excavations to inform the Central Coast Highway upgrade project would assist to achieve the goals of relevant local and regional plans.	Long-term, moderate, positive.
r) Any impact on other relevant environmental factors? All relevant environmental factors are considered in Chapter 3 of this REF. The proposal is not expected to have a significant impact on the environmental factors assessed.	Short-term, minor, negative.

4.2 Matters of National Environmental Significance checklist

Table 4-2 Checklist matters of national environmental significance

Environmental factor	Impact
a) Any impact on a World Heritage property? There are no world heritage properties within the vicinity of the proposal. Direct or indirect impacts are not expected.	Nil
b) Any impact on a National Heritage place? There are no national heritage places within the vicinity of the proposal. Direct or indirect impacts are not expected.	Nil
c) Any impact on a wetland of international importance (often called 'Ramsar' wetlands)? There are no wetlands of international importance within the vicinity of the proposal. Direct or indirect impacts are not expected.	Nil

Environmental factor	Impact
d) Any impact on nationally threatened species, ecological communities or migratory species? A total of seven threatened fauna species were recorded during field surveys completed in the Central Coast Highway project alignment. Twenty-five migratory species have been recorded or have habitat within the wider locality of the impact area (see Appendix A: Biodiversity memorandum). The proposal is small in extent and would result in a temporary and minor disturbance of native and non-native groundcover vegetation associated with test pits and sieving. However, no mature native vegetation, including trees or shrubs, would be removed. The proposal may also involve the trimming of vegetation, where required, to access some locations. Trimming would have limited impacts on vegetation and would be managed through the implementation of safeguards and environmental management measures provided in Section 5. The proposal would not impact on Commonwealth listed threatened species or communities, or listed migratory species.	Nil
e) Any impact on a Commonwealth marine area? There would be no environmental impact on a Commonwealth Marine area.	Nil
f) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not constitute a nuclear action.	Nil
Additionally, any impact (direct or indirect) on the environment of Commonwealth land? Commonwealth land would not be affected by the proposal.	Nil

5. Summary of safeguards and environmental management measures

This section provides a summary of the site-specific environmental safeguards and management measures identified in described in Chapters 3 and 4 of this REF. These safeguards will be implemented to reduce potential environmental impacts throughout construction and operation. A framework for managing the potential impacts is provided with reference to environmental management plans and relevant Transport QA specifications. Any potential licence and/or approval requirements required prior to construction are also listed.

Table 5-1: Summary of site-specific safeguards for proposed work

Factor	Environmental safeguard	
Soil	E1	Where wet sieving is required, erosion and sediment control measures (such as the installation of sandbag berms or similar) are to be implemented and maintained in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004) (The Blue Book) to: Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets Minimise the amount of material transported from site to surrounding pavement surfaces
	E2	Where wet sieving is required, erosion and sedimentation controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request
	E3	Where wet sieving is required, erosion and sediment control measures are not to be removed until the works are complete
	E4	Archaeological test excavations will involve the backfilling of spoil, and the ground surface would be reinstated to levels present prior to excavation. Work areas are to be stabilised progressively during the works
	E5	In the event that a pollution incident or unexpected find occurs onsite, the *Environmental Incident Classification and Reporting Procedure* (Roads and Maritime Services, 2016) is to be followed and Transport's Contract Manager and Environment Manager notified immediately
	E6	Vehicle access will be limited to cleared and disturbed areas of the road reserve, including avoiding vehicle movement through areas of native vegetation
	E7	If any unexpected contaminants, or unexpected finds such as asbestos, acid sulphate soils or salinity issues are encountered during the archaeological test excavations, work will cease and Transport's environmental officer will be contacted for advice, in consultation with a contaminated land specialist, on the appropriate action
Waterways and water quality	W1	Weather forecasts will be reviewed ahead of planned fieldwork to confirm suitable conditions are predicted
	W2	New works will not commence, and works in progress would be suspended, during periods of heavy or prolonged rainfall
	W3	If an incident (e.g. spill) occurs, the *Environmental Incident Classification and Management Procedure* (Roads and Maritime Services, 2016) is to be followed and Transport's Contract Manager and Environment Manager notified immediately
Noise and vibration	N1	All work is to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).
	N2	No out-of-hours work will be carried out without written approval from Transport.

Factor	Environmental safeguard	
	N3	All employees, contractors and subcontractors for archaeological test excavations are to receive a site specific prestart/toolbox talk. The talk must at least include: • permissible hours of work • location of nearest sensitive receivers • access and vehicle parking areas • environmental incident procedures
	N4	Behaviour on site will include: No swearing or unnecessary shouting or loud stereos/radios on site.
	N5	Ensure vehicles that are not being used are turned off
	N6	The water cart, where required, would be located as far as practicable from any neighbouring residences, or other sensitive receivers, in the immediate vicinity of the proposal to further reduce potential noise impacts
Air quality	A1	The area of soil surface disturbed will be kept to the minimum amount necessary to complete the proposal and disturbed areas will be rehabilitated to prevent long-term dust generation as soon as possible
	A2	Weather conditions will be monitored to ensure adequate dust control measures are implemented where excavation and dry sieving activities are to occur during periods of adverse weather conditions, such as dry, windy conditions or when visible dust emissions are likely to cause localised nuisance impacts
Aboriginal Heritage	B1	All works would be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010)
	B2	If bones or skeletal remains are uncovered during the works, all works in the vicinity of the find must cease. If the bones are identified by a qualified forensic or physical anthropologist as human, the NSW Police should be notified and Transport's Aboriginal cultural heritage officer and/or regional environment manager contacted immediately. Steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* must be followed
Non-Aboriginal Heritage	H1	If unexpected, non-Aboriginal heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* must be followed. Transport's Senior Environment Specialist - Heritage must be contacted immediately
Biodiversity	F1	As far as is reasonable and practicable, disturbance to areas of native vegetation (including derived native grassland) should be reduced to that only required to complete the works including safe access
	F2	Final siting of excavation locations will avoid impacts to native vegetation by using previously cleared sites or areas with sparse vegetation
	F3	Tree trimming will be reduced where practical and if unavoidable, will be permitted to the removal of branches <100mm only
	F4	If during excavation works unexpected threatened fauna or flora species are suspected or discovered, works will stop immediately and the site team will follow the Transport for NSW *Unexpected Threatened Species Find Procedure* in the Transport for NSW *Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*. All personnel working onsite will undergo site induction training on identification of the threatened fauna and flora with the potential to occur onsite and the how to implement the Unexpected Threatened Species Find Procedure

Factor	Environmental safeguard	
	F5	Vehicle and machinery movements, and sieving areas will be placed in areas outside of native vegetation
	F6	Where necessary, work area limits will be identified prior to commencing work to avoid unnecessary vegetation and habitat removal
Trees	Refer to biodiversity safeguards.	
Traffic and transport	T1	Current traffic movements and property accesses are to be maintained during the works. The use of private access tracks, where relevant, will be confirmed with the relevant landholders prior to the commencement of the proposal, and any disturbance is to be minimised
	T2	Appropriate signage and supervision will be provided at all times to ensure that all archaeological test excavation locations are controlled and that unauthorised personnel are excluded from work areas
	T3	Parking will occur in appropriate areas, and will avoid bus stops or other restricted parking areas. No parking of vehicles is allowed within 1.5 metres of the edge of traffic lanes on the Central Coast Highway
	T4	Off-site parking is preferred. Where this is not feasible, light and heavy vehicles required for the archaeological test excavations will not be permitted to park along the Central Coast Highway at Area 1, instead they will be directed to use Maas Parade
	T5	Archaeological test excavation pits will not be left open overnight, where practicable. Where pits are to remain open overnight, public access to the pits will be excluded by the establishment of temporary fencing (or similar)
Socio-economic	C1	Specific measures to manage impacts associated with noise, dust, cultural heritage, and traffic and transport are outlined in the following sections: • Noise and vibration (refer to Section 3.3) • Air quality (refer to Section 3.4) • Aboriginal Heritage (refer to Section 3.5) • Traffic and transport (refer to Section 3.9).
	C2	Complaints received are to be recorded and attended to promptly in accordance with the *Community Involvement Practice Notes and Resource Manual*
	C3	Pedestrian access will be excluded from wet sieving areas using pedestrian bollards and flagging tap or similar
	C4	Site personnel would monitor for pedestrian and cyclist movements (including informal movements within the road corridor) to ensure safe access is maintained, where required the work area will be reviewed and adjusted onsite to ensure this
	C5	The work areas will not block existing footpaths or shared paths. Where crossing of existing paths is required by field personnel, this will include monitoring for pedestrians and cyclists to prevent disruptions or potential collisions
Landscape character and visual amenity	V1	Specific measures to manage impacts associated with amenity and heritage are outlined in the following sections: • Waterways and water quality (refer to Section 3.2) • Noise and Vibration (refer to Section 3.3) • Non-Aboriginal Heritage (refer to Section 3.6) • Socio-economic (refer to Section 3.9)

Factor	Environmental safeguard	
	V2	Following the excavations, any disturbed areas impacted by the archaeological test excavations will be backfilled and cover reinstated as far as practical, this cover can be grass or natural mulch litter spread back over the surface
Waste	M1	The work site would be kept tidy and free of rubbish at all times, a record of site clean-up and restoration would be kept.
	M2	All waste material would be securely contained and removed daily from the site and once the activity is complete, and disposed of in accordance with the *Waste Classification Guidelines – Part 1* (NSW EPA, 2014)

5.1 Licensing and approvals

No licences and/or other approvals are required for the proposal.

5.2 Other requirements

Table 5-2 Other requirements

Requirement		
Environmental Work Method Statement (to be reviewed by Transport for NSW).	☒ Yes	☐ No

6. Certification, review and decision

6.1 Certification

This minor works REF provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses, to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal.

Prepared by

Signature 

Name:	Bernadette Quirk
Position:	Graduate Environmental Scientist
Company name:	WSP Australia Pty Ltd
Date:	17/08/2022

Minor Works REF reviewed by:

Signature 

Name:	Philip Burns
Position:	Associate Environmental Planner
Company name:	WSP Australia Pty Ltd
Date:	17/08/2022

6.2 Environment staff review

The Minor Works REF has been reviewed and considered against the requirements of sections 5.5 and 5.7 of the EP&A Act.

In considering the proposal this assessment has examined and taken into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of that activity as addressed in the Minor Works REF and associated information. This assessment is considered to be in accordance with the factors required to be considered under section 171 of the Environmental Planning and Assessment Regulation 2021.

The proposal described in the Minor Works REF will have some environmental impacts which can be ameliorated satisfactorily. Having regard to the safeguard and management measures proposed, this assessment has considered that these impacts are unlikely to be significant and therefore an approval for the proposal does not need to be sought under Division 5.2 of the EP&A Act.

The assessment has considered the potential impacts of the activity on areas of outstanding value and on threatened species, ecological communities or their habitats for both terrestrial and aquatic species as defined by the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994*.

The proposal described in the Minor Works REF will not affect areas of outstanding value. The activity described in the Minor Works REF will not significantly affect threatened species ecological communities or their habitats. Therefore, a species impact statement is not required.

The assessment has also addressed the potential impacts on the activity on matters of national environmental significance and any impacts on the environment of Commonwealth land and concluded that there will be no significant impacts. Therefore, there is no need for a referral to be made to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the *Environment Protection and Biodiversity Conservation Act 1999*.

The Minor Works REF is considered to meet all relevant requirements.

6.3 Transport Environment staff recommendation

It is recommended that the proposal to carry out archaeological test excavations for the Central Coast Highway from Wamberal to Bateau Bay Road upgrade proposal, as described in this Minor Works REF, proceed subject to the implementation of all safeguards identified in the Minor Works REF and compliance with all other relevant statutory approvals, licences, permits and authorisations.

The Minor Works REF has examined and taken into account to the fullest extent possible all matters likely to affect the environment by reason of the activity and established that the activity is not likely to significantly affect the environment or threatened species, ecological communities or their habitats.

The Minor Works REF has concluded that there will be no significant impacts on matters of national environmental significance or any impacts on the environment of Commonwealth land.

The Minor Works REF determination will remain current for five years until 17 August 2027 at which time it shall lapse if works have not been physically commenced.

Recommended by:

Signature 

Name: Jeremy Durward

Position: Transport for NSW Environment and Sustainability Officer

Date: 17/08/2022

Noted by:

Signature 

Name: Josh Alce

Position: Transport for NSW Project Development Manager

Date: 17/08/2022

6.4 Determination

In accordance with the above recommendation, I certify that I have reviewed and endorsed the contents of this Minor Works REF and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under Section 170 of the EP&A Regulation, and the information is neither false nor misleading.

I determine that Transport for NSW may:

- proceed with the activity

Signature 

19/8/2022

Name: Bradley Parkes

Position: Senior Project Development Manager

Date: 17/08/2022

7. Definitions

Table 7-1 Definitions

Term	Definition
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ASS	Acid Sulfate Soils
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
DCP	Dynamic Core Penetrometer
EEC	Endangered Ecological Community
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FM Act	*Fisheries Management Act 1994* (NSW)
ICNG	Interim Construction Noise Guideline
LEP	Local Environmental Plan
LGA	Local Government Area
NML	Noise Management Level
NPW Act	The *National Parks and Wildlife Act 1974*
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PMST	EPBC Act Protected Matters Search Tool
REF	Review of Environmental Factors
ROL	Road Occupancy License
RTA	Roads and Traffic Authority (Former NSW department)
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
TCP	Traffic Control Permits

Appendix A: Biodiversity memorandum

MEMO

TO:	Jeremy Durward
FROM:	Nathan Stewart
SUBJECT:	**Central Coast Highway upgrade - Wamberal to Bateau Bay– Biodiversity assessment for archaeological investigations**
OUR REF:	CCHTB-WSPA-CCH-EN-MEM-000006
DATE:	**17 August 2022**

1. Proposal background

TfNSW proposes to undertake archaeological test excavations (the proposal) as part of preparation of the Review of Environmental Factors (REF) for the proposed upgrade of the Central Coast Highway between Wamberal and Bateau Bay (the project).

The proposal would involve completion of archaeological test excavations to be carried out at locations adjacent to the existing Central Coast Highway. The archaeological test excavations are being completed as part of an Aboriginal Cultural Heritage Assessment Report (ACHAR).

The key features of the proposal include:

- survey of archaeological test excavation locations
- completion of archaeological test excavations, including clearing of any surface vegetation
- sieving for Aboriginal artefacts, potentially including wet sieving via use of a water cart
- backfilling and site reinstatement.

Archaeological test excavations would occur within three potentially archaeologically sensitive areas identified during an Aboriginal Heritage due Diligence Assessment (Heritage Now, 2022). The locations and extent of these areas of sensitivity are shown in Figure 1.1.

1.1 Description of works

Test excavations will involve the excavation of 21 test pits (to be 0.5metres (m) x 0.5m in dimension) with a contingency of an extra two test pit at each sensitivity area (additional total six trenches at 0.5m x 0.5m). Test excavations will be undertaken across the three identified areas of potential sensitivity, with an estimated 40 metres spacing between each trench (Figure 1.1). The extra six contingency trenches have been conservatively assumed to impact three locations within each of the two listed endangered ecological communities (EEC).

Four wet sieving locations (10m x 5m in dimension) will also be located just outside of the three identified areas of sensitivity (Figure 1.1), however will not impact on any native vegetation.

Access to archaeological test excavation locations would be from the Central Coast Highway. Where required, some locations may be accessed from adjoining local roads. Access into areas of native vegetation would be by foot, and not result in disturbance.

Minor modifications to the location and methodology of excavations may be implemented by work crews on arrival at each individual investigation site to deliver the required investigation outcomes and minimise environmental impacts.

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Newcastle NSW 2300
PO Box 1162
Newcastle NSW 2300

Tel: +61 2 4929 8300
Fax: +61 2 4929 8382

1.2 Assumed impacts on biodiversity values

For this assessment, it is assumed that disturbances to vegetation would be limited to the disturbance/removal of groundcover and understorey vegetation only for the completion of excavation. It is assumed that no native overstorey vegetation (including hollow bearing trees) would be impacted by the proposal. Areas of impact have been calculated to accommodate 0.5 m x 0.5 m test pits.

Some tree trimming may be necessary but will be limited to vegetation between 1–2 m above the ground using hand tools and would be limited to branches less than 100 (millimetres) mm in diameter. As such, no significant impact from tree trimming is expected to occur with the implementation of management measures.

Survey location markers, either temporary or permanent in nature, would be placed in appropriate locations and not expected to result in direct impacts to native vegetation.

Figure 1.1 provides the locations of the proposed works.

wsp

Central Coast Highway

Figure 1

Proposed Test Pit Locations and Vegetation Communites

Legend

- Proposed test pit locations
- Roads
- Watercourse
- Proposed wet sieve areas (if required)
- Area of potential archaeological sensitivity

GGBF Habitat

- Dispersal habitat

Vegetation Zones

- Miscellaneous ecosystem, highly disturbed areas with no or limited native vegetation
- Miscellaneous ecosystem, Landscape plantings
- PCT 1138 – Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter-Sydney Basin Bioregion, Intact
- PCT 1138 – Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter-Sydney Basin Bioregion, Modified
- PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, Intact
- PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, Modified
- PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast, Intact
- PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast, Modified

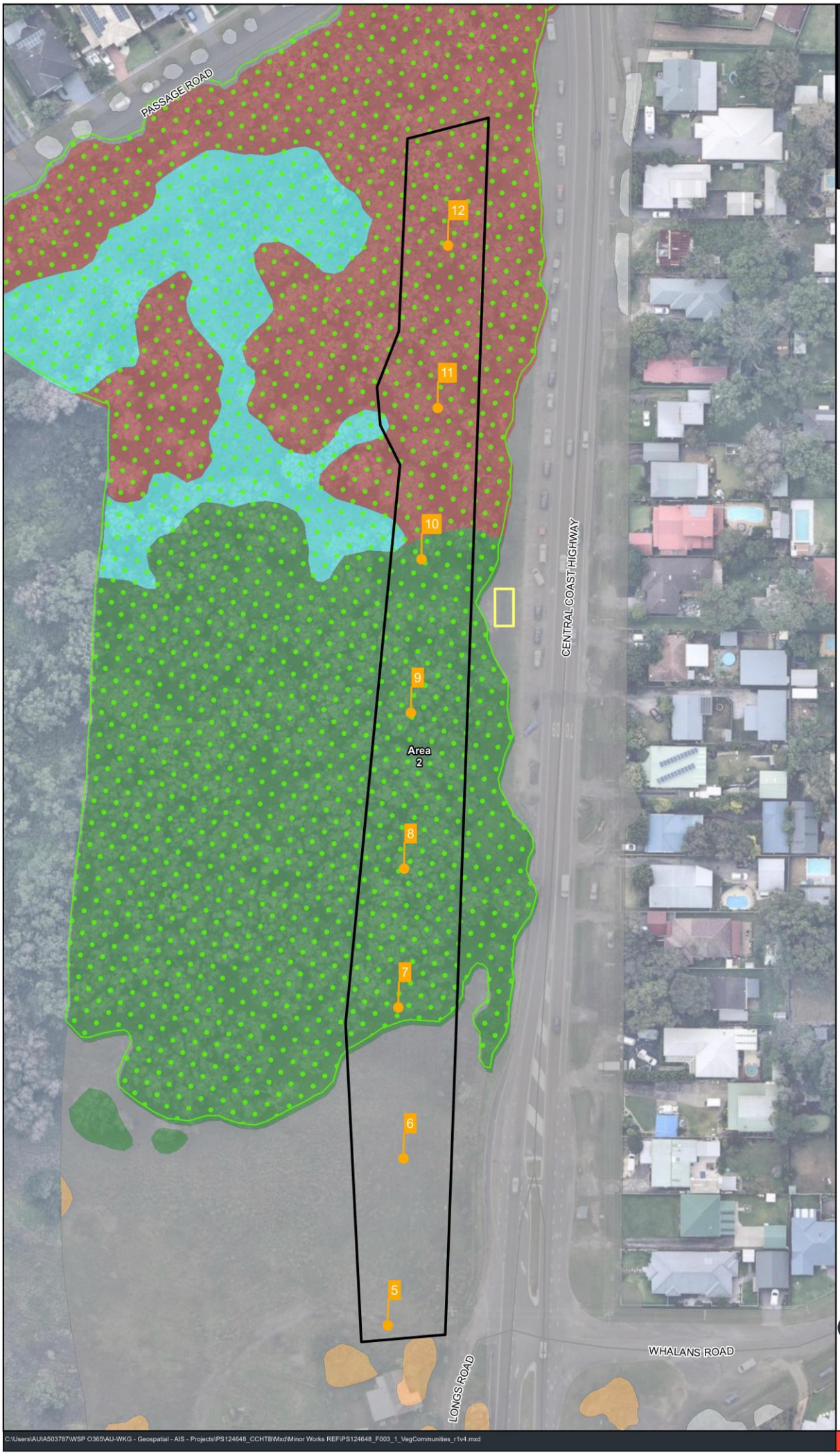
0 10 20
Meters

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 18/05/2022

Data sources: - TfNSW, NSWSS, Geoscience Australia



wsp

Central Coast Highway

Figure 1

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Legend

- Proposed test pit locations
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- PCT 1138 – Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter-Sydney Basin Bioregion, Modified
- PCT 1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast, Modified
- PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast, Intact

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Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

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wsp

Central Coast Highway

Figure 1

Proposed Test Pit Locations and Vegetation Communites

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- Proposed test pit locations
- Roads
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- Proposed wet sieve areas (if required)
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GGBF Habitat

- Dispersal habitat

Vegetation Zones

- Miscellaneous ecosystem, highly disturbed areas with no or limited native vegetation
- Miscellaneous ecosystem, Landscape plantings
- PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, Intact
- PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, Modified
- PCT1716 - Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast, Intact
- PCT1727 - Swamp Oak - Sea Rush - Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast, Modified

0 10 20
Meters

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:1,000 Date: 18/05/2022

Data sources: - TfNSW, NSWSS, Geoscience Australia

2. Methods

2.1 Background research

A desktop assessment of the impact area, including review of:

- NSW BioNet Threatened Biodiversity Data Collection (Environment Energy and Science, 2021d)
- BioNet Atlas of NSW Wildlife (Environment Energy and Science, 2021b)
- BioNet Vegetation Classification Database (Environment Energy and Science, 2021c)
- EPBC Act Protected Matters Search Tool (Department of Agriculture Water and the Energy, 2021c)
- Species Profiles and Threats Database (Department of Agriculture Water and the Energy, 2021e)
- NSW Flora Online (PlantNet) (Royal Botanic Gardens, 2021)
- Atlas of Living Australia – interactive map search (Atlas of Living Australia, 2021)
- NSW Department of Primary Industries (Fishing and Aquaculture) spatial data (Department of Primary Industries, 2018)
- Register of Critical Habitat (Department of Agriculture Water and the Energy, 2021d)
- Register of Declared Areas of Outstanding Biodiversity Value (AOBV) – Critical habitat declarations in NSW (Department of Planning Industry and Environment, 2021a)

In addition, the following spatial data was reviewed:

- Aerial photographic imagery (Land and Property Information, 2022a)
- NSW Mitchell Landscapes (Land and Property Information, 2021b)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) (DOEE 2016)
- Atlas of Groundwater Dependent Ecosystems (GDE) (Australian Bureau of Meteorology 2022)
- Directory of Important Wetlands of Australia (DIWA – DOEE 2022a)
- Priority weed listings for the Greater Sydney region (Department of Primary Industries 2020).

Results of database searches conducted for threatened species, populations and communities, which are known or considered likely to occur within the locality, are summarised in Table 2.1

Table 2.1 Database searches completed

Database	Search date	Area searched	Reference
PlantNet	08/08/2021	Central Coast Local Government Area (LGA)	Royal Botanic Gardens (2021)
NSW BioNet Atlas	08/08/2021	10 kilometre (km) radius around impact area	Environment Energy and Science Group (2021b)
EPBC Protected Matters Search Tool	08/08/2021	10 km radius around impact area	Department of Environment and Energy (2021)
DPI Key Fish Habitat Mapping	08/08/2021	Central Coast LGA	Department of Primary Industries (2021)

2.2 Field survey

The results of vegetation surveys undertaken by WSP as part of the Biodiversity Assessment Report (BAR) prepared for the Central Coast Highway between Wamberal and Bateau Bay REF (WSP, 2022). Surveys were completed over an 11 day period including five days from 23 August to 27 August 2021 (weather interrupted), four days from 26 October 2021 to 29 October 2021, and two days from 28 February 2022 and 1 March 2022.

2.3 Likelihood of assessment

The likelihood of threatened and migratory species and endangered populations occurring within the impact area was assessed against the criteria outlined in Table 2.2.

Species subject to likelihood of occurrence assessments were those identified during the desktop assessments and any additional species considered to have potential to occur due to previous field surveys undertaken in the locality and in the professional opinion of the contributors to this assessment.

A full likelihood of occurrence table of threatened species is provided in Attachment A and Attachment B.

Table 2.2 Likelihood of occurrence assessment

Likelihood of occurrence	Criteria
Recorded	The species has been previously recorded within the impact area.
High	A species has a high likelihood of occurrence if it was not recorded during field surveys and fit one or more of the following criteria: — the impact area is likely to contain suitable habitat, habitat types that are present in the impact area are abundant and/or in good condition — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are likely to be present — the species has been recorded recently and/or frequently in similar habitat in the impact area and locality — the impact area is likely to support a resident population or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if it was not recorded during field surveys and fit one or more of the following criteria: — the impact area contains or is likely to contain potential habitat, habitat types and resources present in the impact area may be poor or modified in condition — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are likely to be present — the species has not been recently recorded in similar habitat within the locality or has been recorded infrequently in the locality — the impact area is unlikely to support a resident population or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used opportunistically on an infrequent basis during seasonal movements and/or dispersal — are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	A species has a low likelihood of occurrence if it was not recorded during field surveys and fit one or more of the following criteria: — have not been recorded previously in the impact area and surrounds and for which the impact area is beyond the current distribution range — rely on specific habitat types or resources that are not present in the impact area — are considered locally extinct — are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

3. Existing environment

The proposal is located in a rural-residential area, with land in the area predominantly previously modified and disturbed due to agricultural activities and urbanisation. Vegetation within the study site is predominantly native vegetation including riparian zones and road reserves. Disturbed areas of vegetation include parks, reserves, paddocks and cemeteries. Remnant paddock trees are also present throughout areas used for cropping and grazing.

3.1 Vegetation communities

Vegetation communities were determined through field surveys completed and existing broadscale mapping was used to identify the vegetation communities present within this area for the BAR.

Four NSW Plant Community Types (PCTs) were recorded in the proposal area. These are:

- PCT 1138 – Scribbly Gum – Smooth barked Apple – Red Bloodwood shrubby forest of the Lower Hunter- Sydney Basin Bioregion
- PCT1646 – Smooth-barked Apple – Blackbutt – Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- PCT 1716 – Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast
- PCT 1725 – Swamp Mahogany – Broad-leave Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast
- PCT 1727 – Swamp oak – Sea Rush – Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast.

Other areas of vegetation within the proposal comprise miscellaneous ecosystems as highly disturbed areas with no or limited native vegetation.

Vegetation communities identified within the proposal area, and their corresponding status, are summarised in Table 3.1. The extent and distribution of each vegetation type and zone is shown in Figure 1.1.

Table 3.1 Vegetation communities identified as occurring within impact area

Plant community type (PCT)	Condition	BC Act status	EPBC Act status	Total test excavations	Area of impact (m^2)
Native Plant Communities					
PCT 1138 – Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter- Sydney Basin Bioregion	Intact	Nil	Nil	4	1
PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Intact	Nil	Nil	2	0.5
PCT1716 - Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	Nil	Nil	1	0.25
PCT 1725 Swamp Mahogany – Broad-leave Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	EEC[1]	Nil	8 (including 2 contingency test pits)	2
	Modified	Nil	Nil	6 (including 1 contingency test pit)	1.5
1727 Swamp oak – Sea Rush – Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	EEC[2]	Nil	4 (including 3 contingency test pits)	1
Total native vegetation				25	6.25

Plant community type (PCT)	Condition	BC Act status	EPBC Act status	Total test excavations	Area of impact (m^2)
MISCELLANEOUS PLANT COMMUNITIES					
Miscellaneous Ecosystem	N/A	N/A	N/A	2	0.5
			Total	27	6.75

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC listed under the BC Act.
2. Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC listed under the BC Act.

3.2 Fauna habitat types

Fauna habitat within the locality consists of remnant woodland and wetland vegetations. Potential habitat recorded during previous ecological investigations identified fauna microhabitats, including hollow-bearing trees, leaf litter and fallen timber, which provide foraging, roosting and breeding opportunities for some species. Nectar producing plants such as the *Eucalyptus* species provide potential foraging opportunities for threatened nectarivorous species.

Terrestrial fauna habitats

Native habitats recorded in the greater study area, provide foraging, roosting and breeding opportunities for several threatened and migratory fauna species which occur locally. Although large areas of the habitats available on site are fragmented and disturbed in nature, there are some higher quality patches that contain important habitat attributes such as hollow-bearing trees, leaf litter and fallen timber, which are required by some species for foraging, roosting and breeding.

A small number of hollow-bearing occur throughout the greater study area, which provide potential roosting and breeding habitat for threatened woodland birds, arboreal mammals and microchiropteran bats. Miscellaneous ecosystems for the most part provide habitat for common and introduced fauna. Although some of the vegetated fauna habitat associated with the impact area consists of disturbed areas and miscellaneous plantings. Where vegetation occurs, it protects the integrity of adjoining remnants and supports wildlife movement within a fragmented mosaic landscape which many fauna species locally depend upon.

Aquatic habitats

The aquatic habitats recorded within the study area, including waterways and wetlands, are outside of the proposal area for the archaeological test excavations and will not be impacted by these proposed works.

4. Threatened biodiversity

This section provides an overview of the threatened and protected species, populations and communities recorded or considered likely to use habitat within the impact area. Threatened biodiversity is listed as Vulnerable, Endangered and/or Critically Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

4.1 Threatened ecological communities

Two BC Act listed threatened ecological communities (TEC) were identified within the impact area, being:

Native vegetation within the study area is considered to meet the final determination of three threatened ecological communities listed under the BC Act, these being:

- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions – Endangered.

Table 4.1 provides an overview of the PCT types and conditions which align with these threatened ecological communities and the potential impacts to these associated with the proposal.

Table 4.1 Threatened ecological communities within the impact area

Vegetation type	Condition	BC Act status	EPBC Act status	Extent in impact area (m^2)
Native Plant Communities				
PCT1716 – Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast [1]	Intact	Not listed	Not listed	0.25
PCT1725 – Swamp Mahogany – Broad-leaved Paperbark – Swamp Water Fern – Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast [1]	Intact	Endangered	Not listed	2
	Modified	Not listed	Not listed	1.5
PCT1727 – Swamp Oak – Sea Rush – Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast [2]	Modified	Endangered[5]	Not listed	1
Sub-total of native vegetation (m^2)				**4.75**

1. Plant Community Type associated with Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions – Endangered.
2. Plant Community Type associated with Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered.

4.2 Threatened flora species

No threatened flora species were recorded within the three areas of sensitivity. However, the proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components within habitat which threatened species have the potential to occur. A list of species have been assessed with a likelihood of occurrence in Table A.1. However, given the small-scale works proposed to remove ground cover only the following species have been assessed for the purpose of this report:

- *Caladenia tessellate* (Thick-lipped Spider-orchid)
- *Cryptostylis hunteriana* (Leafless Tongue-orchid)
- *Diuris praecox* (Rough Doubletail).

The implementation of safeguards and management measures from the proposal will allow site personal to avoid and minimise impact on any suspected threatened orchid species. With safeguards implemented and the very small area of proposed disturbance at each excavation site, it is unlikely that the minor excavation works will significantly impact these species.

4.3 Threatened fauna species

A total of seven threatened fauna species were recorded during field surveys completed in the Central Coast Highway project alignment, including Powerful Owl (*Ninox strenua*), Green and Golden Bell Frog (*Litoria aurea*), Little Bent-winged Bat (*Miniopterus australis*), Southern Myotis (*Myotis Macropus*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) and Grey-headed Flying-fox (*Pteropus poliocephalus*). Although the foraging ecology of these species is diverse, they dedicated at least some of their foraging activity to the ground layer and sheltering amongst ground cover (Green and Golden Bell Frog). It is considered that the habitat present is considered dispersal habitat only and not suitable overwintering/ breeding habitat (Figure 1.1).

The proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components, however, due the very small area of proposed disturbance, the diverse foraging substrates used and their mobility, the proposal is unlikely to significantly impact these species. A list of species have been assessed with a likelihood of occurrence in Table B.. However given the small scale works proposed to remove ground cover only the following species have been assessed for the purpose of this report:

- Crinia tinnula (Wallum Froglet)
- *Litoria aurea* (Green and Golden Bell Frog)
- Artamus cyanopterus cyanopterus (Dusky Woodswallow)
- Burhinus grallarius (Bush Stone-curlew)
- Daphoenositta chrysoptera (Varied Sittella)
- Glossopsitta pusilla (Little Lorikeet)
- Lathamus discolor (Swift Parrot)
- Falsistrellus tasmaniensis (Eastern False Pipistrelle)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- Miniopterus orianae oceanensis (Large Bent-winged Bat)
- *Myotis macropus* (Southern myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Due the very small area of proposed disturbance, implementation of safeguards and management measures the proposal is unlikely to significantly impact these species.

4.4 Migratory species

Migratory species are protected under international agreements to which Australia are a signatory, including the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of National Environmental Significance and are protected under the EPBC Act.

Based on EPBC Protected Matters area search and preliminary ecological investigations, 25 migratory species have been recorded or have habitat within the wider locality of the impact area. Based on the scale of impact and impact to vegetation communities would include minor ground disturbance and ground level vegetation removal for the proposal, it is unlikely that any migratory species would be significantly impacted due to the proposal.

4.5 Other relevant Matters of National Environmental Significance

There are no wetlands of international importance (Ramsar) occurs within 10 km of the study area.

4.6 Priority weeds

Of the introduced flora species found within the wider alignment, five were listed as High Threat weeds under the *Biodiversity Conservation Act 2016*. Five of these species was listed as Priority Weeds for the Greater Sydney region under the *Biosecurity Act 2015* (Department of Primary Industries, 2019a) and listed as Weeds of National Significance (WoNS) (Australian Weeds Committee, 2019).

Table 4.2 Priority weeds identified within the Subject Land

Scientific name	Common name	BC Act listing	Priority weed listing[1]	Weed of National Significance
*Senecio madagascariensis**	Fireweed	High Threat	Prohibition on certain dealings	Yes
Asparagus aethiopicus	Ground Asparagus	High Threat	Prohibition on certain dealings	Yes
Lantana camara	Lantana	High Threat	Prohibition on certain dealings	Yes
Chrysanthemoides monilifera subsp. *rotundata*	Bitou Bush	High Threat	Prohibition on certain dealings	Yes
Asparagus scandens	Snakefeather	High Threat	Prohibition on certain dealings	Yes

1. Prohibition on dealings: Must not be imported into the State or sold

5. Potential impacts

5.1 Removal of native vegetation

The proposal's likely direct and indirect impacts on biodiversity are summarised in this chapter. There are a range of potential biodiversity impacts that may occur due to the proposal including:

- removal of native vegetation
- removal of threatened fauna species habitat and habitat features
- invasion and spread of weeds.

The proposal would result in a disturbance of ground cover vegetation at an area of 6.25 m^2 for the completion of test excavations. Partial disturbance to additional 200 m^2 area would occur from wet sieving and spreading of excavated spoil outside of native vegetation (Figure 1.1). Minor trimming of mid story vegetation (i.e. minor pruning of branches) may be required for access to excavation sites; however no further impact on vegetation is anticipated.

The majority of the proposal is located within remnant woodland and wetland vegetation excluding the wet sieving areas which the final locations have been selected to avoid areas of native vegetation. Plant and equipment for the proposal would be limited to light vehicles and some heavy vehicles (e.g. a water cart), however vehicles would park outside areas of native vegetation, with access to the test pits to be by foot. Therefore, impact to native vegetation from access for the proposal is not anticipated.

The completion of test excavations would require the removal of small areas of groundcover which form part of the native vegetation communities identified, including impact to 6.25 m^2 of native vegetation comprising two endangered ecological communities. This impact is summarised in Table 5.1 below. Significance assessments for the impact to these communities from the proposal is included as Attachment B. The clearing of these small areas is considered unlikely to result in a significant impact. Groundcover within the disturbed areas would be left to re-establish after the completion of the proposal.

Table 5.1 Plant community types to be impacted within the impact area

Vegetation type	Condition	BC Act status	EPBC Act status	Maximum extent in impact area (m^2) [3]
Native Plant Communities				
PCT 1138 – Scribbly Gum - Smooth-barked Apple - Red Bloodwood shrubby forest of the Lower Hunter- Sydney Basin Bioregion	Intact	Nil	Nil	1
PCT1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Intact	Nil	Nil	0.5
PCT1716 - Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	Nil	Nil	0.25
PCT1725 - Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	Endangered[1]	Nil	2
	Modified	Nil	Nil	1.5
PCT1727 - Swamp Oak - Sea Rush - Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Intact	Endangered[2]	Nil	1
Total of native vegetation (m^2)				**6.25**

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC listed under the BC Act.
2. Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC listed under the BC Act.
3. Areas of impact have been calculated to accommodate a 0.25 m^2 area of disturbance for each test excavation point required within the study area.

5.2 Removal of threatened plant habitat

No threatened species were recorded within the three areas of sensitivity. However, the proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components within habitat which threatened species have the potential to occur. However, due the very small area of proposed disturbance, implementation of safeguards and management measures the proposal is unlikely to significantly impact these species (See Attachment C for Significance Assessments).

5.3 Fauna habitat loss

A total of seven threatened species were recorded during field surveys completed in the Central Coast Highway project alignment, including Powerful Owl (*Ninox strenua*), Green and Golden Bell Frog (*Litoria aurea*), Little Bent-winged Bat (*Miniopterus australis*), Southern Myotis (*Myotis Macropus*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). Although the foraging ecology of these species is diverse, they dedicated at least some of their foraging activity to the ground layer and sheltering amongst ground cover (See Attachment C for Significance Assessments).

The proposal includes a potential impact of up to 6.25 m^2 of groundcover habitat components, however, due the very small area of proposed disturbance, the diverse foraging substrates used and their mobility, the proposal is unlikely to significantly impact these species. Excavation would also be via hand, with vehicle access and parking to be within the road reserve outside areas of native vegetation. Therefore, the risk of impacts to fauna from injury and mortality is considered to be negligible.

5.4 Weeds and pests

The proposal would have the potential to further distribute priority weeds which occur in the area through transportation on light and heavy vehicles. No impacts on weeds are anticipated with implementation of safeguards and management measures.

The proposal is not likely to result in impacts from pest species due to the minor nature and short duration of the work.

6. Recommendations

To address the potential impacts of the proposal on biodiversity, the following mitigation measures are recommended:

- As far as practicable, disturbance to areas of native vegetation (including derived native grassland) should be minimised to that required to complete the works.
- Final siting of excavation locations will consider minimising impacts to native vegetation through selection of cleared sites or areas sparsely vegetation.
- Tree trimming should be minimized as far as practicable and will be limited to the removal of branches <100mm only.
- If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the TfNSW *Unexpected Threatened Species Find Procedure* in the *TfNSW Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*.
- Vehicle and machinery movements, and sieving areas will be limited to areas outside of native vegetation.
- Where necessary, work area limits should be identified prior to commencing work to avoid unnecessary vegetation and habitat removal.

Regards,

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Ecologist

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Attachment A – Threatened flora likelihood of occurrence

Table A.1 Threatened flora species likelihood of occurrence assessment

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Acacia bynoeana Bynoe's Wattle	E1	V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata* and *Angophora bakeri*.	PMST	Moderate – although not recorded within the locality, modelled habitat is present, and an associated vegetation type (PCT 1636) occurs within the study area. Surveys have not been able to access the entirety of this habitat type within the study area, so complete targeted surveys have not been undertaken.	No – while surveys have not been undertaken in all patches of this PCT 1636 within the study area, the patches of PCT 1636 to be impacted (the linear strips adjacent to The Entrance Road) have been surveyed and the species was not found. If the construction footprint was modified to include impacts to the patches of habitat that have not been surveyed behind the houses on Bellevue Road then this decision would need to be revisited. At this stage there is no predicted impact to this species.
Acacia pubescens Downy Wattle	V	V	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones.	PMST	Low – no associated vegetation has been recorded from the study area. This species is mostly restricted to the Cumberland Plain within Western Sydney.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Acacia terminalis subsp. *terminalis* Sunshine Wattle (Sydney region)	E	E	Restricted to near-coastal areas from the Botany Bay to the northern shores of Sydney Harbour with most records occurring in Sydney's eastern suburbs. Typically, grows in scrub and open eucalypt woodland on sandy soils of creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs.	PMST	Low – species is highly restricted to Sydney harbour and eastern suburbs.	No – species is considered unlikely to occur within the study area.
Angophora inopina Charmhaven Apple	V	V	Grows in open woodland on deep white sandy soils over sandstone. Species is known to occur as far north as Karuah and as far south as Charmhaven, with the main population occurring between Morisset and Charmhaven.	PMST, BAM-C	Low – species not recorded during survey.	No – species is considered unlikely to occur within the study area.
Asperula asthenes Trailing Woodruff	V	V	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	BAM-C	Low – study area is outside of the distribution of this species. Species not recorded during survey.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Asterolasia elegans	E	E	A slender shrub between 1-3 m high known to grow in wet sclerophyll forest on moist hillsides. Currently known from only seven populations but presumed to occur in the Baulkham Hills, Hawkesbury, Hornsby and western part of the Gosford local government areas.	PMST	Low – no associated vegetation types recorded in the proposal study area. Species not recorded during survey.	No – species is considered unlikely to occur within the study area.
Baloskion longipes Dense Cord-rush	V	V	Grows in swamps or depressions in sandy alluvium soils within tall forest and Black Gum (*Eucalyptus aggregata)* woodland. Populations recorded from Kanangra-Boyd National Park south to the southern tablelands.	PMST	Low – no associated vegetation types recorded in the proposal study area. Proposal study area not within known distribution.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Caladenia tessellata Thick-lipped Spider-orchid	E1	V	Occurs south of Swansea where it grows on clay loam or sandy soils. Prefers low open forest with a heathy or sometimes grassy understorey. Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas.	PMST	Moderate – on the Central Coast this species is known from three populations in the Wyong area. Associated vegetation types occur in the study area in the form of PCT 1646, PCT 1636, and 1628. The required survey period for this species is September and October. Surveys were undertaken in October 2021 in most of the habitats that may be suitable for this species. However, there was no access to habitat on Lot 9 DP661926 at that time, so surveys were not completed.	Yes – assumed present in the habitats on Lot 9 DP661926. As access to all potential habitat areas was not available at the correct time of year the presence of this species cannot be entirely discounted. As a precautionary approach, this species will be assumed present in suitable habitat not subject to survey during the known flowering period.
Chamaesyce psammogeton Sand spurge	E1	-	Small herb that forms mats to 1m across. It grows on dunes and sea strandlines. Leaves are smooth, to 30mm long and 15mm wide. Tiny flower-heads are surrounded by white leaf-like bracts. Found sparsely along the coast from south of Jervis Bay to QLD and Lord Howe Island. Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex and Prickly Couch. Flowering in spring and summer.	BioNet (333 records), BAM-C	Low – a population of this species is known to occur in the locality (including specimen backed records) on a foredune at Spoon Bay Beach. No associated habitat is recorded within the study area and as such this species is considered unlikely.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Corunastylis insignis Wyong Midge Orchid 1	CE	CE	A terrestrial orchid that grows to 6-15cm tall and bears 5-12 dark purple to dark reddish-purple flowers with a dark reddish-purple labellum. Species is known to occur in four localities in the Wyong local government area and appears to be associated with PCT 1636 Scribbly Gum- Red Bloodwood – *Angophora inopina* heathy woodland on lowlands of the central Coast.	PMST	Low – no associated vegetation types recorded in the proposal study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats.	PMST	Moderate – associated vegetation types occur in the study area in the form of PCT 1646, PCT 1636, and 1628. The required survey period for this species is November and December. A reference population for *Cryptostylis hunteriana* in the Munmorah State Conservation Area was visited on the first day of survey in October 2021 and the species was flowering and detectable. Flowering for this species in 2021 was earlier than other years making October a valid survey period for this species. Surveys were undertaken in October and November in 2021 in most of the habitats that may be suitable for this species. However, there was no access to habitat on Lot 9 DP661926 at that time, so surveys were not completed.	Yes – assumed present in the habitats on Lot 9 DP661926. As access to all potential habitat areas was not available at the correct time of year the presence of this species cannot be entirely discounted. As a precautionary approach, this species will be assumed present in suitable habitat not subject to survey during the known flowering period.
Cynanchum elegans White-flowered Wax Plant	E1	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes. This species typically occurs at the ecotone between dry subtropical forest/woodland communities.	PMST	Low – this species has not recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Dendrobium melaleucaphilum Spider Orchid	E1	-	Occurs in coastal districts and nearby ranges, extending from Queensland to its southern distributional limit in the lower Blue Mountains. In NSW, it is currently known from seven recent collections. There has been no subsequent confirmation from the locations of three earlier (pre-1922) collections and it is possible that these are now extinct.	BioNet (1 record)	Low – one inaccurate record from the 1930s is present in the locality. Given the absence of any other records since, the observation is considered to be erroneous.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Diuris praecox Rough Doubletail	V	V	Occurs in coastal and near-coastal districts from Ourimbah to Nelson Bay where it grows in sclerophyll forest often on hilltops or slopes	PlantNet, BioNet (209 records), PMST, BAM-C	Moderate – recorded within the locality (within 800 m of the study area) and associated vegetation types occur within the study area in the form of PCT 1646, PCT 1628, PCT 1636 and PCT 1725, and PCT 1716. The survey period for this species is extremely short and restricted to August. Surveys were undertaken within the study area in August. A reference population of *Diuris praecox* in the Wyrrabalong National Park was visited on the first day of the August surveys and the species was in flower and detectable. The August surveys were however limited to PCT 1725 and PCT 1716 largely in the south of the study area due to access limitations.	Yes – assumed present. While surveys were conducted during known flowering period, access to all potential habitat areas was not available. As such, the presence of this species cannot be entirely discounted. As a precautionary approach, species will be assumed present in suitable habitat not subject to survey during known flowering period.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Eucalyptus camfieldii Camfield's Stringybark	V	V	Occurs in scattered locations within a restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Grows in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone, in coastal heath mostly on exposed sandy ridges. Occurs mostly in small, scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	PlantNet, BioNet (30 records), PMST	Recorded – this species is known to occur within the locality with a population occurring to the north of the study area at Forresters Beach. Stringybark trees with characteristics intermediate between *Eucalyptus camfieldii*, *Eucalyptus oblonga* and *Eucalyptus capitellata* were recorded during the survey and a sample sent to the Royal Botanic Gardens for confirmation of identification.	No - potentially recorded in the overall study area during targeted surveys. However, does not occur within the impact area and will not be impacted by test excavation,

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Eucalyptus oblonga Eucalyptus oblonga population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area	E2	-	Narrow-leaved Stringybark (family Myrtaceae) is a tree to 15 m high with persistent, grey to red-brown, stringy bark on the trunk and larger branches. The species occurs from Gosford to the Appin and Waterfall districts. The disjunct outlier population at Bateau Bay, Forresters Beach and Tumbi Umbi includes occurrences on the Patonga Claystone Formation and derived soils, corresponding to the Woodburys Bridge Soil Landscape. Here it is at the eastern limit of the species' range and is of significant conservation value because elsewhere the species occurs on sandstone. The population of *Eucalyptus oblonga* consists of about 20 trees. Normally found on in dry open forest with infertile sandy soils on sandstone. The population at Bateau Bay occurs on coastal sands.	BioNet (46 records)	Recorded – this species is known to occur within the locality with a population occurring to the north of the study area at Forresters Beach. Stringybark trees with characteristics intermediate between *Eucalyptus camfieldii*, *Eucalyptus oblonga* and *Eucalyptus capitellata* were recorded during the survey and a sample sent to the Royal Botanic Gardens for confirmation of identification.	No - potentially recorded in the overall study area during targeted surveys. However, does not occur within the impact area and will not be impacted by test excavation,

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Eucalyptus parramattensis subsp. *decadens*	V	V	There are two separate meta-populations of *E. parramattensis* subsp. *decadens*. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Occurs on deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	BAM-C	Low – this species has not recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Eucalyptus parramattensis C. Hall. subsp. *parramattensis* in the Wyong and Lake Macquarie local government areas	E2	-	The species usually occurs from the Goulburn Valley on the Central West slopes to Hill Top on the Central Coast. The endangered population in the Lake Macquarie and Wyong local government areas is at the north-eastern limit of the species range and is quite separate from other known populations. The majority of the population occurs within Wyong in the Porter's Creek and the Wallarah Creek catchments. This species is associated with low moist areas alongside drainage lines and adjacent to wetlands. It is often found in woodland on sandy soils. The endangered population occurs on sandy alluvium within a floodplain community which also supports *Eucalyptus robusta, E. tereticornis, Corymbia gummifera* as well as *Melaleuca* species.	BAM-C	Low – this species has not recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Eucalyptus pumila Pokolbin Mallee	V	V	A mallee Eucalypt that grows to 6m high with smooth grey/grey-brown bark. Grows in dry sclerophyll forest on skeletal soils from sandstone. Currently known from a single stand near Pokolbin but historically recorded in Sandy Hollow and Wyong.	PlantNet	Low – this species is only found in a single stand near Pokolbin. Not recorded during the survey.	No – species unlikely to occur within the proposal study area.
Euphrasia arguta	CE	CE	A small annual herb which grows to 20-35cm in open forest associated with mixed grass and shrub understorey. Once thought extinct, this species was rediscovered in the Nundle area in 2008 where the species had regenerated following disturbance.	PMST	Low – this species is associated with the tablelands from Bathurst north to near Walcha.	No – species unlikely to occur within the proposal study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Genoplesium baueri Yellow Gnat-Orchid	E1	E	Grows in dry sclerophyll forest and moss gardens over sandstone. The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from northern Sydney suburbs. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	PMST	Low – this species has not recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Grevillea parviflora subsp. *parviflora* Small-flower Grevillea	V	V	Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct population near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales.	PlantNet, PMST, BAM-C	Moderate – not recorded within the locality despite surveys having been conducted throughout the locality suggesting that the species does not occur. It was not recorded during surveys undertaken in PCT 1725. However, associated habitat in the form of PCT 1636 also occurs within the study area and surveys have not been able to access the entirety of this habitat type so complete targeted surveys have not been undertaken.	No – while surveys have not been undertaken in all patches of this PCT 1636, the patches of PCT 1636 to be impacted (the linear strips adjacent to The Entrance Road) have been surveyed and the species was not found. If the construction footprint was modified to include impacts to the patches of habitat that have not been surveyed behind the houses on Bellevue Road then this decision would need to be revisited. At this stage there is no predicted impact to this species.
Lindsaea fraseri Fraser's Screw Fern	E1	-	In NSW it is known only from two areas - near Hastings Point on the Tweed coast and in the Pillar Valley east of Grafton. Also occurs in far north and south-east Queensland.	BioNet (1 record)	Low – One inaccurate record from the 1950s is present in the locality. Given the absence of any other records since, the observation is considered to be erroneous.	No – species is considered unlikely to occur within the study area.
Macadamia tetraphylla Rough-shelled Bush Nut	V	V	Confined chiefly to the north of the Richmond River in north-east NSW, extending just across the border into Queensland. Many records, particularly those further south, are thought to be propagated.	BioNet (1 record)	Low – This species does not naturally occur on the Central Coast. Any plants that are present in the locality are horticultural stock.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Maundia triglochinoides	V	-	Known from Sydney area north to southern Queensland in coastal swamps or shallow freshwater in heavy clay. Populations within Sydney are now believed to be extinct, leaving Wyong as the southern limit of the current distribution.	PlantNet BAM-C	Low – there are no records of this species within the locality but there is a record slightly further afield near Mardi (specimen backed) from 1978. There is some associated habitat in the study area in the form of PCT 781 and PCT 1716 but the species, or any species with which it may be confused (i.e. *Triglochin* spp. or *Philydrum* sp.) were not recorded during the surveys.	No – species is considered unlikely to occur within the study area.
Melaleuca biconvexa Biconvex Paperbark	V	V	Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records is in the Gosford/Wyong area. Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects.	PlantNet, BioNet (8,799 records), PMST, BAM-C	Recorded – large populations of this species are known to occur within the locality and this species was recorded in one location near the roundabout at the intersection of Crystal Street and The Entrance Road.	No – it was recorded in the study area during targeted surveys and is therefore considered likely to be affected by the Proposal. However, does not occur within the impact area and will not be impacted by test excavation,
Melaleuca deanei Deane's Melaleuca	V	V	Occurs as disjunct populations from Ku-ring-gai/Berowra and the Central Coast, inland to Springwood and Wollemi National Park and south to Yalwal. Typically occurs in ridgetop woodland in wet heath on sandstone.	PMST	Low – no associated habitat recorded within the proposal study area. No individuals recorded during survey.	No – species unlikely to occur within the proposal study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Persicaria elatior Knotweed	*V*	V	Occurs infrequently in coastal regions where it grows in damp places especially beside streams and lakes. Also occasionally occurs in swamp forest or associated with disturbance.	PMST, BAM-C	Low – this species is not known to occur within the locality, and it was not recorded in wetland habitats during the surveys.	No - it is considered unlikely to occur or be affected by the proposal.
Persoonia hirsuta Hairy Geebung	E1	E	The species occurs in small populations distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains in the west. It is found in dry sclerophyll open forest, woodland and health on sandstone, growing in sandy soils.	PMST	Low – this species has not been recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Prostanthera askania Tranquility Mintbush	E1	E	Occurs over a very restricted geographic range (of less than 12 km) in the upper reaches of creeks that flow into Tuggerah Lake or Brisbane Water within the Wyong and Gosford local government areas. Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. These communities are generally tall forests with a mesic understorey; *Eucalyptus saligna* and *Syncarpia glomulifera* are usually present, though canopy species present can be highly variable.	PlantNet, BioNet (851 records), PMST	Low – recorded within the locality (including specimen backed records) but associated PCTs or preferred habitat was not recorded within the study area.	No – species is considered unlikely to occur within the study area.
Prostanthera densa Villous Mintbush	V	V	Typically grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges on sandstone. Recorded to occur from Currarong area in Jervis Bay, north to Nelson Bay in Port Stephens.	PMST	Low – this species has not been recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Prostanthera junonis Somersby Mintbush	E	E	Restricted to the Somersby Plateau where it grows in open forest/low woodland/open shrub on weathered Hawkesbury sandstone. Recorded to have a north-south range of approximately 19 kms.	PMST	Low – no associated habitat recorded within the proposal study site – study site not within the Somersby Plateau.	No – species is considered unlikely to occur within the study area.
Pultenaea maritima Coast Headland Pea	V	-	In NSW, this species has been recorded from Newcastle to Byron Bay on 16 headlands. Occurs in grasslands, shrublands and heath on exposed coastal headlands and adjoining low coastal heath. Clay or sandy loam over sandstone at altitude 5-30m. Associated with *Banksia integrifolia* and *Themeda triandra*. Flowers from (June) August to March.	PlantNet, BioNet (46 records)	Low – recorded within the locality (including specimen backed records) although no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Rhizanthella slateri Eastern Underground Orchid	V	E	Flowers from September to November. Little is known about the preferred habitat of this species, but apparently prefers Sclerophyll forest with a reasonably deep layer of organic litter. *Rhizanthella slateri* is restricted to New South Wales where it is currently known from 14 populations including Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. The *Rhizanthella slateri* population in the Great Lakes Local Government Area (LGA) occurs at the known northern limit of the species' range and is disjunct from other known populations of the species.	PMST	Low – this species has not been recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Rhodamnia rubescens Scrub Turpentine	E4A	CE	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm.	PlantNet, BioNet (229 records), PMST	Low – Not recorded during surveys. A single individual of this species was recorded in PCT 1716 to the south west of the study area during surveys undertaken for Stage 1 of the project, but no plants were found in the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Rhodomyrtus psidioides Native Guava	E4A	-	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW.	PlantNet, BioNet (419 records), PMST	Low – recorded within the locality although no associated PCTs or preferred habitat was recorded within the study area. Not recorded during surveys.	No – species is considered unlikely to occur within the study area.
Rutidosis heterogama Heath Wrinklewort	V	V	Grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides.	PMST	Low – this species has not been recorded in the locality and no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.
Senecio spathulatus Coast Groundsel	E1	-	Occurs in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah) where it grows on primary dunes.	PlantNet, BioNet (5 records), BAM-C	Low – recorded within the locality (including specimen backed records) although no associated PCTs or preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Syzygium paniculatum Magenta Lilly Pilly	E1	V	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the Central Coast, Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	PlantNet, BioNet (125 records), PMST	Low – a population of this species is known to occur in the locality within littoral rainforest vegetation in the Wamberal Lagoon Nature reserve. No associated habitat is recorded within the study area and as such this species is considered to have a low likelihood of occurrence.	No – species is considered unlikely to occur within the study area.
Tetratheca juncea Black-eyed Susan	V	V	Occurs in coastal districts from Bulahdelah to Port Macquarie where it grows in dry sclerophyll forest and occasionally swampy heath in sandy, low nutrient soils with a dense understorey of grasses. Specifically, it is known to occur within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland.	BioNet (2 records), PMST, BAM-C	Low – recorded within the locality although no preferred habitat was recorded within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Thelymitra adorata Wyong Sun Orchid	CE	CE	Currently known from the Central Coast and southern Lake Macquarie council regions where it has been recorded to grow in grassy woodland and derived grasslands on clay loam or shale derived soils. There seems to be a strong association with Spotted Gum – Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs.	PlantNet, PMST	Low – no suitable habitat recorded within the study area. All known plants occur to the north of the locality. Not known to be associated with any of the PCTs within the study area.	No – species is considered unlikely to occur within the study area.
Thesium australe Austral Toadflax	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Grows in association with *Themeda triandra* and (less frequently) with *Poa* spp.	PMST	Low – not recorded within the locality suggesting that the species may not occur. Not known to be associated with any of the PCTs within the study area.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Wilsonia backhousei Narrow-leafed Wilsonia	V	-	In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). It grows in all southern states. This is a species of the margins of salt marshes and lakes. Flowering occurs in spring and summer.	BioNet (1 record)	Low – a population of this species is known to occur in the locality within the Wamberal Lagoon Nature reserve. This species grows in saltmarsh vegetation and no associated habitat is recorded within the study area and as such this species is considered unlikely to occur.	No – species is considered unlikely to occur within the study area.
Zannichellia palustris	E1	-	A submerged aquatic plant. In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	BAM-C	Low - *Zannichellia palustris* was not recorded in any of the wetlands during the surveys. It is not known to occur in the locality.	No – species is considered unlikely to occur within the study area.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				

Distribution and habitat requirement information adapted from Australian Government Department of the Agriculture, Water and the Environment SPRAT http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl and NSW Department of Planning & Environment Threatened Species Data Collection https://www.environment.nsw.gov.au/threatenedspeciesapp/

Key: Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – X = Extinct, CE = Critically Endangered, E = Endangered, V = Vulnerable. Listed under the NSW Biodiversity Conservation Act 2016 – E4 = Critically Endangered, E1 = Endangered Species, E2 = Endangered Population, V = Vulnerable.

BioNet = OEH Bionet Atlas of NSW Wildlife, PMST = Department of Environment and Energy's EPBC Protected Matters Search Tool and PlantNet = Royal Botanic Gardens PlantNet Spatial Search.

Attachment B – Threatened fauna likelihood of occurrence

Table B.1 Threatened fauna likelihood of occurrence assessment

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Invertebrates						
Petalura gigantea Giant Dragonfly	-	E1	Found in permanent swamps and bogs with some free water and open vegetation. Both coastal and upland from moss Vale northwards to southern Queensland	Bionet (3 records)	Low – no permanent mossy open wetlands with suitable sedge dominated area occur within the study area or its vicinity.	No – species considered unlikely to occur within proposal study area
Fish						
Epinephelus daemelii Black Rockcod	V	V	The Black Rockcod is found in warm temperate and subtropical parts of the south-western Pacific. Adult Black Rockcod can grow to 2 m in length and at least 80 kg in weight, but it is more common to see smaller fish (up to 1m/30kg).	PMST	Low – the study area does not contain estuarine habitats or is immediately adjacent to those habitats.	No – species considered unlikely to occur within proposal study area
Macquaria australasica Macquarie Perch	E	E	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury/Nepean and Shoalhaven catchments. Macquarie Perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water).	PMST	Low – no suitable habitats within or immediately adjacent to suitable habitats.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Prototroctes maraena Australian Grayling	E	V	Occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia. The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea.	PMST	Low – no suitable habitats within or immediately adjacent to suitable habitats.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Amphibians						
Heleioporus australiacus Giant Burrowing Frog	V	V	Exists as two distinct populations: a northern population on the sandstone geology of the Sydney Basin, from Wollemi National Park in the north, south to Jervis Bay; and a southern population in disjunct pockets from about Narooma south into eastern Victoria. In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys where the frog is associated with small headwater and slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from collected water. Also observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised and are surrounded by undisturbed habitat. In the southern population, records appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphics and are generally from more heavily timbered areas. It is absent from areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks	PMST	Low – no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Crinia tinnula Wallum Froglet	V,P	-	Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney. Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.	Bionet (4)	Moderate – 4 records within 10km radius with 1 record approximately. Habitat onsite is considered suitable for the species.	Yes – suitable foraging and breeding habitat present.
Pseudophryne australis Red-crowned Toadlet	V,P	-	The Red-crowned Toadlet is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Bionet (8)	Low – no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Litoria aurea Green and Golden Bell Frog	E	V	This species occurs in fragment patches near coastal locations from Vic to south of the NSW-QLD border. For breeding it utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral wetlands. It is found in small pockets of habitat in otherwise developed areas and can occur in disturbed sites. There is a clear preference for sites with a complexity of vegetation structure and terrestrial habitat attributes which include extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation and other cover used for foraging and shelter. Over-wintering shelter sites may be adjacent to or some distance away from breeding sites, but the full range of possible habitat used is not yet well understood	Bionet (59) PMST	Recorded – In 2021 from Ecoplanning surveys	Yes – species recorded in 2021 survey. Archaeological tests will impact dispersal habitat only,
Litoria brevipalmata Green-thighed Frog	E1,P	V	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland. It occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range but extends into drier forests in northern NSW and southern Queensland.	Bionet (2)	Low – marginal suitable habitat present, due to very small extent, but presence cannot be entirely discounted.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Mixophyes balbus Stuttering Frog	E1	V	Occurs along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	Bionet (2 records) PMST	Low – no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area
Mixophyes iteratus Giant Barred Frog	E	V	Terrestrial species which occurs in rainforests, Antarctic beech or wet sclerophyll forests. Feeds on insects and smaller frogs). The species is associated with permanent flowing drainages, from shallow rocky rainforest streams to slow-moving rivers in lowland open forest. It is not known to utilise still water areas. More prevalent at lower altitudes and in larger streams than its congeners, although has been recorded up to 1000 m asl.	PMST	Low – no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Uperoleia mahonyi Mahony's Toadlet	E1	V	Found between Kangy Angy and Seal Rocks on leached white sands. Vegetation types typically associated with this species include wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland Breeding occurs in permanent or semi-permanent swamps or ponds of moderate size, and individuals are terrestrial outside of the breeding period.	Bionet (1) PMST	Low – no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area
Reptiles						
Hoplocephalus stephensii Stephen's Banded Snake	V	V	Found in coastal areas from Gosford district to southern QLD. Arboreal snake usually encountered in the wetter sclerophyll or rainforests which occur within its range	Bionet (1 record), PMST	Low – marginal suitable habitat present, due to very small extent, but presence cannot be entirely discounted.	No - species considered unlikely to occur within proposal study area
Hoplocephalus bungaroides Broad-headed Snake	E1	V	Largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney.	PMST	Low - no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area
Varanus rosenbergi Rosenberg's Monitor	V,P	-		Bionet (1)	Low - no suitable habitat identified within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Birds						
Anous stolidus Common Noddy	-	M	The Common Noddy is found in tropical and sub-tropical seas off the west, north and east coasts of Australia, from the Abrolhos Islands in WA to the islands of the Great Barrier Reef in Qld, as well as Norfolk and Lord Howe Islands. Some are seen almost annually in NSW as far south as Sydney. It also ranges across tropical parts of the Pacific, Indian and Atlantic Oceans. The Common Noddy is found on offshore tropical islands, often in large colonies of more than 100,000 nests	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Actitis hypoleucos Common Sandpiper	-	M	The Common Sandpiper frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.	PMST	Low – no suitable habitat identified within the study area or its vicinity	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Anthochaera phrygia Regent Honeyeater	E4A	CE	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box), E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum)	Bionet (21 record), PMST	Low – although vegetation on site contains winter foraging resources (Swamp Mahogany E. Robusta) for the Regent Honeyeater, there are no records within the study area or its general vicinity to suggest it uses resources associated with the study area.	No - species considered unlikely to occur within proposal study area
Apus pacificus Fork-tailed Swift	-	M	In NSW, the species is recorded in all regions. Many records occur east of the Great Divide. The Fork-tailed Swift is almost exclusively aerial with them foraging and roosting aerially.	PMST	Low – may occur in aerial habitats over the study area on a seasonal basis but unlikely to use terrestrial habitats associated with the study area.	No - species considered unlikely to occur within proposal study area
Arenaria interpres Ruddy Turnstone	-	M	Occurs at beaches and coasts with exposed rock, stony or shell beaches, mudflats, exposed reefs and wave platforms	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Artamus cyanopterus cyanopterus Dusky Woodswallow	V,P	-	Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Bionet (3)	Moderate –Habitat onsite is considered suitable for the species.	Yes – suitable foraging habitat present onsite.
Botaurus poiciloptilus Australasian Bittern	E1	E	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory.	Bionet (2 records), PMST	Low – marginal suitable habitat present, due to very small extent, but presence cannot be entirely discounted.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Burhinus grallarius Bush Stone-curlew	E1	-	Found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the southeast it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. In coastal areas, structurally similar elements of tidal and estuarine communities (Casuarina woodlands, saltmarsh and mangroves) provide suitable habitat. Nesting sites are frequently located in relatively open areas, where ground cover is extremely low and/or sparse including native vegetation and mown lawns, ploughed paddocks and paddocks cut for hay, dirt and gravel roads, seaweed on sand beach, playing fields, and vacant lots.	Bionet (394 records)	Moderate –Habitat onsite is considered suitable for the species.	Yes – suitable foraging habitat onsite.
Calidris acuminata Sharp-tailed Sandpiper	-	M	Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Calidris alba Sanderling	-	M	The Sanderling occurs in coastal areas around Australia. Inland records have occurred in most states of singles or small groups, birds probably on migration. In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops. Less often the species occurs on more sheltered sandy shorelines of estuaries, inlets and harbours. Rarely, they are recorded in near-coastal wetlands, such as lagoons, hypersaline lakes, salt ponds and samphire flats. There are rare inland records from sandy shores of ephemeral brackish lakes and brackish river-pools	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Calidris canutus Red Knot	-	E, M	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps.	Bionet (67 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Calidris ferruginea Curlew Sandpiper	E1	CE, M	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes	Bionet (79 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Calidris melanotos Pectoral Sandpiper	-	M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species frequents coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It is usually found in coastal or near coastal habitat but occasionally further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Calidris ruficollis Red-necked Stint	-	M	Mostly found in coastal areas, including sheltered inlets, bays lagoons and estuaries. They also occur in shallow wetlands near the coast or inland, including lakes, waterholes and dams. They forage in mudflats, shallow water, sandy open beaches, flooded paddocks and in samphire feeding along the edges. The species roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle. Occasionally they roost on exposed reefs or shoals and amongst seaweed, mud and cowpats. During high tides they may also use sand dunes and claypans.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Calidris tenuirostris Great Knot	V	CE, M	Generally, a coastal species found on tidal mudflats and sandy ocean shores. A migratory species visiting Australian waters between September and March.	Bionet (36 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Callocephalon fimbriatum Gang-gang Cockatoo	V,P, 3	E1	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (Eucalyptus pauciflora) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Bionet (13 records)	Moderate – no recent records of this species in the vicinity of the study area, but due to mobility and potential foraging resources on site, cannot be discounted.	Yes – suitable foraging habitat present.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Calyptorhynchus lathami Glossy Black-Cockatoo	V,P, 2	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuarina diminuta, and A. gymnanthera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites.	Bionet (75 records)	Low – no recent records of this species in the vicinity of the study area, but due to mobility and potential foraging resources on site, cannot be discounted.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Charadrius bicinctus Double-banded Plover	-	M	The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. It is sometimes associated with coastal lagoons, inland salt lakes, exposed seagrass beds, exposed reefs and rock platforms and coastal sand dunes.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Charadrius leschenaultii Greater Sand Plover		V, M	Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders. Diet includes insects, crustaceans, polychaete worms and molluscs. Prey is detected visually by running a short distance, stopping to look, then running to collect the prey.	Bionet (1 record), PMST	Low – no suitable habitat identified within the study area	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Charadrius mongolus Lesser Sand-plover	V	E, M	Migratory bird that migrates from the northern hemisphere to coastal areas of northern and east coast of Australia. The species is almost strictly coastal during the non-breeding season, preferring sandy beaches, mudflats of coastal bays and estuaries, sand-flats and dunes near the coast, occasionally frequenting mangrove mudflats.	Bionet (7 record), PMST	Low – no suitable habitat identified within the study.	No - species considered unlikely to occur within proposal study area
Chthonicola sagittata Speckled Warbler	V,P		The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Bionet (1)	Low – no suitable habitat identified within the study.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Cuculus optatus Oriental Cuckoo	-	M	A non-breeding migrant to Australia, it often inhabits rainforest, vine thickets, wet sclerophyll forest and open woodland and sometimes occurs in mangroves, wooded swamps and as vagrants in gardens. The population trend appears to be stable.	Bionet (1 record), PMST	Low – a very rare vagrant to the wider locality, which is unlikely to be dependent on habitat identified within the study area.	No - species considered unlikely to occur within proposal study area
Daphoenositta chrysoptera Varied Sittella	V	-	The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Bionet (50 records)	Moderate – suitable habitat identified within the study area, which may occur within the home ranges of local individuals.	Yes – suitable foraging habitat present onsite.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Ephippiorhynchus asiaticus Black-necked Stork	E1, P	-	Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Bulahdelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish).	Bionet (12 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Falco subniger Black Falcon		V,P	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of km (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	Bionet (2)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Falco hypoleucos Grey Falcon		V	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Gallinago hardwickii Latham's Snipe	-	M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Gallinago megala Swinhoe's Snipe	-	M	During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens (Higgins & Davies 1996). Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands. This includes swamps, billabongs, river pools, small streams and sewage ponds. They are also found in drying claypans, and inundated plains pitted with crab holes (Higgins & Davies 1996).	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Gallinago stenura Pin-tailed Snipe		M	There are confirmed records from NSW, south-west Western Australia, Pilbara and the Top End. In NSW a single banded bird was reported near West Wyalong. In Western Australia the species was reported at Pilbara, Port Headland, Myaree Pool, Maitland River and near Karratha. In Pilbara the distribution is believed to be bound by Pardoo (Banningarra Spring) and the lower Maitland River and Shay Gap. During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands (Higgins & Davies 1996).	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Glossopsitta pusilla Little Lorikeet	V	-	The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria.	Bionet (114 records)	High – 3 records occur within the study area to the north. Suitable foraging habitat is identified within the study area and due to the species' mobility it may occur across the whole study site.	Yes – suitable foraging/ breeding habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Grantiella picta Painted Honeyeater	V	V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Haliaeetus leucogaster White-bellied Sea-eagle	V	M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs.	Bionet (493 records)	Moderate - this species is considered likely to occur flying over the study area, however there is no suitable foraging or nesting habitat within the study area.	No - species considered unlikely to occur within proposal study area
Haematopus fuliginosus Sooty Oystercatcher	V	-	The Sooty Oystercatcher is found on rocky headlands, rock shelves, exposed reefs with rock pools, beaches and muddy estuaries. The species forages on exposed intertidal rocky shorelines at low tide. It breeds almost exclusively on offshore islands, and occasionally on isolated promontories during spring and summer. They nest on the ground in amongst rocks, seaweed, shells and pebbles.	Bionet (212 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Haematopus longirostris Pied Oystercatcher	E1	-	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas.	Bionet (325 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Hieraaetus morphnoides Little Eagle	V	-	The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet.	Bionet (22 records), PMST	Low – locally sparse and marginal habitat identified within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Hirundapus caudacutus White-throated Needletail	-	V, M	Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. It is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes.	Bionet (234 records), PMST	Low – species known to utilise aerial habitats above the study area on a seasonal basis, but it is unlikely to occur within terrestrial habitats within the study area	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Irediparra gallinacean Comb-crested Jacana	V,P	-	The Comb-crested Jacana occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavourable conditions further north). Beyond Australia, the Comb-crested Jacana occurs from Borneo and the Philippines, south and east through Sulawesi, the Moluccas and Lesser Sunda Islands, to the Aru Islands, New Guinea and New Britain. Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	Bionet (2)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Ixobrychus flavicollis Black Bittern	V,P	-	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Bionet (38 records)	Low – marginal suitable habitat identified within the study area or its vicinity. No recent records occur close or within the vicinity of the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Lathamus discolor Swift Parrot	E1	CE	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia it is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year.	Bionet (170 records), PMST	Moderate – study area contains winter flowering tree species, which may be used by this species intermittently on a seasonal basis.	Yes – Mapped habitat onsite, assumed present.

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Limosa lapponica Bar-tailed Godwit	-	V, M	The Bar-tailed Godwit is a migratory wader which undertakes the largest non-stop flight of any bird. The trans-Pacific route from its breeding grounds in the Arctic to its non-breeding grounds in the southern hemisphere covers over 11,000 km. Birds arrive in New South Wales between August and October and then leave between February and April, with a small number of individuals overwintering. The subspecies is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven River estuaries, Port Stephens and Botany Bay. It is a rare visitor to wetlands away from the coast with scattered records as far west as along the Darling River and the Riverina. It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Limosa lapponica baueri Nunivak Bar-tailed Godwit	-	V	The Bar-tailed Godwit (both subspecies combined) has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria. The migratory Bar-tailed Godwit (western Alaskan) does not breed in Australia. Occurs mainly in coastal habitats in coastal habitats which include large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It also has been recorded in coastal sewage farms and saltworks, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms and coral reef-flats.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Limosa limosa Black-tailed Godwit	V	M	This species is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, can be found on mudflats and in water less than 10cm deep, around muddy lakes and swamps.	Bionet (12 record), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Lophoictinia isura Square-tailed Kite	V	-	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	Bionet (39 records)	High – highly mobile, local records and suitable habitat within the study area.	Yes – suitable foraging habitat present
Monarcha melanopsis Black-faced Monarch	-	M	Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating	PMST	Moderate – may occur within the study area during migratory movements or post-breeding dispersals, but unlikely to establish breeding territories within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Motacilla flava Yellow Wagtail	-	M	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Myiagra cyanoleuca Satin Flycatcher	-	M	Widespread in eastern Australia. In Queensland, it is widespread but scattered in the east. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. In Victoria, the species is widespread in the south and east, in the area south of a line joining Numurkah, Maldon, the northern Grampians, Balmoral and Nelson. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the tree-line.	PMST	Low – rare locally and unlikely to occur within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Ninox connivens Barking Owl	V	-	The Barking Owl is found throughout continental Australia except for the central arid regions. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats.	Bionet (24 records)	Low – study area is unlikely to be important to this species locally, but incidental occurrences cannot be entirely discounted.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Ninox strenua Powerful Owl	V	-	A sedentary species with a home range of approximately 1000 hectares it occurs within open Eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally, feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands.	Bionet (339 records)	Recorded – A Pair were recorded in the northern vicinity of the study area. Site contains suitable foraging habitat but no recorded breeding habitat.	Yes – Recorded onsite. Suitable foraging habitat only.
Numenius madagascariensis Eastern Curlew	-	CE, M	Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and other invertebrates. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia	Bionet (4 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Numenius minutus Little Curlew		M	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast (Minton 2002 pers. comm.). There are records of the species from inland Australia, and widespread but scattered records on the east coast. The species has also been recorded on Lord Howe Island, Cocos-Keeling Island and Christmas Island (Higgins & Davies 1996). The species is recorded in Australia between September and April and there are few winter records (Blakers et al. 1984). The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Higgins & Davies 1996).	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Onychoprion fuscata Sooty Tern	V		The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters.	Bionet (1 record)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Oxyura australis Blue-billed Duck	V,P		The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed but prefers to dive if approached.	Bionet (3)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Pandion cristatus Eastern Osprey	V	-	Eastern Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	Bionet (206 records), PMST	Moderate - this species is known to occur flying over the study area, however there is no suitable foraging or nesting habitat within the study area.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Petroica boodang Scarlet Robin	V,P		The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Bionet (1)	Low – marginal suitable habitat identified within the study area or its vicinity but only one old record in a 10km radius.	No - species considered unlikely to occur within proposal study area
Phaethon rubricauda Red-tailed Tropicbird	V		Ranges throughout tropical and subtropical zones of the Indian and West Pacific Oceans, breeding on oceanic islands. Lord Howe Island is said to have the greatest breeding concentration in the world.	Bionet (2 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Pluvialis fulva Pacific Golden Plover	-	M	Prefers sandy, muddy or rocky shores, estuaries and lagoons, reefs, saltmarsh, and or short grass in paddocks and crops. The species is usually coastal, including offshore islands; rarely far inland. Often observed on beaches and mudflats, sandflats and occasionally rock shelves, or where these substrates intermingle; harbours, estuaries and lagoons.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Pluvialis squatarola Grey Plover	-	M	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes. They usually forage on large areas of exposed mudflats and beaches and occasionally in pasture and on muddy margins of inland wetlands. They usually roost in sandy areas, such as on unvegetated sandbanks or sand-spits on sheltered beaches or other sheltered environments.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Ptilinopus magnificus Wompoo Fruit-Dove	V	-	Occurs in rainforests, monsoon forests, adjacent eucalypt forests, fruiting trees on scrubby creeks or in open country.	Bionet (4 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Ptilinopus superbus Superb Fruit-Dove	V	-	Occurs primarily from north-eastern Qld to north-eastern NSW. It is much less common further south. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Bionet (5 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Rhipidura rufifrons Rufous Fantail	-	M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range.	PMST	Recorded	No - species considered unlikely to occur within proposal study area
Rostratula australis Australian Painted Snipe	E1	E	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Sternula albifrons Little Tern	E1,P	C,J,K	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several km from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	Bionet (284 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Sternula nereis nereis Australian Fairy Tern	-	V	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia, occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there (Birdlife International 2010; Garnett & Crowley 2000).	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Stictonetta naevosa Freckled Duck	V	-	In most years this species appears to be nomadic between ephemeral inland and coastal wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests.	Bionet (21 record)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Symposiarchus trivirgatus Spectacled Monarch		M	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It is also found in Papua New Guinea, the Moluccas and Timor. The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Thinornis cucullatus Eastern Hooded Plover		V	In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Tringa brevipes Grey-tailed Tattler	-	M	Often found on sheltered coasts with reefs, rock platforms or with intertidal mudflats. It is also found at intertidal rocky, coral or stony reefs, platforms and islets that are exposed at low tide. It has also been found in embayments, estuaries and coastal lagoons, especially fringed with mangroves. It is rarely seen on open beaches and occasionally found around near-coastal wetlands, such as lagoons, lakes and ponds in sewage farms and saltworks. Inland records for the species are rare. The species forages in shallow water, hard intertidal substrates, rock pools, intertidal mudflats, mangroves, banks of seaweed and among rocks and coral rubble, over which water may surge. The species roosts in mangroves, dense stands of shrubs, snags, rocks, beaches, reefs, artificial structures (sea walls, oyster racks), occasionally in near-coastal saltworks and sewage ponds and rarely on sandy beaches or sand banks.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Tringa nebularia Common greenshank	-	M	Occurs in a range of inland and coastal environments. Inland, it occurs in both permanent and temporary wetlands, billabongs, swamps, lakes floodplains, sewage farms, saltworks ponds, flooded irrigated crops. On the coast, it occurs in sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. It generally prefers wet and flooded mud and clay rather than sand.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Tringa stagnatilis March Sandpiper	-	M	Occurs in coastal and inland wetlands (salt or fresh water), estuarine and mangrove mudflats, beaches, shallow or swamps, lakes, billabongs, temporary floodwaters, sewage farms and saltworks ponds.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Tyto novaehollandiae Masked Owl	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares.	Bionet (22 records)	Low – marginal foraging habitat identified within the study area and its vicinity. No suitable breeding habitat recorded	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Tyto tenebricosa Sooty Owl	V	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (Pseudocheirus peregrinus) or Sugar Glider (Petaurus breviceps). Nests in very large tree-hollows.	Bionet (151 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Xenus cinereus Terek Sandpiper	V	M	Recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks located near mangroves but may also be observed on rocky pools and reefs, and occasionally up to 10km inland around brackish pools.	Bionet (10 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Mammals						
Cercartetus nanus Eastern Pygmy-possum	V	-	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast, to inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	Bionet (4 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Chalinolobus dwyeri Large-eared Pied Bat	V, P	V	Occurs in moderately wooded habitats, mainly in areas with extensive cliffs and caves and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Breeding habitat (maternity roosts) is located in roof domes in sandstone caves. Thought to forage below the forest canopy for small flying insects.	Bionet (7 records), PMST	Low – rare locally with no recent records, no records in the vicinity of the study area. Due to mobility and potential foraging and roosting habitat cannot be discounted.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Dasyurus maculatus Spotted-tailed Quoll	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold. Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods.	Bionet (5 records), PMST	Low – no local records and suitable habitat not identified within the study area.	No - species considered unlikely to occur within proposal study area
Falsistrellus tasmaniensis Eastern False Pipistrelle	V, P	-	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Bionet (26 records)	Recorded – To a possible extent in 2021 ultrasonic bat recorder survey	Yes – suitable foraging/ roosting habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	V, P	-	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Also known to roost and breed in the hollows of mangroves and travelling considerable distances to forage.	Bionet (33 records)	Recorded – In 2021 ultrasonic bat recorder survey	Yes – suitable foraging/ roosting habitat present
Phoniscus papuensis Golden-tipped Bat	V, P	-	The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. It also occurs in New Guinea. Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests.	Bionet (1 record)	Low – limited local records and only marginal suitable habitat not identified within the study area.	No - species considered unlikely to occur within proposal study area
Miniopterus australia Little Bent-winged Bat	V, P	-	Distributed along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Found in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally, found in well-timbered areas. Roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Bionet (88 records)	Recorded – In 2021 ultrasonic bat recorder survey	Yes – suitable foraging/ roosting habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Miniopterus orianae oceanensis Large Bent-winged Bat	V, P	-	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Hunt in rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, Melaleuca forests and open grasslands.	Bionet (90 records)	High – potential foraging habitat identified within the study area and records within its vicinity. Likely to forage within the study area, but no roosting habitat present.	Yes – suitable foraging/ roosting habitat present
Myotis macropus Southern myotis	V, P	-	Found in most habitat types in association with streams and permanent waterways usually at low elevations in flat or undulating landscapes from northern areas of Western Australia, and the Northern Territory, down the entire east coast and the southern coast of Australia to just west of the Victoria/South Australia border and inland along the Murray River. Roosts in caves, tree hollows, in clumps of dense vegetation (e.g. Pandanus), mines, tunnels, under bridges, road culverts and stormwater drains often in abandoned, intact Fairy Martin nests. Roost sites are strongly associated with bodies of water where this species commonly feeds on aquatic insects, shrimp and small fish at the water surface, however, aerial foraging for other insects is also known. Breeding habitat likely to coincide with roosting habitat.	Bionet (19 records)	Recorded – To a possible extent in 2021 ultrasonic bat recorder survey	Yes – suitable foraging/ roosting habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Petaurus australis Yellow-bellied Glider	V	-	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	Bionet (35 records)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Petaurus norfolcensis Squirrel Glider	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum Forest west of the Great Dividing Range and Blackbutt-Bloodwood Forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Bionet (4 records)	Moderate – although there is a relatively low number of hollows within the study area, there is sufficient shelter and foraging habitats to support local individuals.	Yes – suitable foraging/ roosting habitat present
Petauroides volans Greater Glider	-	V	The Greater Glider has a restricted distribution in eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevated range from sea level to 1200m above sea level. The species is largely restricted to eucalypt forests and woodlands, with a diet comprising of eucalypt leaves and occasional flowers. It is found in abundance in montane eucalypt forest with relatively old trees and an abundance of hollows. It also favours forests with a diversity of eucalypts to cater for seasonal variation in food abundance.	Bionet (7 records), PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Pseudomys gracilicaudatus Eastern Chestnut Mouse	V,P		In NSW the Eastern Chestnut Mouse mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis Bay area. In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands.	Bionet (3)	Low – only marginally suitable habitat and no records identified within the study area or its vicinity	No - species considered unlikely to occur within proposal study area
Pseudomys novaehollandiae New Holland Mouse	P	V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes	Bionet (1), PMST	Low – only marginally suitable habitat and no records identified within the study area or its vicinity	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Macropus parma Parma Wallaby	V,P		The species once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to south of the Bruxner Highway between Tenterfield and Casino. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Bionet (1)	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area
Petrogale penicillata Brush-tailed Rock Wallaby	E1	V	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It prefers rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres.	PMST	Low – no suitable habitat identified within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Phascolarctos cinereus Koala	V,P	E	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabits eucalypt woodlands and forests. Koalas Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The preferred tree species vary widely on a regional and local basis. Some preferred species include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured. Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW BC Act.	Bionet (12 records), PMST	Low – moderately suitable habitat identified within the study area and its vicinity. Low number of old records with 10km radius but none within the study area or its vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Potorous tridactylus Long-nosed Potoroo	V, P	V	The long-nosed potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. There are geographically isolated populations in western Victoria. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha.	Bionet (5 records), PMST	Low – marginally suitable habitat identified within the study area with limited records within the study area or vicinity.	No - species considered unlikely to occur within proposal study area

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Pteropus poliocephalus Grey-headed flying Fox	V	V	Occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. However, only a small proportion of this range is used at any one time, as the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly. At a regional scale, broad trends in the distribution of plants with similar flowering and fruiting times support regular annual cycles of migration. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, elsewhere, during spring, Grey-headed Flying-foxes are uncommon south of Nowra and widespread in other areas of their range. The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. In winter, the species congregates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW (associated with flowering Spotted Gum Corymbia maculata) and on the northwest slopes (generally associated with flowering White Box Eucalyptus albens or Mugga Ironbark E. sideroxylon). Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban	Bionet (3627 records), PMST	Recorded – a diverse range of suitable seasonal foraging habitat identified within the study area, with an abundance of local records. Species observed foraging on Red Mahogany blossom (Eucalyptus resinifera ssp. resinifera).	Yes – suitable foraging/ roosting habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
			gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines			
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V	-	This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally, a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders	Bionet (10 record)	Moderate – no recent records in the vicinity of the study area. Due to mobility and potential foraging and roosting habitat cannot be discounted.	Yes – suitable foraging/ roosting habitat present
Scoteanax rueppellii Greater Broad-nosed Bat	V	-	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks, but it may also forage in rainforest. Typically, it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings.	Bionet (42 records)	Moderate – no recent records in the vicinity of the study area. Due to mobility and potential foraging and roosting habitat cannot be discounted.	Yes – suitable foraging/ roosting habitat present

Common Name (Scientific Name)	Status		Habitat requirements	Number of records (source)	Likelihood of occurrence	Significant impact assessment required?
	BC Act	EPBC Act				
Vespadelus troughtoni Eastern Cave Bat	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Bionet (2 record)	Low – very rare locally with scant records in the region. There are no suitable roosting habitats for this species in the vicinity of the site.	No - species considered unlikely to occur within proposal study area

Distribution and habitat requirement information adapted from Australian Government Department of the Agriculture, Water and the Environment SPRAT http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl and NSW Department of Planning & Environment Threatened Species Data Collection https://www.environment.nsw.gov.au/threatenedspeciesapp/

Key: Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – X = Extinct, CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory. Listed under the NSW Biodiversity Conservation Act 2016 – E4 = Critically Endangered, E1 = Endangered Species, E2 = Endangered Population, V = Vulnerable.

BioNet = OEH Bionet Atlas of NSW Wildlife, PMST = Department of Environment and Energy's EPBC Protected Matters Search Tool.

Attachment C – Assessments of Significance

1. Coastal Floodplain Forests

Native vegetation within the study area is considered to meet the final determination of two threatened ecological communities listed under the BC Act, these being:

- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions – Endangered.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

1.1 Specific impacts

The proposed works will involve the removal of native vegetation for test excavation areas (which are approximately of 0.5 m^2 in size), accumulatively this will impact approximately 4.75 m^2 of *Coastal Floodplain Forest.*

1.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**
- **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The action proposed will require the removal of 4.75 m^2 *Coastal Floodplain Forests*, this involves a number of test excavation areas, approximately 0.5 m^2 in size.

All direct impact on this ecological community will be limited to the groundcover and regeneration post works is considered to limit this to a temporary impact.

The reduction of 4.75 m^2 of *Coastal Floodplain Forest*, for the test excavation areas, is unlikely to have an adverse effect on the extent of the ecological community, or adversely modify the extent and/or composition of this community that its local occurrence be placed at risk of extinction. This assessment applies to the following two TECs as listed under the BC Act:

- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered BC Act.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Bioregion and South East Corner bioregions – Endangered BC Act.

The local occurrence of these two TECs is outlined below in Table D-1. The local occurrence of each TEC was estimated from the broad scale mapping provided in the Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855 (State Government of NSW and Department of Planning, Industry and Environment, 2012). The estimates provided below in Table D-1 provide an indication of the extent of the local occurrence. In all cases the actual local occurrence is likely to be larger than estimated as not all patches of vegetation are mapped accurately.

As can be seen from Table D-1., the proposal would not have an adverse effect on the extent of any of the ecological communities such that the local occurrence is likely to be placed at risk of extinction. The proportional impacts to the local occurrence of each TEC is low and the proposal would not result in the local extinction of the TECs.

Table D-1: Estimation of the local occurrence of each TEC and proportional impact

Threatened ecological community	Local occurrence (within 10km of study area)	Area impacted	Proportional impact to local occurrence
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	801 ha	0.0003 ha	0.000375%
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	119 ha	0.000025 ha	0.00002%

The proposal is considered unlikely to substantially and adversely modify the composition of the two TECs so that their local occurrences are placed at risk of extinction. The local occurrences of these TECs have already been substantially and adversely modified by past land use practices. All TECs subject to this assessment are currently suffering from altered composition caused by a reduction in ecological function, as indicated by:

- altered community structure (ie missing structural layers)
- altered species composition (ie lack of native species
- disruption of ecological processes (ie altered drainage, mowing preventing natural regeneration)
- invasion and establishment of exotic species resulting in weed dominance
- degradation of habitat
- fragmentation.

The proposal is not considered likely to further modify the composition of any of the TECs such that the local occurrence of either TEC is placed at risk of extinction. The composition of the threatened ecological communities within the locality is predicted to remain as is after the implementation of the proposal.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.
- The extent of predicted impacts to each TEC is shown in . This is a worst case scenario assuming clearing of the entire construction footprint which is unlikely to occur. The proportional impact to each TEC is low and will be lower after detailed design.
- The TECs within the study area are already fragmented by the existing Central Coast Highway, adjacent roads, and agricultural development. Fragmentation is unlikely to occur from the proposal as the work would involve removing vegetation from patch edges rather than breaking apart of large blocks of vegetation into many smaller patches. Importantly, the proposal would not result in the breaking apart of large blocks of high quality examples of threatened ecological communities. No further habitat fragmentation on a landscape scale would occur because of the proposal. Isolation of habitats is likely to increase by a small extent as the distance between patches on either side of the highway would be increased.

- Due to the conservation significance of these TECs, the remaining patches of these TECs within NSW are likely to be important for their survival. However, no patches of vegetation in the study area have been recognised as priority conservation land or as part of core habitats or regional corridors by the OEH. As such, the TEC patches within the study area can be considered less important than larger high quality examples of these TECs in the locality that retain high levels of ecological integrity and function.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not impact on any declared area of outstanding biodiversity value.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the BC Act and at the present there are currently 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to the TECs subject to this assessment (see Table D-2). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees.

Table D-2: Key Threatening Processes and relevance to the proposal

Key Threatening Process	Relevance to the proposal
Clearing of native vegetation	Yes. The proposal would result in clearing of native vegetation. The proposal are part of this KTP and will exacerbate the KTP.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Yes. The proposal may result in the introduction or spread of amphibian chytrid. However, hygiene measures would be followed to prevent spread of this fungus.
Infection of native plants by Phytophthora cinnamomi	Yes. The proposal may result in the introduction or spread of Phytophthora cinnamomi. However, hygiene measures would be followed to prevent spread of Phytophthora cinnamomi.
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	Yes. The proposal may result in the introduction or spread of Exotic Rust Fungi. However, hygiene measures would be followed to prevent spread of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scramblers	Yes. The proposal may result in the invasion and establishment of exotic vines and scramblers. However, weed control measures would be followed to prevent invasion and establishment of exotic vines and scramblers.
Invasion of native plant communities by African Olive Olea europaea L. subsp. cuspidata	Yes. The proposal may result in the invasion and establishment of African Olive Olea europaea L. subsp. cuspidata. However, weed control measures would be followed to prevent invasion and establishment of African Olive *Olea europaea* L. subsp. c*uspidata*.
Invasion, establishment and spread of Lantana camara	Yes. The proposal may result in the invasion and establishment of *Lantana camara*. However, weed control measures would be followed to prevent invasion and establishment of *Lantana camara*.

Key Threatening Process	Relevance to the proposal
Invasion of native plant communities by exotic perennial grasses	Yes. The proposal may result in the invasion and establishment of exotic perennial grasses. However, weed control measures would be followed to prevent invasion and establishment of exotic perennial grasses.
Removal of dead wood and dead trees	Yes. Some dead wood and dead trees may be removed.

Conclusion

In summary, the proposal is considered unlikely to have an adverse effect on the extent of the two TECs such that the local occurrence of each is likely to be placed at further risk of extinction. The proportional impact is small when considered in the context of the actual impact in hectares and the extent of the TECs within the broader locality. The proposal is considered unlikely to substantially and adversely modify the composition of any of the TECs as the current composition of the TECs is highly modified. There is unlikely to be any further increase in fragmentation from the proposal. The TECs within the study area are not recognised as important to the long-term survival of the TECs in the locality. Furthermore, none of the TEC patches to be impacted is identified as important. Considering the context of the TECs and intensity of the potential impacts to these TECs from the proposal, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to these TECs.

2. Threatened Orchid Species – Caladenia tessellata, Cryptostylis hunteriana and Diuris praecox

This assessment applies to the threatened orchid species *Caladenia tesselata*, *Cryptostylis hunteriana*, and *Diuris praecox*.

Caladenia tesselata is a very rare orchid species previously recorded in scattered coastal localities south from Swansea on the Central Coast, preferring low, open to dense heathy forest on well drained sands and on wetland fringes (see Jones 2006; Bishop 2000; Wyong Shire Council 2000). Records of this species from the Central Coast are very sparse and it may be locally extinct due to habitat removal and modification (see NSW Scientific Committee, 2008). The survey undertaken for the adjacent Stage 1 proposal (see Sclerophyll Flora Surveys, 2020) did not record *Caladenia tesselata.* However, based on the presence of potentially suitable habitats in the study area the potential occurrence of this species must be addressed. Targeted surveys were undertaken in October 2021 during the flowering period for *Caladenia tesselata* in most of the habitats that may be suitable for this species. However, at the time of survey there was no access to habitat on Lot 9 DP661926, so this habitat was not able to be surveyed. As such, in the absence of survey data *Caladenia tesselata* is assumed present in the habitats on Lot 9 DP661926.

Cryptostylis hunteriana is a rare leafless orchid that is known to occur on the Central Coast largely in forests dominated by *Angophora costata, Corymbia gummifera,* and *Eucalyptus haemastoma* (similar to the dry sclerophyll forest habitat types found within the study area) often in areas where congeners *Cryptostylis subulatus* and *Cryptostylis erecta* are found. *Cryptostylis hunteriana* is a cryptic species and the habitat preferences of this species are relatively poorly understood indicated by recent findings of this species in new habitats and in previously unknown locations. *Cryptostylis hunteriana* is not often recorded but appears to be widespread. The survey undertaken for the adjacent Stage 1 proposal (see Sclerophyll Flora Surveys, 2021) did not record *Cryptostylis hunteriana*. However, the sandy dry sclerophyll forest habitats within the study area dominated by *Angophora costata, Corymbia gummifera,* and *Eucalyptus haemastoma* and containing the congeners *Cryptostylis subulatus* and *Cryptostylis erecta* may potentially be suitable for this species. Targeted surveys for *Cryptostylis hunteriana* were undertaken within the study area in October and November 2021 and the species was flowering and detectable. Surveys were undertaken in October 2021 in most of the habitats that may be suitable for this species. However, there was no access to habitat on Lot 9 DP661926 at that time. As such, in the absence of survey data *Cryptostylis hunteriana* is assumed present in the habitats on Lot 9 DP661926.

Diuris praecox is a species restricted to coastal areas from Nelson Bay south to Ourimbah, preferring open heathy forest on conglomerate clays, wallum shrubland on coastal headland sand sheets and in slashed powerline easements typically on well drained aeolian dunal sand sheets (Bell 1998; Jones 2006; Wyong Shire Council 2000). Wyrrabalong National Park contains one of the three main populations of *Diuris praecox* and is located within 700 m east of the study area. The habitat present in the sandy dry sclerophyll forests within the study area is similar to habitats within which *Diuris praecox* is known to occur and given the presence of a known population within 700 m of the study area, the potential occurrence of this species must be addressed. Targeted surveys for *Diuris praecox* were undertaken in August 2021 and this species was in flower during the survey period. However, there were access limitations at the time. The August surveys were limited to PCT 1725 and PCT 1716 largely in the south of the study area. Most of the potential habitat that may be suitable for this species in the form of PCT 1138, PCT 1646, and PCT 1636 were not able to be surveyed in August. In the absence of survey data *Diuris praecox* is assumed present in the habitats of PCT 1138, PCT 1646, and PCT 1636.

These three orchid species may potentially be found in the same habitats within the study area so are assessed together in this 5-part test.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

2.1 Specific impacts

The proposed works will involve the removal of native vegetation for test excavation areas (which are approximately of 0.5 m^2 in size), accumulatively this will impact approximately 6.25 m^2 of *threatened orchid habitat*

BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The key assessment here is risk of extinction of a viable local population. Viability refers to the capacity to successfully complete each stage of the life cycle under normal conditions (State of NSW and Office of Environment and Heritage, 2018). A viable population is one which is capable of being self-sustaining in the medium to long term. Demonstrating that a population is not viable would require considerable time, effort and study and therefore any known or presumed local population should be assumed viable unless the contrary can be conclusively demonstrated through analysis of local ecological information, records, references and knowledge of species' behaviour and habitat, or through a comprehensive on-site ecological study (State of NSW and Office of Environment and Heritage, 2018). This assessment is based on impact to populations of these species that are assumed to be viable local populations.

The 'local population' is defined as the population that occurs in the study area and may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area (State of NSW and Office of Environment and Heritage, 2018). For threatened plant species, the local population includes those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with (connected to) the study area that could reasonably be expected to be cross-pollinating with those in the study area (State of NSW and Office of Environment and Heritage, 2018).

For threatened plants, effective pollination is important to maintain population viability. The separation of individual plants is a consideration when determining the local population and likelihood of cross pollination. The size and connection of habitat affects the ability of individual plants to disperse seed and genetic material, and also determines what constitutes a population and future viability. Orchid pollination and the subsequent dispersal and germination of seeds are key limiting factors that determine the persistence and spread of orchids in natural habitats (Brundrett, 2019). Pollination is more complex in orchids than in most other plants, due to highly specialised flower structures which encourage cross pollination and are linked to relatively specific interactions with insects (Brundrett, 2019). *Caladenia tesselata*, *Cryptostylis hunteriana*, and *Diuris praecox* are deceptive orchids relying on insects for pollination. Seed dispersal in orchids is via wind dispersal but dispersal distance is generally very limited with only rare long-distance seed dispersal events.

Areas of unsuitable habitat (e.g. non-vegetated habitat) for insect pollinators are likely to form an effective barrier for the transfer of pollen between habitat fragments. A maximum distance of around 500 m between areas of suitable habitat is expected to be the maximum distance for pollination between populations based on likely flying distances of pollinators for orchid species (see Menz *et al.* 2013). Habitats on either side of the existing Central Coast Highway are therefore within flight distance for pollinators and as such the habitats are considered to be connected. Any orchids present in habitat on either side of the existing Central Coast Highway would be part of a single local occurrence if the plants were within 500 m of each other.

There are no records of *Caladenia tesselata* or *Cryptostylis hunteriana* within 10km of the study area so no estimate of the occurrence of a local population can be made. The study area is likely too far away from the population of *Diuris praecox* in Wyrrabalong National Park to be within dispersal distance of insect pollinators (>500 m) so any *Diuris praecox* plants that may occur within the study area would likely be part of a separate local occurrence. As such, the local occurrence of these species is assumed to be within the habitats in the study area and contiguous habitats.

The risk of extinction will increase if any factor operates to reduce population size or reproductive success (State of NSW and Office of Environment and Heritage, 2018). Importantly, the proposal is not likely to disrupt pollination in the local populations of these species if they are present. The proposal involves clearing of habitats at the edge of the existing Central Coast Highway. As such, there would be an increase in the distance of habitats either side of the road.

Importantly, the distance between habitat patches either side of the road will not exceed the flight distances of insect pollinators. Insect pollinators will cross the road and genetic exchange is still likely to occur between any plants either side of the existing Central Coast Highway if the plants are present. Pollination and seed dispersal will still occur, and population viability is unlikely to be impacted to the extent that a local population of these species will become extinct either in the short term or in the long term. As pollination will not be impacted the proposal is not likely to have an adverse effect on the life cycle of *Caladenia tesselata*, *Cryptostylis hunteriana*, or *Diuris praecox* such that a viable local population of the species is likely to be placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent to which habitat is likely to be removed or modified should be determined by estimating the total area of habitat to be directly and indirectly impacted by the proposed development, activity or action (State of NSW and Office of Environment and Heritage, 2018). This may be an estimation of the surface area of land to be affected, and/or in some cases the number of key habitat components to be affected (State of NSW and Office of Environment and Heritage, 2018). It is estimated that approximately 6.25 m^2 of potential habitat would be removed.

Importantly, the proposal is not likely to disrupt pollination in the local populations if they are present. Removal of vegetation will not create a barrier to pollinators and will not fragment the local populations. A distance of around 500 m between areas of suitable habitat is expected to be the maximum distance for pollination between populations based on likely flying distances of pollinators. The proposal will not be implementing a new barrier to pollinator movement as the Central Coast Highway already exists. Current levels of genetic exchange from pollinators crossing the road is expected to continue and population viability will not be affected.

To assess the importance of the habitat to be removed modified, fragmented or isolated in the locality, we have used the quantitative and qualitative approach outlined by State of NSW and Office of Environment and Heritage (2018), as follows:

- An assessment of the area and quality of habitat of the threatened species or ecological community that occurs within the locality: There is approximately 58 ha of similar Coastal Dune Dry Sclerophyll Forest habitat mapped in the locality. There is a further 492 ha of other dry sclerophyll forest habitat types mapped in the locality. At around 550 ha of mapped dry sclerophyll forests in the locality the area of potential habitat for these species is relatively extensive.
- An estimate of the area and quality that the habitat of the study area represents in relation to the area and quality of that habitat within the locality: The study area contains approximately 7.29 ha of potential habitat for these orchid species of which 0.000678 ha would be removed. The proportional impact to available habitat in the locality (which is estimated at 550 ha) is approximately 0.0093%. The habitat to be removed is generally disturbed vegetation at the edge of the existing Central Coast Highway and therefore lower quality than any undisturbed core habitats in the locality.

- An assessment of the role of the habitat to be affected in sustaining habitat connectivity in the locality: The potential habitat at the edge of the Central Coast Highway to be impacted does provide some value in terms of connectivity for pollinators as the habitat to the north is part of a broken corridor from Tumbi Umbi Creek east to the coast and the vegetation in the south is part of a broken north south corridor connecting Wamberal Nature Reserve with the habitats to the north such as Carbeen Road Reserve. The corridors are already disconnected, and the increased width of the Central Coast Highway would not impact pollinators to an extent that a barrier to pollinators is created.
- An assessment of the ecological integrity of the habitat to be affected in the study area, in relation to the ecological integrity, tenure and security of the habitat which will remain both in the study area and in the locality: The habitat to be removed is generally disturbed edge along the existing Central Coast Highway. The better quality internal habitats in the core of the bushland patches in the study area will remain in similar condition. Compared to the habitats in other nature reserves and parks in the locality, the habitats at the edge of the Central Coast Highway are not as secure and due to disturbance have reduced ecological integrity from the adjacent road.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

This applies to declared areas of outstanding biodiversity value (AOBVs) under Part 3 of the BC Act. The proposal will not impact on any declared area of outstanding biodiversity value.

Table D-3: Key Threatening Processes and relevance to the proposal

This factor refers only to those key threatening processes listed in Schedule 4 to the BC Act. A KTP is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. At present there are 38 listed KTPs. Of the 38 listed KTPs under the BC Act, nine are applicable to this assessment (see Table D-4). However, hygiene and weed control measures would reduce or avoid the impact of most KTPs with the exception of clearing of native vegetation and removal of dead wood and dead trees. The proposal involves works are part of a KTP and will exacerbate the KTP.

Table D-4: Key Threatening Processes and relevance to the proposal

Key Threatening Process	Relevance to the proposal
Clearing of native vegetation	Yes. The proposal would result in clearing of native vegetation. The proposal is part of this KTP and will exacerbate the KTP.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Yes. The proposal may result in the introduction or spread of amphibian chytrid. However, hygiene measures would be followed to prevent spread of this fungus.
Infection of native plants by Phytophthora cinnamomi	Yes. The proposal may result in the introduction or spread of Phytophthora cinnamomi. However, hygiene measures would be followed to prevent spread of Phytophthora cinnamomi.
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	Yes. The proposal may result in the introduction or spread of Exotic Rust Fungi. However, hygiene measures would be followed to prevent spread of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scramblers	Yes. The proposal may result in the invasion and establishment of exotic vines and scramblers. However, weed control measures would be followed to prevent invasion and establishment of exotic vines and scramblers.

Key Threatening Process	Relevance to the proposal
Invasion of native plant communities by African Olive Olea europaea L. subsp. cuspidata	Yes. The proposal may result in the invasion and establishment of African Olive Olea europaea L. subsp. cuspidata. However, weed control measures would be followed to prevent invasion and establishment of African Olive *Olea europaea* L. subsp. *cuspidata*.
Invasion, establishment and spread of Lantana camara	Yes. The proposal may result in the invasion and establishment of *Lantana camara*. However, weed control measures would be followed to prevent invasion and establishment of *Lantana camara*.
Invasion of native plant communities by exotic perennial grasses	Yes. The proposal may result in the invasion and establishment of exotic perennial grasses. However, weed control measures would be followed to prevent invasion and establishment of exotic perennial grasses.
Removal of dead wood and dead trees	Yes. Some dead wood and dead trees may be removed.

Conclusion

There will be an impact to potential habitat for *Caladenia tesselata*, *Cryptostylis hunteriana*, and *Diuris praecox* but there is a high certainty that the impacts are unlikely to result in a significant impact to these species. This outcome is habitat based and is made despite the fact that some areas could not be surveyed due to property access restrictions during the particular survey seasons.

The short term or long term existence of any local *Caladenia tesselata*, *Cryptostylis hunteriana*, and *Diuris praecox* population is unlikely to be dependent on any plants that may be present in the construction footprint. As pollination will not be impacted, the habitat removal is not likely to have an adverse effect on the life cycle of *Caladenia tesselata*, *Cryptostylis hunteriana*, or *Diuris praecox* such that a viable local population of these species is likely to be placed at risk of extinction. The extent of habitat removal is small with the proportional impact to available habitat approximately 0.0093%. No fragmentation of the habitats would occur. The habitats to be impacted are not considered to be important to these species. Areas of outstanding biodiversity value will not be impacted. The clearing of habitat would however be part of a KTP (Clearing of native vegetation).

The assessment of significance is the first step in considering potential impacts. The Section 7.3 BC Act 'test of significance' is not a 'pass or fail' test. It allows for a detailed analysis of the likely impacts to a threatened species and whether further assessment needs to be undertaken through a species impact statement (SIS) or Biodiversity Development Assessment Report (BDAR). While some of the factors in the test above are negative, and some potential habitat for *Caladenia tesselata*, *Cryptostylis hunteriana*, and *Diuris praecox* would be impacted and the habitat removal is part of a KTP (Clearing of native vegetation) and will exacerbate the KTP, an overall conclusion must be drawn from all factors in combination.

From the consideration of the factors of the Section 7.3 BC Act 'test of significance' there is a high certainty that while an impact to *Melaleuca biconvexa* would occur, the impact is unlikely to significantly affect *Melaleuca biconvexa* I'm to or its habitat. A SIS or BDAR would not be required.

3. Green and Golden Bell Frog

The Green and Golden Bell Frog is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

Green and Golden Bell Frogs occur across a range of wetland habitats as well as lakes and dams. There are currently only 40 known remnant populations of this species throughout the coast of NSW, but the species has been known for its ability to colonise highly modified and industrial areas. Green and Golden Bell Frogs require such habitat for all life stages, but particularly large bodies of water during breeding periods.
The study area does represent breeding habitat for Green and Golden Bell Frogs, and individuals which might use the site may be important to the maintenance of genetic diversity in the local population. Therefore, a population of Green and Golden Bell Frog in the study area is considered likely to be important, to the Green and Golden Bell Frog population. Green and Golden Bell Frog was recorded in one location in the southern portion of the study area by Ecoplanning in 2021. Extensive surveys were undertaken in December 2021 by WSP but the species was not recorded.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

3.1 Specific impacts

Fauna habitat assessment undertaken within the study area assessed that wetland habitats with potential to represent habitat for the Green and Golden Bell Frog occur along the boundaries of the study area. The habitat to be impacted consists of 6.25 m^2 dispersal habitat.

3.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

A total of (6.75 m6.25 m^2 ^{2}) of wetland habitat, representing potential dispersal habitat for the Green and Golden Bell frog may be set to be removed by the proposed works.

During December 2021, surveys targeting the Green and Golden Bell Frog did not record any individuals within the study area – which doesn't necessarily mean these habitats are not being utilised by the Green and Golden Bell Frog. The only other record of this species being present in the proposed works area was made in 2020, where a call was heard from the northern sections of the study area. As this does not provide an accurate location, further investigation of this area may be required to identify local populations and which areas they utilise in the proposed works. Although the proposed works may represent the loss of potential dispersal habitat, such resources within the study area are only a marginal component of locally occurring resources that are accessible to this species. Therefore, the proposed works are considered unlikely to impact these species such that a viable or local population of the species is likely to be placed at a significant risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;
- The proposal will remove or alter approximately (6.25 m^2) of wetland habitats that provide potential dispersal habitat for this species.
- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and
- The extent of potential habitat to be removed represents a marginal proportion of potential habitat available in the surrounding landscape. The proposed works would not further fragment current habitat but would
- potentially increase isolation between wetland habitat utilised by the Green and Golden Bell Frog. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of local Green and Golden Bell Frog populations.
- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent of potential habitat that may be impacted represents a small proportion (ha) of habitat available to the Green and Golden Bell Frog within the surrounding landscape. Owing to the relatively small extent of habitat impact, the proposal is unlikely to affect the long-term survival of the Green and Golden Bell Frog in the local area.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The extent of potential habitat to be removed represents a marginal proportion of potential habitat available in the surrounding landscape. The proposed works would not further fragment current habitat but would potentially increase isolation between wetland habitat utilised by the Green and Golden Bell Frog. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of local Green and Golden Bell Frog populations.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to the Green and Golden Bell Frog, the proposal is consistent with one key threatening process under the BC Act, being clearing of native vegetation. The extent of native vegetation clearing, and habitat removal associated with the proposed works is minimal in terms of the available habitat available for this species within the surrounding landscape. However, with the proposed works potentially further isolating existing Green and Golden Bell Frog populations as dispersal habitat is removed, individuals may be subject to increased risk of road mortality which is a recognised KTP under the BC Act.

Conclusion

The extent of native vegetation clearing, and habitat removal associated with the proposal, is very small in terms of the available habitat for this species within the surrounding landscape. The potential loss of [6.25 m^2] of potential dispersal habitat for the Green and Golden Bell Frog is not considered to be significant in regard to the maintenance of this species locally, and therefore the proposed works are not likely to have a significant impact upon this species, which might lead to its extinction locally.

4. Wallum Froglet

The Wallum Froglet (*Crinia tinnula*) is listed as Vulnerable under the BC Act. The Wallum Froglet has been assessed due to the species use of coastal freshwater wetland habitats, located at the southern sections of the study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

4.1 Specific impacts

Fauna habitat assessment undertaken within the study area assessed that wetland habitats with potential to represent habitat for the Wallum froglet to occur along the boundaries of the study area. The proposal will result in the disturbance of 4.25 m^2 of melaleuca wetland habitats, which may provide potential breeding habitats for this species under suitable climatic conditions.

4.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

A total of 4.25 m^2 of melaleuca wetland habitats, representing potential habitat for the Wallum Froglet, may be adversely affected by the proposed works. Although the proposed works may represent the loss of potential foraging habitat, such resources within the study area are only a very small marginal component of locally occurring resources that are accessible to this species. Therefore, the proposed works are considered unlikely to impact these species such that a viable local or intermittent seasonal population would be placed at a significant risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;

The proposal will remove or alter approximately 4.25 m^2 of melaleuca wetland habitats that provide potential foraging habitat for this species.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and

The extent of potential habitat to be removed represents a very small 4.25 m^2 proportion of potential habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of the Wallum Froglet in habitats adjacent to the study area.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent of potential habitat that may be impacted represents a small proportion (4.25 m^2) of habitat available to the Wallum Froglet within the surrounding landscape. Owing to the relatively small extent of habitat impact, the proposal is unlikely to affect the long-term survival of the Wallum Froglet.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to the Wallum Froglet, the proposal is consistent with one key threatening process under the BC Act, being clearing of native vegetation. The extent of native vegetation clearing, and habitat removal associated with the proposed works, is considered very small 4.25 m^2 in terms of the available habitat for this species within the surrounding landscape.

Conclusion

The extent of native vegetation clearing, and habitat removal associated with the proposal, is very small 4.25 m^2 in terms of the available habitat for this species within the surrounding landscape. The potential loss of habitat for the Wallum Froglet is not considered to be significant in regard to the maintenance of this species locally, and therefore the proposed works are not likely to have a significant impact upon this species, which might lead to its extinction locally.

5. Woodland Birds

- Varied Sittella (*Daphoenositta chrysoptera*), listed as Vulnerable on the BC Act
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), listed as Vulnerable on the BC Act

Both species have been assessed together due to their similarity of preferred habitat and resources relevant to the boundaries of the study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

5.1 Specific impacts

Two threatened woodland occupying birds are assessed as having a moderate or greater chance of occurrence within the proposal study area. The proposed works will represent the removal of wooded vegetation (5 m^2) which may provide potential foraging habitat for these two threatened species.

5.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

A total of 5 $m^2$of habitat, representing potential habitat for the Varied Sittella and Dusky Woodswallow, may be adversely affected by the proposed works. Although the proposed works may represent the loss of potential foraging habitat, such resources within the study area are only a very small marginal component of locally occurring resources that are accessible to this species. Therefore, the proposed works are considered unlikely to impact these species such that a viable local population would be placed at a significant risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;

The proposal will remove or alter approximately 5 m^2ha of wooded habitats that provide potential foraging habitat for this species.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and

The extent of potential habitat to be removed represents a very small proportion (5 m^2) of potential habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of the Varied Sittella and Dusky Woodswallow in habitats adjacent to the study area.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent of potential habitat that may be impacted represents a small proportion of habitat available to the Varied Sittella within the surrounding landscape. Owing to the relatively small extent of habitat impact, the proposal is unlikely to affect the long-term survival both these woodland species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to both the Dusky Woodswallow and Varied Sittella, the proposal is consistent with one key threatening process under the BC Act, being clearing of native vegetation. The extent of native vegetation clearing, and habitat removal associated with the proposed works, is considered very small (5 m^2) in terms of the available habitat for this species within the surrounding landscape.

Conclusion

The extent of native vegetation clearing, and habitat removal associated with the proposal, is very small (5.25 m^2) in terms of the available habitat for these species within the surrounding landscape. The potential loss of habitat for the Varied Sittella is not considered to be significant in regard to the maintenance of this species locally, and therefore the proposed works are not likely to have a significant impact upon this species, which might lead to its extinction locally.

6. Nectivorous Birds

- Swift Parrot (*Lathamus discolor*) listed as Endangered under the BC Act and Critically Endangered under the EPBC Act.
- The Little Lorikeet (*Glossopsitta pusilla*) listed as Vulnerable under the BC Act.

Both species have been assessed together, due to their shared dependence on the blossom resources of myrtaceous canopy trees and their nomadic habits to access those foraging resources, which occur widely along the boundaries of the study area. While the Little Lorikeet is likely to breed locally, the Swift Parrot, which only breeds in Tasmania, is only present on the mainland between April and September to seek nectar resources from winter flowering events.

purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

6.1 Specific impacts

Fauna habitat assessments undertaken within the study area assessed that wooded vegetation communities with potential to represent habitat for the Little Lorikeet and Swift Parrot occur widely along the boundaries of the study area. The proposal will result in the disturbance 5.25 m^2 of wooded habitats, which may provide potential foraging habitats for these species.

6.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

A total of 5 $m^2$of wooded habitats, representing potential foraging habitat for the Little Lorikeet and Swift Parrot and very marginal breeding opportunities for Little Lorikeet, may be adversely affected by the proposed works. Although the proposed works may represent the loss of wooded habitat, the loss of such resources within the study area is only a very small marginal component of locally occurring resources that are accessible to these species. Therefore, the proposed works are considered unlikely to impact these species such that a viable local or intermittent seasonal population would be placed at a significant risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;

The proposal will remove or alter approximately 5 $m^2$of wooded habitats that provide potential foraging habitat for this species. 5 $m^2$of this wooded area is mapped as important habitat for the Swift Parrot.

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and

The extent of potential habitat to be removed represents a very small proportion of wooded habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of the Swift Parrot or Little Lorikeet in habitats adjacent to or within the study area.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The extent of potential habitat to be removed represents a very small proportion of wooded habitat available within the surrounding landscape. Owing to the relatively small extent of potential habitat impacts, the proposal is assessed as unlikely to significantly affect the long-term survival of the Swift Parrot or Little Lorikeet in habitats adjacent to or within the study area.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to the Swift Parrot or Little Lorikeet, the proposal is consistent with one key threatening process under the BC Act, being clearing of native vegetation. The extent of native vegetation clearing (5 m^2), associated with the proposed works, is considered very small in terms of the available habitat for these species within the surrounding landscape.

Conclusion

The extent of native vegetation clearing, and habitat removal associated with the proposal, is very small (5 $m^2$for little lorikeet and important swift parrot habitat) in terms of the available habitat for this species within the surrounding landscape. The potential loss of habitat for the Swift Parrot or Little Lorikeet is not considered to be significant in regard to the maintenance of these species locally, and therefore the proposed works are not likely to have a significant impact upon these species, which might lead to its extinction locally.

7. Cave Dwelling Microchiropteran Bats

- Little Bent-wing Bat (*Miniopterus australis*), listed as Vulnerable on the BC Act
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*), listed as Vulnerable on the BC Act
- Southern Myotis (Myotis macropus), listed as Vulnerable on the BC Act

For the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

7.1 Specific impacts

moderate or greater chance of occurrence within the proposal study area. Those species of cave-dwelling microchiropteran bat considered most likely to occur, include, the Little Bent-wing Bat and Large Bent-winged Bat and Southern Myotis. These three species are dependent on cave habitats for roosting purposes, which are not present in the study area or its vicinity, so local occurrences are dependent only upon aerial foraging resources associated with onsite vegetation. Both the Little Bent-wing Bat and the Southern Myotis have been recorded within the study area during field surveys.

7.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Due to the very small amount (6.25 m^2) of forested foraging habitats to be impacted, the proposed works are unlikely to have a significant adverse effect on the life cycle of cave-dwelling microchiropteran bats to the point that these species are likely to be placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;

The proposal will remove or alter approximately 6.25 $m^2$of wooded foraging habitats

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and.

The removal of 6.25 $m^2$of wooded vegetation within the study area will not add substantially to existing fragmentation or prevent movements to and from the abundance of similar and higher quality habitat within the wider locality.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The removal of 6.25 $m^2$of wooded vegetation within the study area will not add substantially to existing fragmentation or prevent movements to and from the abundance of similar and higher quality habitat within the wider locality.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to cave-dwelling microchiropteran bats, the proposed action is consistent with one key threatening process under the BC Act, being clearing of native vegetation consisting of the removal of 6.25 $m^2$of wooded vegetation. Therefore, the removal of potential foraging habitat associated with the proposed action is considered relatively small. Although the proposed action will represent a small loss of potential foraging habitat, such habitat represents a very small component of locally occurring resources accessible to these species.

Conclusion

The proposal may remove of 6.75 m^2 of wooded habitats representing a very small amount of potential foraging habitat for these species. Whilst potential habitat exists within the study area, the extent of habitat removal associated with the proposal is considered relatively small in terms of available local habitat for these species. Although the loss of habitat will represent a small incremental loss of cave-dwelling microchiropteran bat habitat, the proposed works are unlikely to have a significant impact upon these species.

8. Cave Dwelling Microchiropteran Bats

- Eastern False Pipistrelle (Falsistrellus tasmaniensis), listed as Vulnerable on the BC Act
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), listed as Vulnerable on the BC Act
- Greater Broad-nosed Bat (Scoteanax rueppellii), listed as Vulnerable on the BC Act
- Yellow-bellied Sheathtail Bat (Saccolaimus flaviventris), listed as Vulnerable on the BC Act

For the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats —

8.1 Specific impacts

Four species of threatened cave-dwelling microchiropteran bats are assessed as having a moderate or greater chance of occurrence within the proposal study area. The proposed works will represent the removal of wooded vegetation with a very low density of hollows suited to the roosting habits of small cave-dwelling microchiropteran bats. Impact to these species will be largely limited to the removal of foraging habitat only for these species.

8.2 BC Act assessment

In the case of a Threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Due to the very small amount (6.25 m^2) of forested habitats to be impacted, the proposed works are unlikely to have a significant adverse effect on the life cycle of hollow-dwelling microchiropteran bats to the point that these species are likely to be placed at risk of extinction.

In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
- Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
- Not applicable.

In relation to the habitat of a Threatened species or ecological community:

- The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity;

The proposal will remove or alter approximately 6.25 $m^2$of wooded habitats during the proposed works

- Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity; and.

The removal of 6.25 m^2ha of wooded habitats within the study area will not add substantially to existing fragmentation or prevent movements to and from an abundance of similar and higher quality habitat within the wider locality.

- The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

Although the proposed action will add incrementally to foraging habitat loss within the locality it is unlikely to exacerbate fragmentation at local or regional scales that would prevent these species from foraging or breeding within the locality. Given the small area to be impacted (6.25 m^2), the mobile nature of these species, and the availability of suitable habitat in the wider locality, the loss of a very small amount of potential foraging habitat is unlikely to affect the long-term survival of these species.

Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area did not represent a declared area of outstanding biodiversity value and is not in the immediate vicinity of such areas.

Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

With respect to hollow-dwelling microchiropteran bats, the proposed action is consistent with one key threatening process under the BC Act, being clearing of native vegetation consisting of the removal of 6.25 $m^2$of wooded vegetation. Therefore, the removal of potential foraging habitat associated with the proposed action is considered relatively small. Although the proposed action will represent a small loss of potential foraging habitat, such habitat represents a very small component of locally occurring resources accessible to these species.

Conclusion

The proposal may remove of 6.25 $m^2$of wooded vegetation habitats representing a very small amount (6.25 m^2) of potential foraging habitat for these species. The study area contains a very low density of hollow-bearing trees, which contain a small number of hollows of dimensions, suitable for small microchiropteran bats. Whilst potential foraging habitat exists within the study area, the extent of habitat removal associated with the proposal is considered relatively small in terms of available local habitat for these species. Although the loss of some wooded habitat will represent a small (6.25 m^2) incremental loss of hollow-dwelling microchiropteran bat habitat, the proposed works are unlikely to have a significant impact upon these species.

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