



# Review of Environmental Factors

THROSBY CREEK SEDIMENT AND MANGROVE REMOVAL, TIGHES HILL



SEPTEMBER 2019



## Document Verification



Project Title: Throsby Creek Sediment and Mangrove Removal,  
Tighes Hill

Project Number: 19-146

Project File Name: 19-146 Throsby Creek REF Finalv2

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft v1 (Ch1-4)	29/04/19	Zoe Quaas	Fiona McKay	Fiona McKay
Draft v2	29/05/19	Zoe Quaas	Fiona McKay	Fiona McKay
Final v1	12/07/19	Zoe Quaas	Fiona McKay	Fiona McKay
Final v2	03/09/19	Ainslee Roser	Fiona McKay	Fiona McKay

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# CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	PURPOSE OF THE REF .....	1
<b>2</b>	<b>THE PROPOSAL.....</b>	<b>1</b>
2.1	BACKGROUND .....	1
2.2	LOCATION OF THE ACTIVITY.....	2
2.3	REASONS FOR THE ACTIVITY AND CONSIDERATION OF ALTERNATIVES.....	4
2.3.1	Reasons for the activity .....	4
2.3.2	Consideration of alternatives .....	4
2.4	DESCRIPTION OF THE ACTIVITY .....	6
2.4.1	Scope of works.....	6
2.4.2	Construction methodology.....	8
2.4.3	Proposed construction equipment.....	10
2.4.4	Timing and construction hours.....	10
<b>3</b>	<b>LEGAL AND POLICY REQUIREMENTS.....</b>	<b>11</b>
3.1	LEGAL PERMISSIBILITY.....	11
3.2	CONFIRMATION OF PART FIVE ASSESSMENT .....	17
<b>4</b>	<b>CONSULTATION.....</b>	<b>17</b>
4.1.1	ISEPP consultation .....	17
4.1.2	Other consultation.....	19
<b>5</b>	<b>ENVIRONMENTAL ASSESSMENT.....</b>	<b>21</b>
5.1	TOPOGRAPHY GEOLOGY AND SOILS .....	21
5.1.1	Existing environment .....	21
5.1.2	Potential impacts .....	23
5.1.3	Safeguards and mitigation measures .....	24
5.2	HYDROLOGY, CATCHMENT VALUES AND WATER QUALITY .....	25
5.2.1	Existing environment .....	25
5.2.2	Potential impacts .....	29
5.2.3	Safeguards and mitigation measures .....	30
5.3	BIODIVERSITY .....	30
5.3.1	Methodology .....	30
5.3.2	Existing environment .....	32
5.3.3	Potential impacts .....	34

5.3.4	Safeguards and mitigation measures .....	36
5.4	NOISE AND VIBRATION .....	36
5.4.1	Existing environment .....	36
5.4.2	Potential impacts .....	37
5.4.3	Safeguards and mitigation measures .....	38
5.5	TRAFFIC AND ACCESS .....	39
5.5.1	Existing environment .....	39
5.5.2	Potential impacts .....	40
5.5.3	Safeguards and mitigation measures .....	40
5.6	AIR QUALITY, RESOURCES AND WASTE .....	41
5.6.1	Policy setting.....	41
5.6.2	Existing environment .....	42
5.6.3	Potential impacts .....	42
5.6.4	Safeguards and mitigation measures .....	43
5.7	SOCIO-ECONOMIC IMPACTS .....	43
5.7.1	Existing environment .....	43
5.7.2	Potential impacts .....	44
5.7.3	Safeguards and mitigation measures .....	44
5.8	LANDSCAPE CHARACTERISTICS AND VISUAL AMENITY .....	45
5.8.1	Existing environment .....	45
5.8.2	Potential impacts .....	45
5.8.3	Safeguards and mitigation measures .....	45
5.9	INDIGENOUS HERITAGE .....	46
5.9.1	Existing environment .....	46
5.9.2	Potential impacts .....	46
5.9.3	Safeguards and mitigation measures .....	46
5.10	NON-INDIGENOUS HERITAGE .....	47
5.10.1	Existing environment .....	47
5.10.2	Potential impacts .....	47
5.10.3	Safeguards and mitigation measures .....	48
5.11	CUMULATIVE IMPACTS .....	48
5.11.1	Policy setting.....	48
5.11.2	Potential impacts .....	48
5.11.3	Safeguards and mitigation measures .....	48

5.12	PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT .....	49
5.12.1	The precautionary principle.....	49
5.12.2	Inter-generational equity.....	49
5.12.3	Conservation of biological diversity and ecological integrity .....	49
5.12.4	Appropriate valuation of environmental factors.....	49
6	SUMMARY OF SAFEGUARDS AND MITIGATION MEASURES.....	50
7	SUMMARY OF LICENCES AND APPROVALS .....	55
8	CONCLUSION .....	56
8.1	ENVIRONMENTAL IMPACTS.....	56
8.2	JUSTIFICATION OF THE PROPOSAL.....	56
9	REFERENCES.....	57
APPENDIX A	DATABASE SEACHES .....	A-I
APPENDIX B	CORRESPONDENCE .....	B-I
APPENDIX C	THREATENED SPECIES EVALUATIONS.....	C-I
APPENDIX D	CLAUSE 228 CHECKLIST .....	D-I
APPENDIX E	MNES.....	E-I

## TABLES

Table 3-1	Legal requirements for the proposal .....	11
Table 5-1	Contaminated lands proximity to proposal area .....	22
Table 5-2	Database searches for threatened species and communities, groundwater-dependent ecosystems and priority weeds .....	31
Table 5-3	Weather condition at the time of surveys.....	31
Table 5-4	Summary of heritage findings.....	47
Table 6-1	Key environmental safeguards .....	50
Table 7-1	Summary of licences and approvals required.....	55

## FIGURES

Figure 2-1	Proposal location .....	3
Figure 2-2	Proposed works extent and indicative laydown areas .....	7
Figure 2-3	Barge launch location .....	9

Figure 5-1 Sediment accumulation surrounding Union Street Footbridge .....	21
Figure 5-2 Acid Sulfate Soils in Throsby Creek (NSW Department of Planning & Environment, 2016).....	22
Figure 5-3 Mine subsidence in the Tighes Hill area (NSW Department of Planning & Environment, 2016). .....	23
Figure 5-4 Throsby Creek catchment (NNC, 2004) .....	27
Figure 5-5 Flood risk of proposal area (NCC, 2019) .....	29
Figure 5-6 Overhanging mangroves within the proposal area .....	34

## ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
AEC	Areas of Environmental Concern
AHIMS	Aboriginal heritage information management system
ASS	Acid Sulfate Soils
AWS	Automatic weather station
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
Biosecurity Act	<i>Biosecurity Act 2015 (NSW)</i>
BOM	Australian Bureau of Meteorology
CEMP	Construction Environmental Management Plan
Cwth	Commonwealth
db(A)	Decibels A-weighting
DECCW	Refer to OEH
DOEE	Department of Environment and Energy
DPI	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwth)</i>
EPL	Environment Protection Licence
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
ESCP	Environmental and Sediment Control Plan
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
GDE	Groundwater Dependent Ecosystem
ha	hectares
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
HWC	Hunter Water Corporation
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007 (NSW)</i>
KFH	Key Fish Habitat
km	kilometres
LEP	Local Environment Plan
LGA	Local Government Area
m	Metres
MNES	Matters of National environmental significance under the EPBC Act (c.f.)

NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PCT	Plant Community Type
PMST	Protected Matters Search Tool
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
RBL	Rating Background Noise
REF	Review of Environmental Factors
SCS	Soil Conservation Services
SEPP	State Environmental Planning Policy (NSW)
SES	State Emergency Services
SHI	NSW State Heritage Inventory
SOC	State Owned Corporation
SPRAT	Species Profiles and Threats Database
TAFE	Technical and Further Education
VC	Vegetation Classification
Water Act	<i>Water Act 1912</i>
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WM Act	<i>Water Management Act 2000</i>



# 1 INTRODUCTION

## 1.1 PURPOSE OF THE REF

Soil Conservation Services (SCS) have been contracted by Hunter Water Corporation (HWC) to assess the environmental impacts for the removal of accumulated sediment and juvenile mangroves in Throsby Creek, Tighes Hill, NSW (the proposal) (Figure 2-1). SCS have engaged NGH Environmental to undertake the environmental assessment of the proposal. This Review of Environmental Factors (REF) has been prepared by NGH Environmental Pty Ltd on behalf of HWC.

This REF satisfies HWC's duty under Section 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'.

# 2 THE PROPOSAL

## 2.1 BACKGROUND

Hunter Water Corporation (HWC) is a State-Owned Corporation (SOC) providing drinking water, wastewater, recycled water and some stormwater services across the Lower Hunter Region. Throsby Creek is a major stormwater channel which flows directly into Newcastle Harbour and is managed by HWC. Throsby Creek and its tributaries form a highly modified drainage network that collects stormwater from the major part of central Newcastle and conveys it to Newcastle Harbour. The catchment of the creek covers an area of approximately 3,000 hectares (ha), the majority of which are within the boundaries of Newcastle City Council Local Government Area (LGA).

Throsby Creek stormwater system is mainly open, with sections lined with concrete up to 55 metres (m) wide; the total length is 55 kilometres (km). The creek downstream of Tighes Hill is tidal, with a level stream bed and slow-moving water body, creating a depositional environment of sediment accumulation from the Throsby Creek Stormwater System (Newcastle City Council, 2004).

A hydrodynamic assessment of the Throsby Creek channel was conducted to compare peak water level differences for 2011 to 2016. The study assessed the changes to the Throsby Creek sea floor via assessment of the accretion and/or erosion of sediments within the creek channel. The study found an increase to peak flood levels and increased flow behaviour over time from sediment accumulation (Smith and Rahman, 2018).

Sediment accumulation has resulted in two mangrove islands in Throsby Creek increasing in size (refer Figure 2-1). This has resulted in reduced water retention areas around Throsby Creek during high rainfall events, causing water levels to back up during high rainfall events and potential increase in flooding levels in the local area.

The removal of juvenile mangroves, overhanging branches and some accumulated sediment in the area around the Union Street Footbridge is proposed to discourage future mangrove growth and reduce obstructions to water flow in the Throsby Creek stormwater system.

## 2.2 LOCATION OF THE ACTIVITY

Throsby Creek stretches approximately 3.2 km from Carrington to Tighes Hill and is owned and managed by HWC. The sediment and juvenile mangroves to be removed (the proposal) is located approximately 3 km up-stream and 3.4 km north west of Newcastle Harbour and 5.1 km south west of Kooragang Island (Figure 2-1). The proposal would take place within Throsby Creek, 300 m to the west of the Union Street Footbridge, and within 200 m to the east of the adjacent Islington Park (Figure 2-1).

For the purpose of this report, the following definitions apply:

- *Proposal area*: the area directly impacted by the proposed works.
- *Study area*: the area surveyed for the purpose of this assessment, equivalent to the proposal area, as defined above.
- The *locality*: is defined as the area within a 10 km radius of the proposal site.

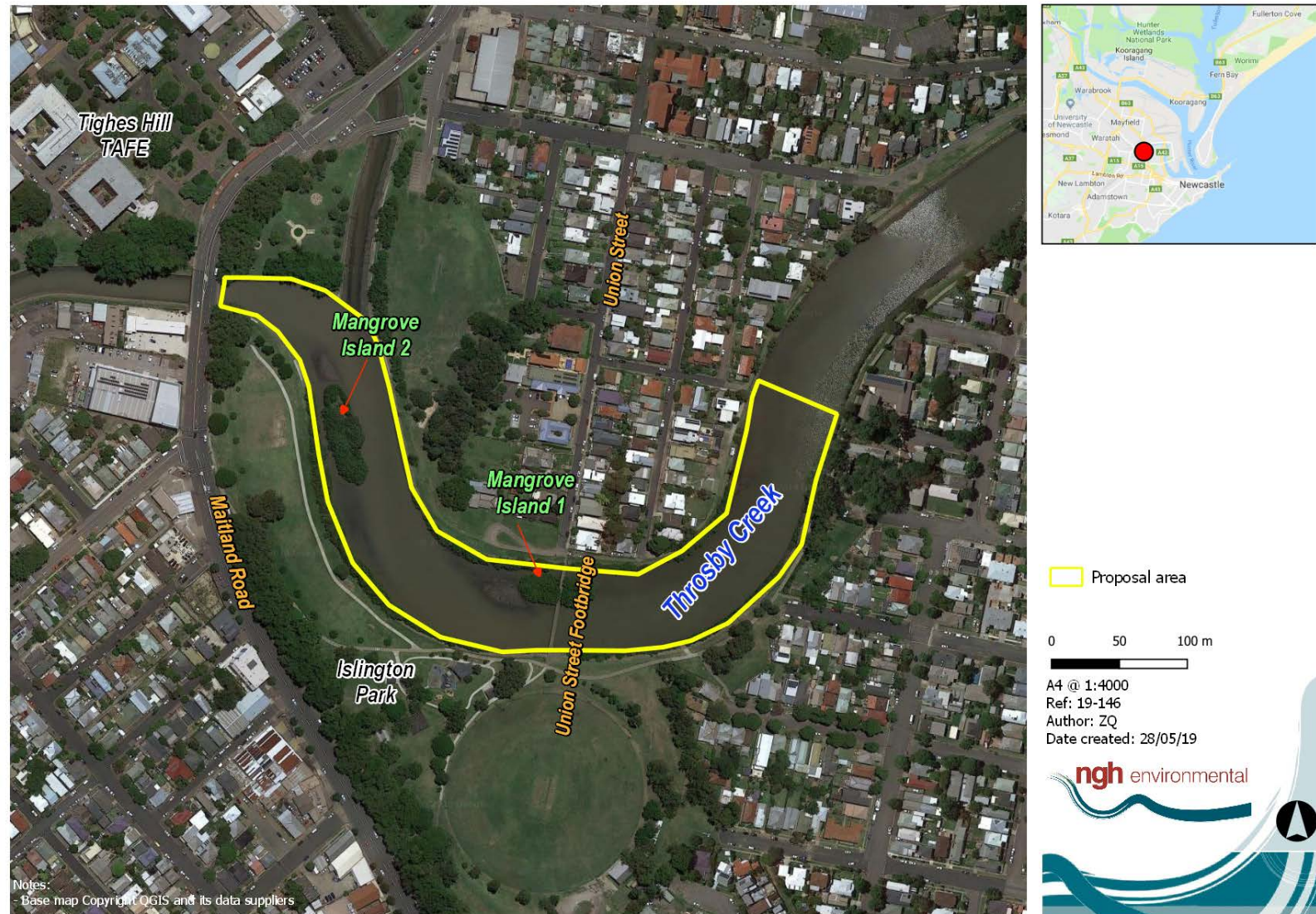


Figure 2-1 Proposal location

## **2.3 REASONS FOR THE ACTIVITY AND CONSIDERATION OF ALTERNATIVES**

### **2.3.1 Reasons for the activity**

HWC are responsible for the maintenance and provision of stormwater services in Throsby Creek. This responsibility includes:

- Managing the health of Newcastle's Creek systems
- Managing stormwater and water efficiency
- Enhancing the condition of catchments, creek systems and improving water quality (NCC, 2004).

As previously discussed, sediment has steadily been accumulating around the mangroves at the Union Street footbridge within Throsby Creek, encouraging further mangrove growth. Flood impact modelling has shown that stormwater flows within the creek are restricted due to the increased sediment and mangrove growth reducing stormwater flow (Smith and Rahman, 2018). This results in increased potential for flooding due to water backing up during high flow events.

The objectives of the proposed works are:

- To prevent future growth of mangroves on the surrounding accumulated sediment
- To improve water flow within Throsby Creek
- To manage flooding impacts in the local area and prevent flood levels rising in the surrounding stormwater systems
- To manage mangrove communities and prevent spread of mangrove islands and further sediment build up in Throsby Creek.

### **2.3.2 Consideration of alternatives**

Two NGH representatives meet onsite with the representatives from the Department of Primary Industries (DPI) Fisheries, HWC and SCS to identify options to best address the proposal. A number of alternatives were considered in development of the preferred option, as outlined below.

#### **Do nothing**

The 'Do Nothing' option would involve retaining the juvenile mangroves, overhanging branches and accumulated sediment in the area around Mangrove island 1 within Throsby Creek. This option would keep the site in its current form with the potential for additional growth of mangroves and accumulation of sediment which would lead to further reduced capacity for stormwater flow. This option would not meet the objectives of the proposed works and water flows would continue to be restricted in Throsby Creek, with potential for increased flood levels within the stormwater system due to back-up of water during high flow events.

#### **Alternative 1- Remove full extent of mangrove islands and all large sediment swathes**

Under this alternative, the full extent of mangrove islands 1 and 2 and large sediment swathes surrounding both mangrove islands would be removed. This option would improve water flow within Throsby Creek and prevent flood levels rising. However, after consultation with DPI Fisheries, it was identified that the mature mangroves on the islands would not impact the flow of water. Therefore, the removal of the full extent of the mangrove islands and large sediment swathes would cause unnecessary clearing and would



not meet the proposal objectives, however, this option is not feasible due to cost and potential environmental impacts of the works.

### **Alternative 2 – Remove all juvenile mangroves surrounding islands and low hanging mangroves (no sediment removal)**

Under this alternative, all juvenile mangroves to approximately 3 cm diameter and low hanging mangroves on the edge of both the mangrove islands would be removed. While this option would manage a portion of the mangrove communities, retaining accumulated sediment would not improve flow of storm water. This option would also rely on flood flows flushing out the accumulated sediment, which cannot be guaranteed. Therefore, this option would not meet the objectives of the proposal.

### **Alternative 3 – Remove one large sediment swath accumulated surrounding mangrove island, low hanging branches and juvenile mangroves within Throsby Creek (preferred option)**

Under this alternative, the juvenile mangroves germinating from the sediment build up, low hanging branches and sediment congestion surrounding Mangrove island 1 would be removed (see Figure 2-2). As there is not expansive accumulation of sediment surrounding Mangrove island 2, no sediment removal is required. The removal of the juvenile mangroves, some low hanging branches and sediment would improve free flowing water for the surrounding storm water drains and prevent future spread of mangroves. This alternative would meet the proposal objectives and is the preferred alternative.

No other alternative locations were investigated for sediment and mangrove removal due to the depositional environment of sediment accumulation from the Throsby Creek Stormwater System.

### **Construction compounds and barge launch**

A number of alternative locations have been considered for the construction compound and barge launch locations. These options include:

- An indicative compound area – This area would be located between O’Hara Street and Bell Street. This location is located within Islington Park and within a residential area. The site is the most easily accessed location from the south of the site that is in the most discrete area of Islington Park as to not disturb access or create additional noise and visual impacts to park goers. The dual lane access provides sufficient parking for the workers so that residents would be unlikely to be impacted by the works.
- Carrington boat ramp - The barge would be launched from Carrington boat ramp, located approximately 3 km downstream of the proposal. The boat ramp is the main access to Throsby Creek for boat goers. However, access may be restricted due to tides and the height of the excavator.
- An indicative crane stabilisation location – This area is located to the north west of the proposal area as an indicative barge launch location. This is located within a residential area. The site is the most easily accessed location for a crane and within Hunter Water owned land.

No other alternative areas were investigated due to the restriction for access. These locations are indicative (worst case location); the final locations would be determined between HWC, Newcastle City Council and the contractor prior to construction commencing.

## **2.4 DESCRIPTION OF THE ACTIVITY**

### **2.4.1 Scope of works**

The proposal would remove approximately 0.1 ha of sediment surrounding mangrove island 1, as well as remove low hanging branches from mangrove island 1. Additionally, juvenile mangroves would be removed from the accumulated sediment surrounding mangrove island 1 and 2.

The proposal construction works would include (Figure 2-2):

- Removal of 200 m<sup>3</sup> of sediment accumulated around mangrove island 1, dredging to a depth of approximately 1 m
- Removal of juvenile mangroves on the edges of the mangrove islands
- Removal of low hanging branches from mangrove island 1.

An indicative crane stabilisation area would be located to the north west of the proposal area as an indicative barge launch location; an indicative compound area (30 m x 30 m) would also be located within Islington Park to the south of Throsby Creek, between O'Hara Street and Bell Street (Figure 2-2). The compound area would be used as a compound area to house amenities (toilet, shed, site office), store equipment and stockpile materials. Separate locations were chosen due to the limited access, to minimise visual impacts and availability of areas for amenity and storage. These locations are indicative (worst case location); the final locations would be determined between HWC, Newcastle City Council and the contractor prior to construction commencing.

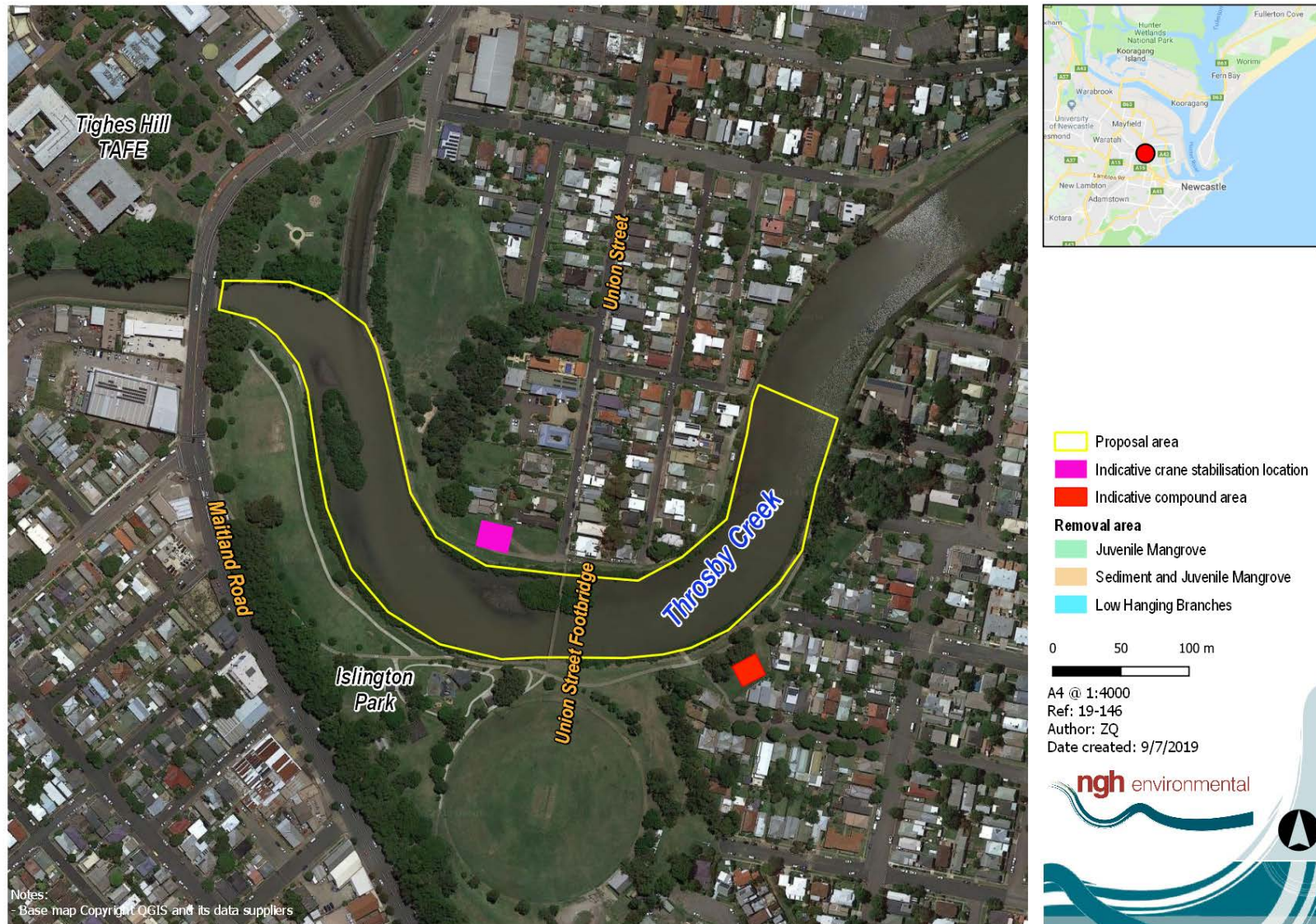


Figure 2-2 Proposed works extent and indicative laydown areas

### **2.4.2 Construction methodology**

The basic construction process for proposed works would be:

- Establishment of ancillary facilities including material compound area (30m x 30m) (Figure 2-2)
- Establishment of environmental safeguards including erosion and sediment controls including silt booms around sediment and juvenile mangrove removal area. Additional silt booms would be established surrounding the barge to avoid sediment spill. Both silt booms would remain in place for the duration of the works.
- Stabilisation of ground for work pad for crane set up with mobile crane stabilisation pads, as per Figure 2-3.
- Setup of 250 tonne crane for barge and excavator positioning
- Launch barge and excavator into Throsby Creek for sediment removal from indicative barge launch location to the north west of the proposal area or Carrington boat ramp
- Excavate sediment and mangroves, as indicated in Figure 2-2
- Disposal of excavated sediment and vegetation to an appropriate licenced waste facility. The wet sediment would be immediately removed from the worksite via dump truck and disposed off site.
- Remove and poison juvenile mangroves surrounding mangrove islands via hand

The above methodology is indicative, assuming that the barge would be launched from the crane stabilisation location adjacent to the works at Islington Park due to height restrictions at different tides that may impact on whether the barge is able to be launched from the Carrington Boat ramp (Figure 2-3). The barge would be launched from the Carrington boat ramp if possible.



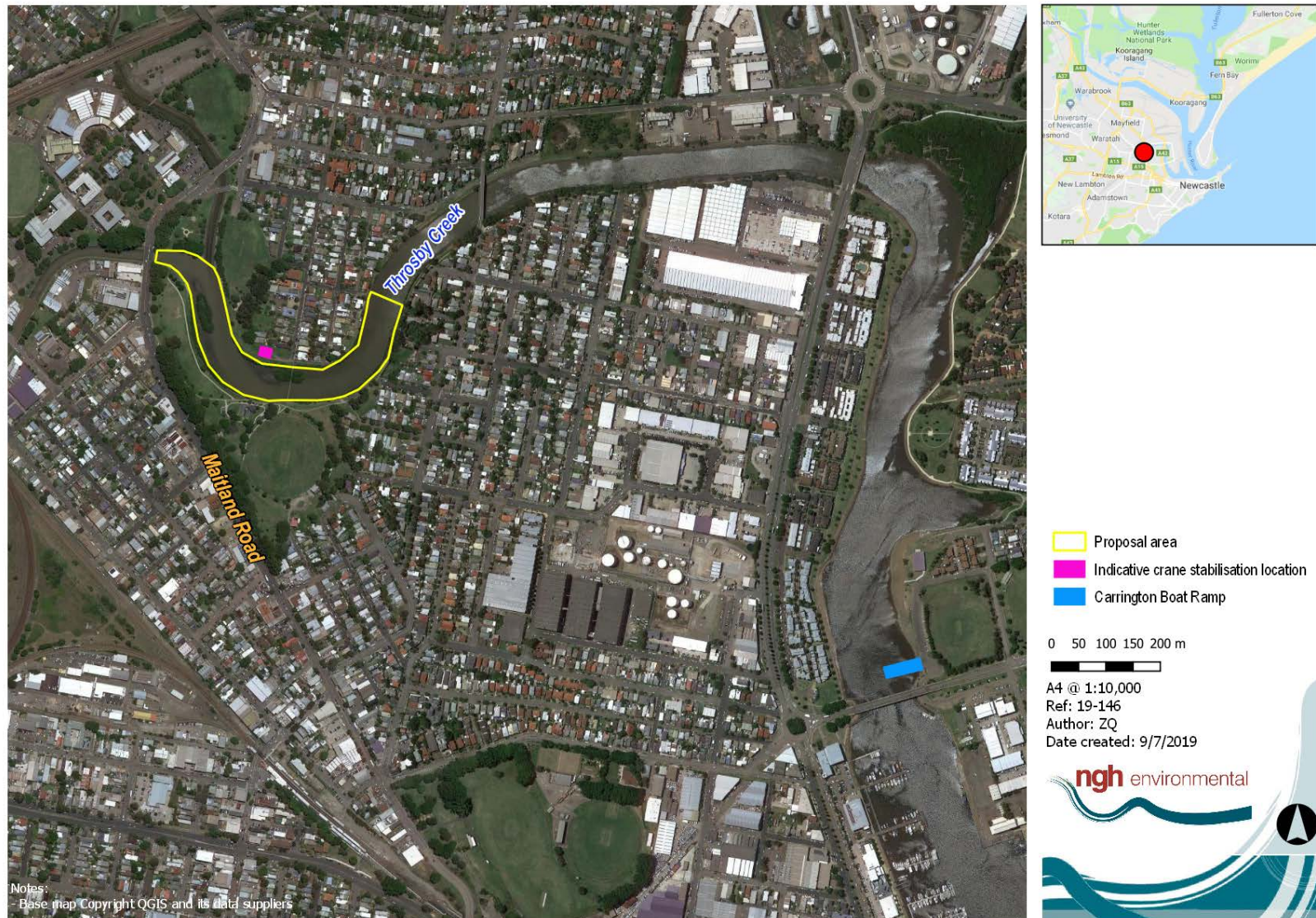


Figure 2-3 Barge launch location

### **2.4.3 Proposed construction equipment**

Indicative equipment likely to be used for the proposal includes:

- 250 tonne crane
- Excavator
- Dump truck
- Trailer
- Heavy vehicles
- Barge
- Compaction equipment
- Light vehicles
- Loppers
- Fencing

### **2.4.4 Timing and construction hours**

The proposed works are due to take place from March to May in 2020, taking approximately 8-12 weeks in total.

Construction would occur during work hours that includes 7am – 6pm, Monday to Friday, 8am to 1pm Saturday and no work on Sunday or public holiday. Works would be completed during low tide only. The low tide working hours would last approximately 5 hours.

## 3 LEGAL AND POLICY REQUIREMENTS

### 3.1 LEGAL PERMISSIBILITY

Table 3-1 Legal requirements for the proposal

Law, Policy or Regulation	Objective	Requirement for the proposal
<b>Local Law</b>		
<b>Newcastle Local Environmental Plan 2012</b>	This plan establishes the framework for future development within the local government area of Newcastle.	<p>The Proposal would be located in land zoned W2 (Recreational Waterways). The Proposal is a stormwater system and is permitted with consent within this land zone.</p> <p>The Newcastle LEP zoning objectives of the works area include:</p> <ul style="list-style-type: none"> <li>• To protect the ecological, scenic and recreation values of recreational waterways.</li> <li>• To allow for water-based recreation and related uses.</li> <li>• To provide for sustainable fishing industries and recreational fishing.</li> </ul> <p>Clause 5.12 of the Newcastle LEP does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under <i>State Environmental Planning Policy (Infrastructure) 2007</i>.</p> <p>Under Clause 111 (1) of <i>State Environmental Planning Policy (Infrastructure) 2007</i> (Infrastructure SEPP) the proposal is permissible without consent (see row below) and falls under Division 5.1 of the EP&amp;A Act.</p> <p>The objectives of the Newcastle LEP zones would be preserved during proposed works and the considerations of the Newcastle LEP would be factored into the REF.</p>

Law, Policy or Regulation	Objective	Requirement for the proposal
<b>State Law</b>		
<b>Environmental Planning and Assessment Act 1979 (EP&amp;A Act)</b>	Provides for a co-ordinated approach to development ensuring the proper management, development and conservation of natural and cultural resources and promoting social and economic welfare and a better environment.	This REF has been completed under Division 5.1, previously Part 5, of the EP&A Act and aims to address HWC's duty in respect to considering the environmental impact of the proposed activities under Section 5.5 of the EP&A Act and Section 228 of the Environmental Planning and Assessment Regulation 2000.
<b>State Environment Planning Policy (Infrastructure) 2007 (Infrastructure SEPP)</b>	ISEPP aims to facilitate the effective delivery of infrastructure across the State. The ISEPP includes provisions for developments which may be carried out by, or on behalf of, a public authority without the requirement for consent.	Clause 111 of Part 3 of the ISEPP applies to Stormwater management systems. Under this clause, development for the purpose of stormwater management systems may be carried out by or on behalf of a public authority without consent on any land. Development for the purpose of stormwater management systems includes routine maintenance works, including maintenance dredging to remove sediment build-up in a stormwater canal or at exit points into natural waterways that affects the efficiency of the stormwater management system.
<b>State Environmental Planning Policy (Coastal Management) 2018</b>	The aim of this Policy is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the <i>Coastal Management Act 2016</i>	Coastal Management SEPP coastal wetlands land is located 800 m east and proximity area for coastal wetlands is located 700m east of the proposed works but would not be directly impacted by the proposal.
<b>Biodiversity Conservation Act 2016</b>	The purpose of the <i>Biodiversity Conservation Act 2016</i> (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.  This Act was enacted on 25 August 2017.	A Biodiversity Assessment was conducted including a search of the OEH Bionet database in March 2019 (see Appendix A). The potential for the proposal to impact threatened species, populations and endangered ecological communities is assessed in Section 5.3.
<b>Biosecurity Act 2015</b>	The primary object of the <i>Biosecurity Act 2015</i> is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers. The biosecurity framework and tools safeguard our economy,	A search of the Department of Primary Industries WeedWise database for regional priority weeds for Newcastle City Council LGA was undertaken in March 2019 (see Appendix A).



Law, Policy or Regulation	Objective	Requirement for the proposal
	environment and community and Any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about.	
<b>Protection of the Environment Operations Act 1997</b>	The POEO Act is the primary legislation regulating pollution control and waste disposal in NSW. It establishes a structure for regulating polluting activities through Environment Protection Licences (EPLs). Activities listed under Schedule 1 of the POEO Act are scheduled activities which require an EPL. Stormwater treatment is listed as a scheduled activity under Schedule 1 of the POEO Act.	Section 148 of this Act requires notification of pollution incidents. HWC are obliged to notify the relevant authorities (e.g. Environment Protection Authority (EPA)) when a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.  Schedule 1 of the POEO Act describes activities for which an Environment Protection Licence is required. The proposal does not conform with the definition of a scheduled activity under this Act, therefore an Environment Protection Licence (EPL) would not be required.
<b>Coal Mine Subsidence Compensation Act 2017</b>	The <i>Mine Subsidence Compensation Act 1961</i> has been repealed by the <i>Coal Mine Compensation Act 2017</i> .  A mine subsidence district is defined under Clause 20 of the Act and accordingly Schedule 3 of the <i>Coal Mine Subsidence Compensation Regulation 2017</i> .  Schedule 3 provides that "Areas proclaimed by the <i>Mine Subsidence Compensation (Mine Subsidence Districts) Proclamation 2017</i> to be mine subsidence districts under the <i>Mine Subsidence Compensation Act 1961</i> immediately before its repeal are taken to be mine subsidence districts under the <i>Coal Mine Subsidence Compensation Act 2017</i> —see clause 8 of Schedule 1 to the Act.	Throsby Creek is not within a proclaimed Mine Subsidence District and is not subject to any building restrictions imposed by the Mine Subsidence Board.
<b>Heritage Act 1977</b>	The <i>Heritage Act 1977</i> provides for the protection of non-indigenous heritage. Section 148 requires notification to the Heritage Branch of any discovery of relics.	Section 5.10 addresses impacts associated with non-indigenous heritage.
<b>National Parks and Wildlife Act 1974</b>	The objectives of the <i>National Parks and Wildlife Act 1974</i> (NPW Act) are to conserve and preserve nature; conserve objects, places or features (including biological diversity) of cultural value within the landscape; foster public	Section 5.9 addresses impacts associated with Indigenous heritage.

Law, Policy or Regulation	Objective	Requirement for the proposal
	appreciation, understanding and enjoyment of nature and cultural heritage and their conservation; and provide for the management of land reserved under this Act.	
<b>Fisheries Management Act 1994 (FM Act)</b>	<p>The <i>Fisheries Management Act 1994</i> (FM Act) applies to all waters in the state of NSW and aims to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. These waters include 'water land' below the highest astronomical tide in tidal areas, extending to at least three nautical miles offshore.</p> <p>The FM Act regulates activities that pose a threat of damage to aquatic habitats, threatened species, populations or ecological communities. The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the activity. Where a significant impact is considered likely, a Species Impact Statement must be prepared and concurrence sought from the Director-General of NSW Trade and Investment. The Minister for Primary Industries may also need to be consulted.</p> <p>The FM Act also provides for the management of dredging and reclamation work and requires approvals for specific activities on 'waterfront land'. Waterway crossings by trenching are considered dredging activities under Part 7 of the FM Act. Additionally, under Part 7 of the FM Act, any structure (such as a weir, causeway or dam) that may inhibit or obstruct the movement of fish within a waterway requires approval.</p>	<p>The proposed works would involve removing sediment, overhanging branches and juvenile mangroves via dredging, works which are considered dredging or reclamation in 'water land', as defined by the FM Act. As a public authority HWC is required to provide the Minister 21 days' notice for planned dredging activities and consider any feedback (s199). A permit is required to harm marine vegetation including mangroves (s205).</p> <p>Section 5.3 summarises the assessment and includes safeguards and mitigation measures to protect aquatic habitat.</p>
<b>Water Management Act 2000</b>	The <i>Water Management Act 2000</i> (WM Act) provides for the sustainable and integrated management of the State's water for the benefit of both present and future generations. The Act controls the extraction and use of water, the construction of water bodies such as weirs and	The WM Act applies to areas that have a water sharing plan in place. Throsby Creek comes under the Hunter Unregulated and Alluvial water sharing plan. The proposed works would not require or result in the extraction of water from Throsby Creek, therefore no water licence is required under this Act.

Law, Policy or Regulation	Objective	Requirement for the proposal
	<p>dams and any activity that is in or near water sources in NSW.</p> <p>It also provides for the preparation and implementation of Water Management Plans, Works Approvals and Water Sharing / Licencing agreements. It regulates controlled activities within 40m of a watercourse and extraction of water within an area covered by a WSP.</p>	<p>Works within waterfront land are a controlled activity under the <u>WM Act</u>. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.</p> <p>The Proposal would involve the carrying out of work within 40m of a waterway, and hence would be classed as a 'controlled activity'. However, HWC is exempt from the requirements to obtain a controlled activities approval for works within 40 m of a waterway, as it is a public authority (Clause 41 of the Water Management (General) Regulation 2018), and as a water sharing plan in place, no approval is required.</p>
<b>Water Act 1912</b>	The <i>Water Act 1912</i> (Water Act) provides guidelines for water management in NSW, including provisions for groundwater management.	Under the Water Act, a dewatering permit would be required from the DPI if the proposal involved dewatering more than 3ML of groundwater. The proposed works would not require the need for dewatering, therefore a licence under Part 5 of the Water Act is not required.
<b>Waste Avoidance and Resource Recovery Act 2001</b>	<p>The objectives of this Act are:</p> <ul style="list-style-type: none"> <li>a) To encourage that most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,</li> <li>b) To ensure that resource management options are considered against a hierarchy of the following order: <ul style="list-style-type: none"> <li>i. Avoidance of unnecessary resource consumption,</li> <li>ii. Resource recovery (including reuse, reprocessing, recycling and energy recovery)</li> <li>iii. Disposal,</li> </ul> </li> <li>c) To provide for the continual reduction in waste generation</li> <li>d) To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste</li> </ul>	<p>Waste management is required to be undertaken in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i>.</p> <p>Waste management is discussed in Section 5.6.</p>

Law, Policy or Regulation	Objective	Requirement for the proposal
	e) To ensure the efficient funding of waste and resource management planning, programs and service delivery, f) To achieve integrated waste and resource management planning, programs and service delivery on a state-wide basis g) To assist in the achievement of the objectives of the <i>Protection of the Environment Operations Act 1997</i> .	
Commonwealth Law		
<b>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</b>	<p>The <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) regulates the assessment and approval of activities that would have or is likely to have a significant impact on Matters of National Environmental Significance (MNES), activities by Commonwealth government agencies and activities by any person on Commonwealth land (Appendix E).</p> <p>Currently MNES include:</p> <ul style="list-style-type: none"> <li>• World Heritage properties</li> <li>• National Heritage places</li> <li>• Wetlands of international importance (listed under the Ramsar Convention)</li> <li>• Nationally listed threatened species and ecological communities, migratory species (protected under international agreements)</li> <li>• Commonwealth marine areas</li> <li>• Great Barrier Reef Marine Park</li> <li>• Nuclear actions (including uranium mines)</li> <li>• A water resource, in relation to coal seam gas development or large coal mining development.</li> </ul>	<p>An EPBC Act protected matters search was undertaken in March 2019 (Appendix A). An assessment of the impacts of the proposed works determined that the proposal does not constitute an activity which may have a significant adverse impact on any MNES nor commonwealth land (Appendix A).</p>



## 3.2 CONFIRMATION OF PART FIVE ASSESSMENT

As the proposal does not require development consent and would be carried out by HWC it would be assessed under Division 5.1 (previously Part 5) of the EP&A Act and therefore development consent is not required.

# 4 CONSULTATION

### 4.1.1 ISEPP consultation

Part 2 of the State Environmental Planning Policy (Infrastructure) (ISEPP) 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.

Is consultation with Council required under clauses 13-15 of the infrastructure SEPP?	
Are the works likely to have a substantial impact on the stormwater management services which are provided by council?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

**Is consultation with Council required under clauses 13-15 of the infrastructure SEPP?**

heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?

Are the works located on flood liable land? If so, will the works change flooding patterns to more than a minor extent? ☐ Yes ☒ No

**Is consultation with public authorities other than councils required under clause 15 and 16 of the infrastructure SEPP?**

Are the works located on flood liable land? (to any extent) (ISEPP 15AA) ☒ Yes ☐ No

If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?

Under Clause 15(4) of the ISEPP, the definition of routine maintenance includes:

- a) routine repairs to or replacement of equipment or assets,
- b) temporary construction yards,
- c) clearing of vegetation (including any necessary cutting, pruning, ringbarking or removal of trees) and associated rectification and landscaping.

The works required within Throsby Creek include excavation of accumulated sediments. As such, the works would require written notice of the intention to carry out works to State Emergency Services (SES). In addition, comments received from the SES must be taken into consideration within 21 days after the notice is given.

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

Do the works involve a fixed or floating structure in or over navigable waters? ☒ Yes ☐ No

Under clause 16(2e) of the ISEPP, consultation with Roads and Maritime (RMS) is required for the proposal.

Hunter Water provided written notice to RMS (Appendix 9B.1) on 21/08/2019 to advise of the use of a floating structure in navigable waters.

Are the works adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*? ☐ Yes ☒ No

<b>Is consultation with public authorities other than councils required under clause 15 and 16 of the infrastructure SEPP?</b>	
<b>Is the proposal in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i>?</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>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?</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>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)</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>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 Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011).</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Are the works on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i>?</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

## SES Consultation

Under Clause 15AA of the ISEPP, written notification is required for the works to the NSW State Emergency Services (SES). Notification of the project was provided to SES by Hunter Water on 13 June 2019 (see Appendix B). To date no feedback has been provided.

### 4.1.2 Other consultation

#### NSW Department of Primary Industries (DPI) Fisheries

Consultation has been undertaken with DPI Fisheries as the works are within key fish habitat and dredging and reclamation works would be undertaken. As a public authority, HWC have a requirement to provide the Minister 21 days' notice for planned dredging activities and consider any feedback (s199 of the FM Act). A permit is required to harm marine vegetation including mangroves (s205 of the FM Act).

Initial consultation with DPI Fisheries included an onsite meeting on 3 March 2019 with two NGH representatives, and representatives from DPI Fisheries, HWC and SCS to discuss the work methodology and potential impacts of the proposal. Recommendations for future work included monitoring sediment movement to determine sedimentation accumulation and growth of both the mangrove islands to inform future management of the stormwater systems.

As discussed at the site meeting, the REF would be provided to DPI Fisheries. Notification and an application for approval under a Part 7 Permit would be undertaken prior to commencement of construction.

### **General Consultation**

No further consultation has been undertaken to date.

Prior to construction the following consultation would be undertaken:

- Newcastle City Council, who are the owners of the land where it is proposed to locate the compound area (see Figure 2-2). Hunter Water Corporation own the land to be used for the crane stabilisation
- Local residents who may be affected by noise and traffic during construction
- The broader community use the park and shared pathway.

## 5 ENVIRONMENTAL ASSESSMENT

### 5.1 TOPOGRAPHY GEOLOGY AND SOILS

#### 5.1.1 Existing environment

The topography of the Tighes Hill and Islington locality consists of gentle rises and level terrain, including Islington Park to the north west and south of the proposal, as well as residential dwellings to the north and east. The proposed works are located within Throsby Creek, a low-lying tidal creek approximately 66 m wide.

A review of the Newcastle 1:250 000 geological sheet indicates the proposal area is located within an area underlain by Quaternary alluvium deposits. Quaternary units of the area consist of gravel, sand, silt, clay, and “waterloo rock” marine and freshwater deposits (Rose et al., 1966). The Newcastle Area Coastal Quaternary Geology Map 1:100 000 shows the Quaternary sediments comprise of Holocene floodplain on either side of Throsby Creek (Troedson, 2016).

Soil landscapes within Islington Park to the north west and south of the proposal area include Bleached-Orthic Tenosol (ASC) and Siliceous Sand (GSG) soils. These soils hold a loose surface condition with a well drain profile that are at a slight risk of erosion (OEH, 2019).

The low gradient of Throsby Creek in Tighes Hill creates a depositional environment for sediment (Figure 5-1). An investigation into the sediment accumulation between 2011 and 2016 found the total volume increase over the five-year study period to be 2,731m<sup>3</sup>, equating to approximately 552m<sup>3</sup>/year (Smith and Rahman, 2018). As of 2004, \$6 million has been spent on dredging in response to the large volumes of sediments that have accumulated over time (NCC, 2004). Dredge material analysis revealed high levels of iron (Public Works Department, 1991). Both lead and zinc have also been found in sediment samples, which is expected due to the accumulation of sediment from historical industrial sources upstream.

One sediment trap with a floating boom is located in Throsby Creek system main channel adjacent to the Tighes Hill Technical and Further Education (TAFE) upstream from the proposal (NCC, 2004).



Figure 5-1 Sediment accumulation surrounding Union Street Footbridge

## Acid Sulfate Soils (ASS)

Acid sulfate soils are soils and sediments that contain iron sulphides. When these sulphides are exposed to oxygen, sulphuric acid is generated. The majority of acid sulphate sediments are formed by natural processes when sulfate-rich water (e.g. saline groundwater, sea water) mixes with sediments containing iron oxides and organic matter (SCS, 2012)

The Newcastle LEP establishes five classes of ASS land based on the level of risk associated with works and the probability of distribution of ASS. Class 1 has the highest risk of ASS. The proposal area has been identified as having Class 1 ASS (Figure 5-2). Previous assessment of acid sulfate soil conditions and the impacts confirmed the presence of ASS within the proposal area (SCS, 2012).

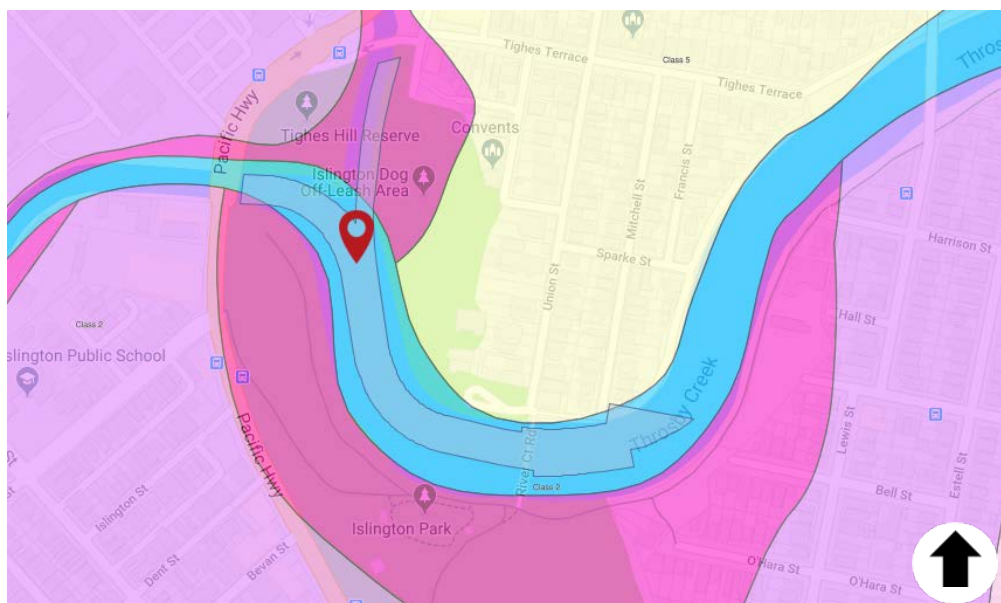


Figure 5-2 Acid Sulfate Soils in Throsby Creek (NSW Department of Planning & Environment, 2016).

## Contaminated land

A search of the EPA Contaminated Sites Register on 1 May 2019 identified one site within the Islington and Tighes Hill area. Additionally, a search of the NSW contaminated sites notified to the EPA on the 13 June 2019 identified two sites present within the Islington area and three sites present within the Tighes Hill area. The location of the sites relative to the proposal area is identified in Table 5-1. None of the contaminated sites are located within proximity to the proposal area.

Table 5-1 Contaminated lands proximity to proposal area

Suburb	Site name	Distance from the proposal area (km)	Direction from the proposal area
<b>EPA Contaminated Sites Register</b>			
<b>Tighes Hill</b>	Former Mobil Terminal	1.2	North east
<b>NSW contaminated sites notified to the EPA</b>			
<b>Tighes Hill</b>	Holcim Australia Cement Batching Plant	1	North east
<b>Tighes Hill</b>	SRA land	0.9	North east
<b>Tighes Hill</b>	Former Ampol Depot	0.9	North east



<b>Islington</b>	Caltex Service Station	0.16	West
<b>Islington</b>	Shell Pipeline Easement	0.57	South

A desktop review of Throsby Creek identified a number of Areas of Environmental Concern (AEC) within and adjacent to the proposal area, including:

- The establishment of polluting industries in the 1870s, including a slaughterhouse, a brewery and various other industries
- Stormwater system discharging contaminated sediments
- Park infrastructure

A site visit on 13 March 2019 revealed an odour from exposed sediment as low tide. No further AECs were identified during the site walkover to those identified in the desktop study.

### Mine Subsidence

The proposal area is not within a proclaimed Mine Subsidence District. A Mine Subsidence district is located approximately 20 m north of the proposal area within the residential area and Islington Park (Figure 5-3). Although the crane stabilisation may require some ground compaction in Islington Park, and the proposal area is located within 20 m of a mine subsidence district, there would be no impacts or restrictions in relation to mine subsidence.

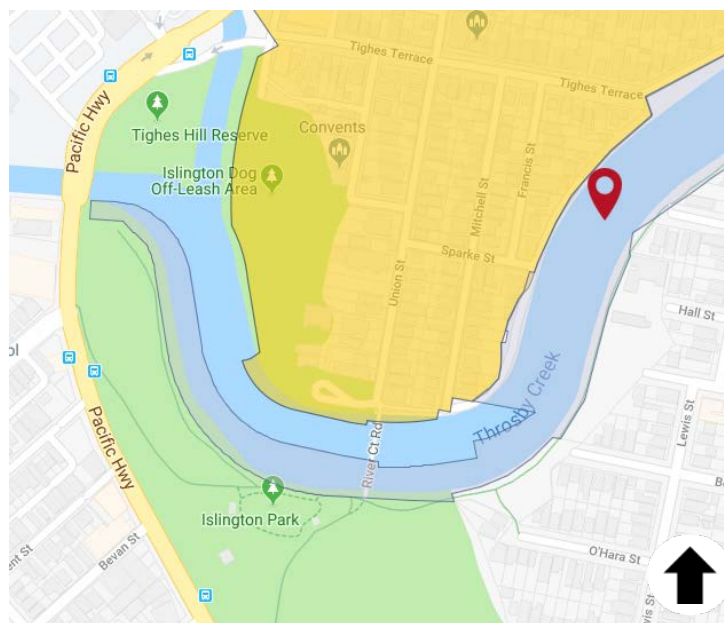


Figure 5-3 Mine subsidence in the Tighes Hill area (NSW Department of Planning & Environment, 2016).

### 5.1.2 Potential impacts

#### Construction

The proposed works would involve the dredging of around 200 m<sup>3</sup> to a depth of 1 m accumulated sediment and removal of juvenile mangroves surrounding mangrove islands 1 and 2. The excavated sediment would be removed from site immediately following dredging via dump truck and disposed of at an appropriate waste facility.

Removal of sediments and juvenile mangroves from the water column has the potential for sediment to disperse and travel downstream impacting localised and downstream water quality. These potential impacts would be mitigated through the implementation of sediment control measures such as boom nets and fencing.

There is potential for accidental chemical and fuel spills to occur during construction which may result in localised contamination of soils. Management measures, as discussed in Section 5.6.4, would be implemented to minimise this risk.

Sediment removed from Throsby Creek has a Class 1 high risk of ASS. Additionally, previous assessment of acid sulfate soil conditions and the impacts confirmed the presence of ASS within the proposal area (SCS, 2012). The disturbance of sediment during dredging has the potential to impact on land and water quality through the release of contaminants. Exposing contaminants, such as sulphides in the soil to oxygen (as a result of lowering the water table or excavation) can produce sulfuric acid, which may have a significant impact on the environment. Leaching of sulfuric acid into waterways can cause serious water quality problems, resulting in fish kills and damage to infrastructure. In small quantities, these materials can contaminate soil, limiting their ability to support vegetation. At higher levels, contaminants may run off into surrounding areas causing a pollution event and / or public safety risk. Runoff from contaminated excavations and spoil stockpiles also poses a risk to receiving environments.

The nearby contamination sites within the Tighes Hill and Islington area are not within close proximity of the proposal area and are unlikely to impact the proposal. Additionally, run off from neighbouring industrial areas and potential spills from high traffic areas along Maitland Road have the potential to contaminate the proposal area.

Acid sulfate soils have the potential to distribute sulfuric acid, iron, aluminium and heavy metals into the water column, impacting the water column.

There is potential for minor ground disturbance from the indicative crane stabilisation area and compound area via vehicle tracking and the crane working pad establishment. There would be no excavation required in these areas.

These potential impacts are considered manageable. Management of these risks would centre on removal of mangroves, installation and maintenance of sediment controls, as well as management of specific contaminants. An Acid Sulfate Soils Management Plan would be prepared.

## Operation

Post construction, materials required for the work pad area and compound area would be removed at the completion of the works. Areas disturbed by the indicative ground stabilisation area have potential to continue to be susceptible to erosion until groundcover is restored. These impacts are expected to be minimal, subject to the implementation of appropriate restoration measures.

### 5.1.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
<b>General Environmental</b>	<ul style="list-style-type: none"><li>A Construction Environmental Management Plan (CEMP) shall be prepared prior to the commencement of work and implemented through all phases of construction. The CEMP would provide the framework for the management of all potential impacts resulting from the construction work and would detail the environmental mitigation measures to be implemented throughout construction.</li></ul>



Impact	Safeguards and mitigation measures
<b>Soil management, erosion and sediment control</b>	<ul style="list-style-type: none"> <li>An Erosion and Sediment Control Plan (ESCP) will be prepared. The plan will be site specific, taking into account the specific nature of the work, such as including silt boom and curtain and sediment control fencing if required. The plan will be prepared in accordance with <i>the Blue Book</i> (Landcom, 2004)</li> <li>Sediment and erosion controls will be maintained during construction and adapted if required to ensure the objectives of the <i>Blue Book</i> (Landcom, 2004) are met</li> <li>A silt curtain will be used to fully contain all working sites including barge locations. Tidal influences will be considered when placing the curtain to avoid dragging and sediment disturbance.</li> <li>Areas of potential sediment exposure will be minimised</li> <li>Construction works will not be carried out in periods of forecast heavy rains or strong/gale wind warnings</li> <li>Sediments and vegetation would be disposed of at an appropriate licenced waste facility</li> <li>Vehicle and machinery movements will be restricted to established access tracks</li> <li>Vehicles and machinery must not be parked on native vegetated areas. Staff shall park at designated parking areas, existing cleared areas or exotic vegetated areas</li> <li>The barge would be launched from Carrington boat ramp or via crane to minimise soil disturbance</li> <li>Remediate disturbed areas to their pre-works condition as soon as practicable.</li> </ul>
<b>Acid Sulfate Soils</b>	<ul style="list-style-type: none"> <li>Prepare and implement an Acid Sulfate Soils (ASS) Management plan. At a minimum it must include methods to: identify; handle and store; treat and dispose; and to capture runoff from ASS.</li> </ul>
<b>Pollution/contamination</b>	<ul style="list-style-type: none"> <li>Trucks and machinery will be checked for leaks as per maintenance schedule or pre-start checks and appropriate spill kits will be available onsite at all times</li> <li>All chemicals and fuels will be stored in suitable bunded areas away from Throsby Creek. The capacity of the bunded area will be at least 110 per cent of the largest chemical container stored within the bunded area</li> <li>The excavated sediment will be removed from site immediately and transported to a licensed waste facility</li> <li>The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas</li> <li>No refuelling will take place on the barge</li> <li>Cease works immediately if contaminated soils are uncovered or suspected (due to odour or discolouration of soils). Contact the Hunter Water Project Manager to determine the appropriate management requirements.</li> </ul>
<b>Pollution incidents</b>	<ul style="list-style-type: none"> <li>Spill kits including a marine spill kit will be made available at the site at all times</li> <li>All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills</li> <li>The Project Manager and Hunter Water will be immediately notified if a pollution incident occurs.</li> </ul>

## 5.2 HYDROLOGY, CATCHMENT VALUES AND WATER QUALITY

### 5.2.1 Existing environment

Throsby Creek and its tributaries form a highly modified drainage system, collecting stormwater from the major part of central Newcastle and conveying it to Newcastle Harbour (NNC, 2004). The stormwater channel extends approximately 7 km south west (Figure 5-4).

Throsby Creek forms part of a drainage network extending throughout NCC area. The creek has a catchment area of approximately 3,000 ha within the NCC area as well as a small section of the Lake Macquarie City Council area (NCC 2004). Few places within Throsby catchment remain in a relatively

natural state with the majority of the drainage network being channelised in concrete stormwater drains. The land use in the Throsby catchment is predominantly residential, with some industrial and commercial (77%), some parks and recreational areas (14%) and bushland regrowth (7%). The section of Throsby Creek subject to the proposal is located in the public recreation area of Islington Park, with nearby residential areas. The proposal area is a marine environment, containing habitat for marine and bird species.

The tides in Throsby Creek are generally semidiurnal with two high tides and two low tides each day. Tidal heights reach lows of approximately 0.6 m and highs of approximately 1.8 m. There is approximately 6 hours in between high and low tides. The proposal is in a tidal area. The very low gradients for this part of the creek create a depositional environment, resulting in sediment accumulation. The lower section of the creek flows through the inner city suburbs of Islington, Wickham, Maryville and Carrington and has been the site of major restoration works as part of the implementation of the Throsby Creek Management Strategy. Dredging has been undertaken in the past in response to the large volumes of sediments that have accumulated over time.

Water quality in Throsby Creek is classified as fair (OEH, 2016). However, sediment accumulation in the watercourse from urban and industrial environments has impacted water quality. Hunter Water conducts limited stormwater sampling in Throsby Creek at the Hannell St Bridge. Water quality results indicate that (NNC, 2004):

- Dissolved oxygen concentrations remain reasonably constant in dry and wet conditions
- Faecal coliform levels are higher during rain events
- Suspended solids levels are of concern in Throsby Creek
- Phosphorous and nitrogen levels appear high if compared to ANZECC guidelines, however ANZECC suggest site specific studies be undertaken to determine desired levels for individual waterways.

The area has an annual rainfall of 1121 mm. Highest risk periods of heavy rain and localised flooding is between March and July (BOM, 2019).

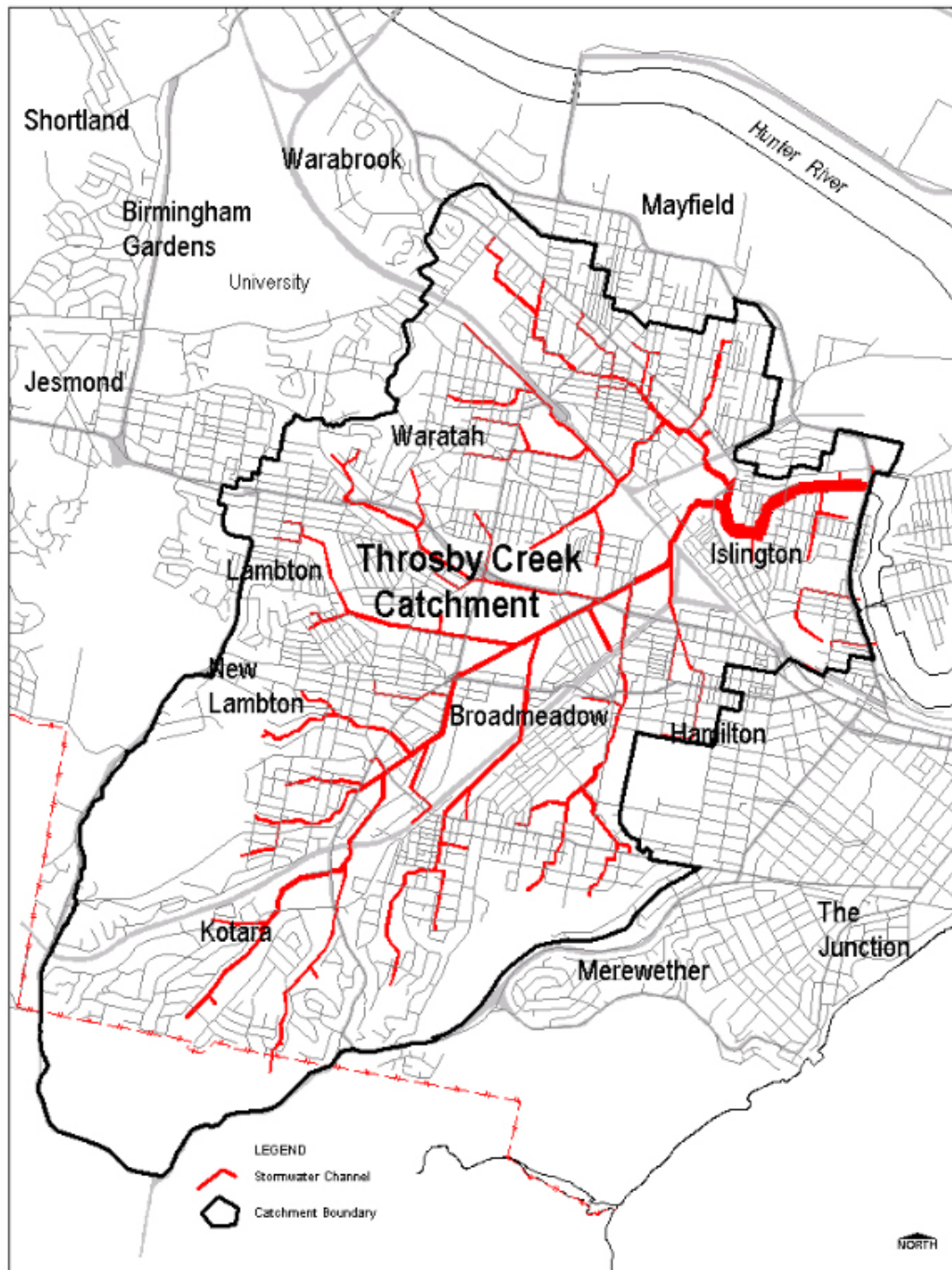


Figure 5-4 Throsby Creek catchment (NNC, 2004)

In the proposal area runoff drains toward Throsby Creek from the surrounding residential and recreational area. Additional surface drainage includes hard surface areas including car parks, roof tops and storage yards from industrial and commercial areas (NNC, 2004).

The proposed works are in a high flood risk area, with areas directly surrounding being classed as low to very low risk of flooding (refer to



Figure 5-5)(NCC, 2019). A baseline flooding assessment found the local flood levels to have risen 0.03 – 0.05 m as of 2016 when compared to the Newcastle City Council Flood modelling in 2008 (Syme and Ryan, 2008). Previous modelling has demonstrated that the increased flood levels are the result of local catchment runoff accumulation at shallow depths (Smith and Rahman, 2018).

Throsby Creek is a third order stream and classifies as Class 1 major fish habitat; the proposal area constitutes Key Fish Habitat under the FM Act. Throsby Creek is also within the Hunter Valley Alluvial Aquifer Groundwater Management Unit (GMU). The Hunter Valley Alluvial Aquifer GMU provides water to the Hunter River as baseflow during periods of above average rainfall and is an important source of groundwater for agricultural activities. The proposal area is subject to the Hunter Unregulated and Alluvial Water Sources Water Sharing Plans (WSP).



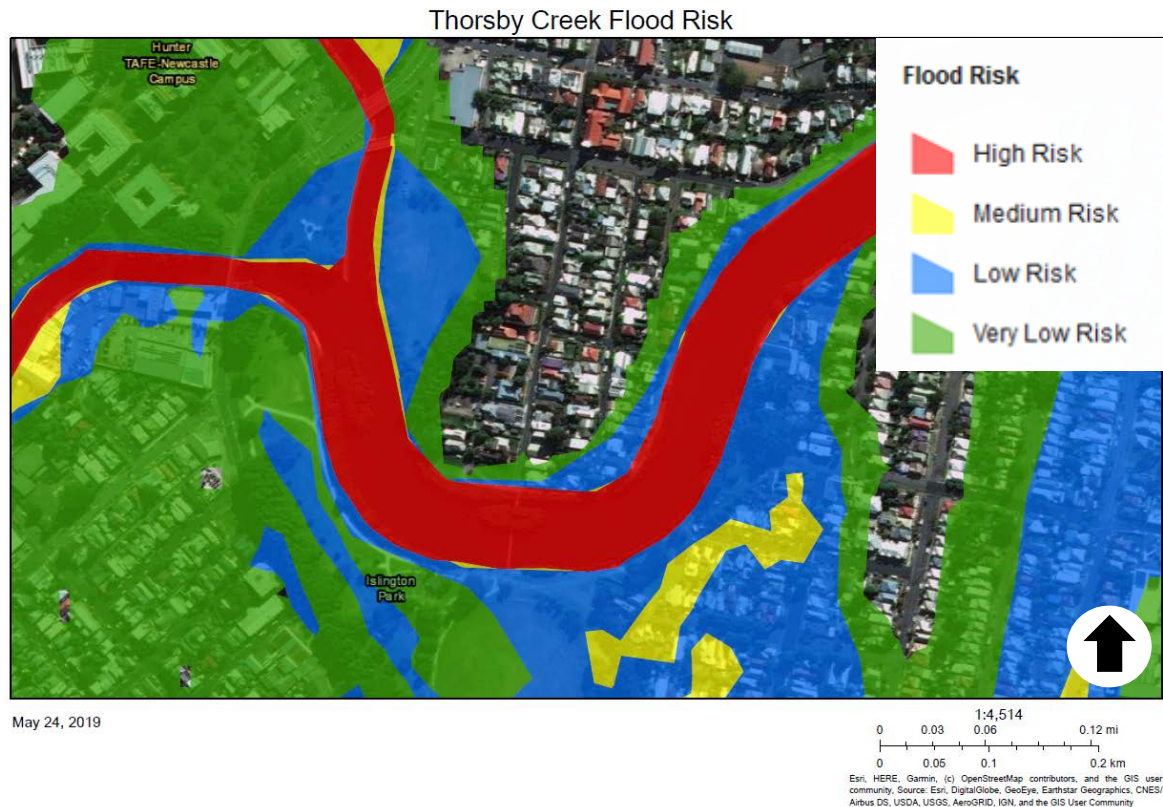


Figure 5-5 Flood risk of proposal area (NCC, 2019)

### 5.2.2 Potential impacts

#### Construction

The proposal would involve the dredging of accumulated sediment and removal of juvenile mangroves. The proposal area is subject to tidal influences. Tidal abnormalities may result from weather impacts such as wind, waves and moon phases. There is potential for the proposed work to disturb sediment resulting in transportation downstream. This would result in localised turbidity and may cause sedimentation in areas downstream of Throsby Creek, including Newcastle Harbour. To minimise impacts to water quality, sediment fencing and silt curtains would be installed during construction. Work would only be undertaken during low tide to minimise work within the water.

There is potential for the proposal to result in the pollution of Throsby Creek water quality. Contaminants may include potential spills of hydrocarbons (fuels, oils, lubricants) from the use of equipment, vehicles and machinery. Incorrect storage of fuel, oils and other chemicals could also result in impacts on water quality.

Dredging work would not be at a depth that would be expected to intercept groundwater.

In a flood event the proposal may become inundated, impeding construction and interfering with the implementation of mitigation measures.

Potential water impacts would be minimised through the implementation of the mitigation measures below.

## Operation

The removal of accumulated sediment, trimming overhanging mangroves and juvenile mangroves from the proposal area would result in increased capacity of Throsby Creek. The removal of the sediment would allow for greater water flow from the adjacent stormwater system having a long-term positive impact on the catchment.

### 5.2.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
<b>Flooding</b>	<ul style="list-style-type: none"> <li>As part of the construction environmental management plan (CEMP), a procedure will be prepared to identify potential flood threats and an evacuation procedure for dispersible materials, hazardous materials and equipment containing such materials. The procedure will include: <ul style="list-style-type: none"> <li>Regular consultation of the Bureau of Meteorology website for weather forecasts and flood warnings</li> <li>Where possible, schedule activities to avoid high flow periods</li> <li>A process for removing equipment and materials off site and out of flood risk areas quickly</li> <li>Storing and use of fuels, chemicals and extracted materials away from the water's edge, in bunded areas.</li> </ul> </li> </ul>
<b>Water contamination</b>	<ul style="list-style-type: none"> <li>Protection (e.g. sedimentation fencing) shall be provided for Throsby Creek to minimise runoff from the crane work pad and compound location into waterways and waterbodies</li> </ul>
<b>Tidal changes</b>	<ul style="list-style-type: none"> <li>Tidal changes will be monitored on a daily basis.</li> <li>Works will only be completed within the low tide times of each workday.</li> <li>The barge will be removed daily and stored within the compound area.</li> </ul>
<b>Soil management, erosion and sedimentation</b>	<ul style="list-style-type: none"> <li>Mitigation measures described in Section 5.1.3 will be implemented</li> </ul>
<b>Pollution/contamination</b>	<ul style="list-style-type: none"> <li>Mitigation measures described in Section 5.1.3 will be implemented</li> </ul>

## 5.3 BIODIVERSITY

### 5.3.1 Methodology

#### Database searches and literature review

Background searches were undertaken, including Commonwealth and State databases, to determine whether any threatened flora and fauna species, populations, ecological communities, migratory species and critical habitats, as detailed in State and Commonwealth legislation, occur or are likely to occur within the proposed works area. In addition to this, searches of the groundwater dependent ecosystems database, NSW Coastal Management SEPP, Department of Primary Industries (DPI) NSW Weed Wise database and DPI NSW Mapping of Estuarine Habitat were also undertaken. The results of the database searches are provided in Appendix A and Appendix C.

Table 5-2 Database searches for threatened species and communities, groundwater-dependent ecosystems and priority weeds

Resource	Target	Search date	Search area
<b>OEH BioNet Atlas (BioNet)</b>	Threatened flora and fauna species, populations and ecological communities listed under the BC Act	31/03/19	10 km radius of the proposal area
<b>OEH BioNet Vegetation Classification (BioNet VC)</b>	Plant Community Type (PCT) identification.	31/03/19	Proposal area
<b>EPBC Act Protected Matters Search Tool (PMST)</b>	Threatened flora and fauna, endangered populations and ecological communities and migratory species	31/03/19	10 km radius of the proposal area
<b>DPI Key Fish Habitat (KFH)</b>	Waterways that are likely to inhabit fish species	31/03/19	Proposal area
<b>Bureau of Meteorology National Atlas of Groundwater Dependant Ecosystems</b>	Vegetation communities that are likely to rely on groundwater.	31/03/19	Proposal area
<b>NSW Coastal Management SEPP</b>	Area for Coastal Wetlands, Proximity Area for Littoral Rainforests	31/03/19	5 km radius of proposal area
<b>DPI Mapping of estuarine habitats of NSW</b>	Estuarine habitat mapping	31/03/19	5km radius of the proposal area

Other literature relevant to this study was also reviewed and included:

- OEH Threatened Species Profiles
- Department of Environment and Energy (DOEE) EPBC Act Species Profiles and Threats Database (SPRAT) (DOEE 2018).

### Field survey

#### Weather conditions

Weather conditions during the field surveys are summarised in Table 5-3 (data from the Newcastle Research station AWS (station 061390) (BOM 2019).

Table 5-3 Weather condition at the time of surveys

Date	Temperature Min (°C)	Temperature Max (°C)	Rain (mm)	Moon	Survey type
20/3/19	20.0	24.4	0	N/A	Diurnal

#### Fauna survey

An investigation was conducted by an NGH ecologist via boat on 20 March 2019. The entire impact area was inspected, including areas adjoining but outside the proposed work areas. The site inspection included the identification of fauna species, potential biodiversity constraints and identification of habitat features within the proposal area.

### 5.3.2 Existing environment

#### Flora

The vegetation within the proposal area is dominated by aquatic habitat. Estuarine mangrove forests were identified within the study area from the DPI Estuarine habitat mapping (DPI, 2006). Onsite assessment determined one mangrove species, Grey Mangrove (*Avicennia marina*) to be present throughout the proposal area. This species is known to occur in the PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion that is classified as FM Act protected marine vegetation. However, as there is only one species present within the proposal area, the vegetation does not classify as part of a PCT.

The vegetation in the crane stabilisation area to the north of the proposal area and the compound area to the south east of the proposal are within Islington Park. The vegetation within the park is highly modified and mostly comprises scattered trees over exotic grasses (i.e. mown lawns).

#### Fauna

##### Threatened fauna

NSW Wildlife Atlas database searches for threatened species listed in the BC Act identified 49 threatened fauna species that are known or have potential to occur within the study locality. The EPBC Act protected matters search tool revealed 57 threatened fauna species records within 10km of the proposal locality. No threatened fauna species, or evidence of, were observed during the field surveys in March 2019.

A number of threatened fauna species have been previously recorded within or in close proximity to the proposal area. The closest historical observations to the proposal area include the Superb Fruit-dove (*Ptilinopus superbus*) located 400 m south east of the proposal, the Grey-headed Flying-fox (*Pteropus poliocephalus*) located 1.2 km east and the Eastern Osprey (*Pandion cristatus*) approximately 1.2 km south east. Onsite investigation found none of these species to be present within the proposal area.

##### Fauna habitat

The proposal area has moderate to good habitat values for migratory bird species. Key habitat values within the proposal area include:

- Mangrove forests – This estuarine vegetation occurs within the proposal area and provides foraging and roosting habitat for wading birds, smaller bird species and bats.
- Intertidal sandbanks and mudflats – Mud flats exposed during low tide events provide foraging habitat and in some cases roosting habitat for a range of shorebirds, including threatened and migratory species. The value of this habitat in the study area is limited by disturbance from recreational activities (such as dog walking, jogging, picnicking and other recreational activities) in the adjacent parkland and urban areas.
- Union Street walking bridge structure - The underside of bridges often provide roosting and breeding habitat for microbats, including the threatened Southern Myotis and Eastern Bentwing Bat. However, based on an inspection from boat, such habitat on the existing bridge structure appears to be limited.

Key habitat values within the locality of the proposal area include:

- Beaches - These beaches provide potential high tide roosting habitat for a range of shorebirds, including threatened and migratory species, and some areas also provides



potential nesting habitat for the threatened Australian Pied Oystercatcher. There are no beaches within the proposal area.

- Coastal Wetland – The mapped Coastal Wetland occurs approximately 1.5 km to the east proposal area. The habitat provides foraging and roosting habitat for wading birds such as herons, egrets, ibis and lapwings, as well as bats. There is no mapped coastal wetland within the proposal area. The Coastal Wetland would not be directly impacted by the proposal.
- Kooragang Island Wetland– Kooragang Islands Wetland forms part of the Hunter Estuary Wetlands Ramsar site which is located in the estuary of the Hunter River. The wetland is located approximately 5 km north east of the proposal area. The wetland does not occur within the proposal area. The wetland is a critical ecosystem to a number of threatened and migratory species, including waterbirds, the green and golden bell frog (*Litoria aurea*), as well as supporting *Sarcocornia* saltmarsh and intertidal mudflats. While the wetland would not be impacted by the proposed works, migratory species occurring at the wetland have the potential to occur in the proposal area.

### Aquatic environment

The estuarine habitat in the proposal area has been modified by stormwater infrastructure development and pollution. The north western portion of the proposal area has been cemented, beginning from approximately 75 m south east of Maitland Road the Junction with Styx Creek, with the conversion of the creek to a stormwater drain. The proposal area consists of a level stream bed and slow tidal moving water body, creating a depositional environment. Grey Mangroves line the banks of the proposal area and include one mangrove islands 1 and 2 (refer Figure 2-1). . Over time, mangroves surrounding Mangrove island 1 have become overgrown and now have low overhanging branches (Figure 5-6). Whilst no water quality test were conducted, observations during field surveys indicated that water quality was in poor condition.

Throsby Creek is a third order stream and classifies as Class 1 major fish habitat. The proposal area constitutes Key Fish Habitat under the FM Act. Downstream the proposal area drains to Newcastle Harbour, approximately 3.2 km to the south. The Koorangang Wetlands are located to the north.



Figure 5-6 Overhanging mangroves within the proposal area

### **Groundwater Dependent Ecosystem (GDEs)**

A search of the Bureau of Meteorology's National Atlas of GDEs on 7 April 2019 found that no vegetation within the study area has potential for groundwater dependent interaction.

### **Coastal Management SEPP**

A search of the Coastal Management SEPP 2018 on 7 April 2018 found that one Coastal Wetland is located approximately 1.5 km east of the proposal area. The Coastal Wetland would not be directly impacted by the proposal.

### **5.3.3 Potential impacts**

#### **Construction**

The proposal would have the following direct and indirect impacts to biodiversity:

- **Clearing of vegetation**

The proposal would result in the removal of juvenile mangroves that are established on the sediment surrounding the mangrove islands and trimming low hanging branches from Mangrove island 1. This would result in a loss of potential foraging habitat for small birds, waders and bats. However, given the large areas of mangroves and wetlands within the broader locality, the impacts of removal of this small area on such fauna would be minor. It is unlikely that any threatened waders would use this particular part of the study area, given its location adjacent to Islington Park and Maitland Road.

The vegetation within the crane stabilisation area and compound area is within areas that are already cleared. No vegetation would be cleared for the use these areas. Any impacts from the use of these areas would be minor.

- **Turbidity, sedimentation and erosion**

The removal of sediment has the potential to cause increased turbidity (suspended sediments). This has the potential to reduce light penetration and/or smother marine vegetation. Additionally, the use of boats to transport the barge downstream has the potential to cause erosion from excess white wash. The potential for increased turbidity through erosion and sedimentation and water-based construction work would be minimised through implementation of mitigation measures described in Section 5.3.4.

- **Disturbance to aquatic habitats and Key Fish Habitat**

The removal of sediment, overhanging branches and juvenile mangroves has the potential to cause disturbance to Key fish habitat and aquatic habitat features, such as mature mangroves. The dredging process has the potential to disturb root structure and pneumatophores, cause contamination from fuels and lubricants and transport sediments downstream. There would be no impacts to Key Fish Habitat given the habitat available in the surrounding areas or from potential for blocking fish passage. Impacts to aquatic habitat would be managed by standard controls set out within a site ESCP.

- **Injury and mortality of fauna**

There would be potential impact to native fauna during proposal work as a result of accidental injury or mortality. Migratory shorebirds would be most at risk through vehicle and boat movements in and near their intertidal habitats. Mitigation measures would be implemented to minimise potential for injury and mortality of fauna.

- **Introduction of weeds**

There would be potential for weeds to be introduced and spread to the parklands surrounding the proposal area and Throsby Creek by vehicles, machinery and equipment during construction. However, vegetation that would be impacted by the proposal occur in highly modified and mostly comprises scattered trees over mown lawns. Additionally, no water weeds were identified within the proposal area. Mitigation measures have been advised in Section 5.3.4 to avoid any introduction of weeds. It is therefore unlikely that any increased weed occurrence would be significant on present vegetation.

- **State and national listed threatened species and communities**

No state or nationally listed threatened species or communities were identified within the proposal area. There would be no significant impacts caused from the proposed works.

## **Operation**

The removal of sediment has the potential to remove foraging habitat for migratory shore birds and impact Key Fish Habitat. However, given the small volume of sediment and small number of juvenile mangroves to be removed from the broader locality, the impacts are considered minor.

### 5.3.4 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
<b>Clearing and prevention of over-clearing</b>	<ul style="list-style-type: none"> <li>• Prior to the commencement of any work, a physical clearing boundary using stakes and flagging tape is to be demarcated and implemented. Clearing would not occur outside of the area identified in this assessment</li> <li>• Compound facilities and the crane staging area will be located in cleared areas outside the tree protection zone</li> </ul>
<b>Turbidity, sedimentation and erosion</b>	<ul style="list-style-type: none"> <li>• All instream works will be undertaken in a manner that reduces potential for increased turbidity</li> </ul>
<b>Direct impact to threatened fauna</b>	<ul style="list-style-type: none"> <li>• An unexpected threatened species finds procedure will be developed prior to commencement of work, with detail included in site inductions and toolbox talks as to potential threatened species encountered, and actions to be taken when encountered</li> </ul>
<b>Accessing the waterway</b>	<ul style="list-style-type: none"> <li>• Vehicles and machinery are kept away from the banks of a waterway where possible.</li> <li>• Boats or other watercraft are used in a manner so as to avoid boat wash that could cause erosion of the banks.</li> </ul>
<b>Disturbance to aquatic habitats and Key Fish Habitat</b>	<ul style="list-style-type: none"> <li>• Work will be undertaken in accordance with a permit issued under the FM Act for the removal of mangroves.</li> <li>• No mangroves will be removed that exceed 3 cm in diameter at a height of 60 cm.</li> <li>• Clearing will not occur during periods when flooding is likely to occur.</li> <li>• Sediment control barriers within aquatic habitats will be removed as soon as practicable and in a manner that does not promote future channel erosion.</li> <li>• Work will be undertaken during low tide</li> <li>• Silt screens will be inspected each shift</li> <li>• Works will be restricted to calm weather conditions</li> <li>• Should any fish kills occur during construction, all work will stop and HWC and DPI (Fisheries) contacted immediately.</li> <li>• Silt booms will not extend across the creek from bank to bank to avoid blocking fish passage.</li> </ul>
<b>Accidental spills and contamination from construction activities (including compound sites)</b>	<ul style="list-style-type: none"> <li>• Mitigation measures described in Section 5.1.3 and Section 5.1.4 will be implemented</li> </ul>
<b>Erosion and sedimentation</b>	<ul style="list-style-type: none"> <li>• Mitigation measures described in Section 5.1.3 will be implemented</li> </ul>
<b>Introduction and spread of priority weeds and pathogens</b>	<ul style="list-style-type: none"> <li>• In the event priority weeds are identified within the proposal area, they will be treated prior to construction with methods and agents suitable for use near waterways</li> <li>• Construction machinery will be cleaned using a high-pressure washer (or other suitable device) prior to being transported to site.</li> </ul>

## 5.4 NOISE AND VIBRATION

### 5.4.1 Existing environment

The proposal is located adjacent to a recreational area and in close proximity to residential lots. The indicative crane stabilisation area is located within Islington Park to the north of the proposal area, while the compound area is located to the south east of the proposal within Islington Park between O'Hara Street

and Bell Street. Sensitive receivers nearby include residents along O'Hara Street, Bell Street and Union Street and the recreational users of Islington Park to the south and north west.

The Roads and Maritime construction noise estimator tool was used to estimate impacts to nearby receivers. The nearest sensitive receiver is 10 m north of the crane stabilisation area and 30 m from the proposal. Vegetation obstructs the line of sight between the sensitive receiver and proposed work.

The receiving environment was classed as an R2 noise area category based on the traffic volume within a 2 km radius carrying over 30,000 Annual Average Daily Traffic (AADT). In accordance with the estimator tool, a construction noise impact assessment, using the Distance Based Assessment (Noisiest Plant) with a 13.5 Tonne Excavator selected as the Noisiest plant equipment, has been undertaken for the works (Appendix A.4).

During the site inspection in March 2019 it was noted that there were a variety of noise sources that contributed to the background noise in the area. The main sources of noise is road traffic, particularly along Maitland Road, which is a two-lane bidirectional road providing access between the southern and northern suburbs of Newcastle. Noise levels appeared to be typical of an urban residential environment.

### **5.4.2 Potential impacts**

#### **Construction**

In total, the proposal would be likely to take up to twelve weeks to complete with construction commencing in August to October 2019. Construction activities would be limited to 7am – 6pm, Monday to Friday, 8am to 1pm Saturdays and no work on Sundays or public holiday within low tide daily. The low tide working hours would last approximately five hours.

Aspects of the proposed work are likely to have noise and/or vibration impacts on nearby sensitive receivers. These are:

- Material delivery– noise and vibration may be emitted by the stabilisation for the crane. This would be stabilised using mobile crane stabilisation pads. Noise would be emitted by construction machinery
- Excavation works within Throsby Creek channel
- Mangrove removal.

#### **Noise criteria and assessment**

The assessment was based on the potential impacts to residence from the crane stabilisation area, with a 13.5 tonne excavator at a distance of 10m, as these residences were the closest to impact areas for the proposal. This is expected to be the worst case scenario and take into consideration all possible noisiest plant equipment.

The assessment identified residential receivers within 85 m of the proposal area may be impacted by the proposal during dredging works. For the R2 category (day works), the Rating Background Noise (RBL) is 45dB(A) and the Noise Management Level (NML) is 55dB(A). The nearest receivers are suburban and fall below the 'highly intrusive' noise level distance (>30 dB(A) above noise background level). Therefore, it is estimated that the construction noise levels would be within the >75dB(A) range. With this information, mitigation measures have been recommended in Section 5.3.4.

The RMS noise calculator outputs are a recommendation only; following review of the recommended measures all reasonable and feasible measures have been proposed.



## Vibration criteria and assessment

Activities that are expected to generate intermittent vibration during construction include the use of an excavator to excavate the sediment from the proposal area. The *Management of Noise and Vibration: Construction and Maintenance Activities* (South Australia Department of Planning, Transport and Infrastructure, 2015) provides indicative vibration levels for construction activities. The indicative vibration level for an excavator is 0.2 millimetre per second at 40m; this activity would be undertaken approximately 10m from the closest residential receiver. Vibration impacts are not expected to be significant during construction. With the implementation of safeguards and mitigation measures described in Section 5.4.3 it is not expected that these levels would be exceeded.

## Operation

The operation of the proposal would not alter the existing noise and vibration environment and no adverse impacts are expected.

### 5.4.3 Safeguards and mitigation measures

Impact	Mitigation measures
<b>General/Site management issues</b>	<ul style="list-style-type: none"> <li>All employees, contractors and subcontractors are to receive an environmental induction and should instruct all persons at the site with regard to all relevant project specific and standard noise mitigation measures detailed herein including permissible hours of work; limitations on high noise generating activities; location of nearest sensitive receivers; construction employee parking areas; designated loading/unloading areas and procedures; site opening/closing times (including deliveries); and environmental incident procedures.</li> </ul>
<b>Hours of work</b>	<ul style="list-style-type: none"> <li>Construction will be undertaken during standard work hours only: <ul style="list-style-type: none"> <li>Monday to Friday – 7am – 6pm</li> <li>Saturday – 8am to 1pm</li> <li>No work Sundays</li> <li>Within low tide daily.</li> </ul> </li> <li>If works are required outside the above standard construction hours additional approval from HWC will be sought prior to commencing out of hours work.</li> </ul>
<b>Noise controls</b>	<ul style="list-style-type: none"> <li>As per the RMS maintenance noise estimator, impacted residence are to be notified via: <ul style="list-style-type: none"> <li>Letter box notification</li> <li>Phone calls</li> <li>Respite offer</li> </ul> </li> </ul>
<b>Source control</b>	<ul style="list-style-type: none"> <li>Avoid unnecessary revving of engines and turn off plant that is not being used / required.</li> <li>Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms.</li> <li>Where possible, the use of tonal reverse alarms shall be avoided.</li> <li>Site set up / movement of plant / delivery of materials / waste removal to site will be restricted to the standard construction hours.</li> <li>Truck drivers are to be informed of site access routes, acceptable delivery hours and must minimise extended periods of engine idling.</li> <li>Ensure there is no unnecessary shouting or loud stereos/radios on-site. There must be no dropping of materials from heights, throwing of metal items, or slamming of doors.</li> <li>Equipment must be inspected on a regular basis and maintained as necessary, to ensure it is in good working order. This must include inspections of the condition and performance of mufflers.</li> <li>Use less noise intensive equipment where reasonable and feasible.</li> <li>Where practical the crane will be positioned as far away as possible from sensitive receivers.</li> </ul>

Impact	Mitigation measures
	<ul style="list-style-type: none"> <li>• Use lower impact or low tonnage equipment where possible.</li> <li>• Routing, operating or locating high vibration sources as far away from sensitive areas as possible.</li> </ul>
<b>Community response to noise and vibration</b>	<ul style="list-style-type: none"> <li>• A dedicated person will form a point of contact for the dissemination of general information regarding site operations. Contact persons will also be defined to receive comment or complaints from the community.</li> <li>• Upon receiving any complaint regarding construction activities, the nominated contact must investigate the source of the complaint. The aim will be for a Project representative to initiate a complaint investigation and to respond to all complaints as soon as possible. Where practicable a visit should be made to the complainant to verify the nature of the complaint and if justified appropriate action should be taken to cease or amend the activity causing the complaint.</li> <li>• A Complaint Management procedure will be developed and implemented by the contractor. The Complaint Management procedure will at a minimum include</li> <li>• Notification to residents will be done at least 5 days prior to work commencing including the nature and estimated timescales for completion of the proposed work.</li> </ul>

## 5.5 TRAFFIC AND ACCESS

### 5.5.1 Existing environment

Maitland Road is a key local road running parallel to Islington Park south of the proposal area. Maitland Road is a major route that joins the New England Highway approximately 7 km north west of the proposal and stretches approximately 30 km from Newcastle to Maitland. The speed limit directly surrounding the proposal area is 50 km/hr.

A number of local residential roads are located to the north and east of the proposal. Key local roads accessed for the proposal include (see Figure 2-2):

- Union Street – Runs north to south, north of the proposal. The most southern end of the road is located within 20 m of the proposal area. The road provides direct access to the Union Street Footbridge and to Islington Park, north west of the proposal area.
- Bell Street – Runs east to west, south east of the proposal area and provides direct access to the waterfront. The road is located north of O'Hara Street and approximately 30 m from the proposal and 10 m from the compound area. This is the preferred access route.
- O'Hara Street - Runs east to west, south east of the proposal area and provides direct access to the waterfront. The road is located approximately 70 m south of Bell Street. The far western end of the road is located approximately 50 m from the proposal area and 10 m from the compound area; this is also the edge of Islington Park.

Islington Park is located directly south and north west of the proposal area. A concrete shared use path runs parallel to the proposal through Islington Park to the south. The path leads to the Union Street footbridge from Islington Park in the south to Union Street; the track is well used by the public.

Carrington boat ramp is the main boat ramp to access Throsby Creek in the Newcastle area. The boat ramp is approximately 2 km downstream, east of the proposal area. The boat ramp is frequently used for recreational and commercial purposes.

### 5.5.2 Potential impacts

#### Construction

During construction the proposal would result in temporary restrictions to vehicle and pedestrian access to construction areas, including boat and recreational water craft on Throsby Creek. Additionally, there may be temporary access restrictions for users of the cycle path from the establishment of the temporary compound area. There would be minor disruptions to traffic flows along Maitland Road, Bell Street and Union Street whilst equipment and machinery are being transported to the compound area and potential barge launch area. Traffic would include construction workers, delivery trucks and other machinery required to undertake the works. Vehicle movements would vary throughout construction, with most traffic required at establishment and conclusion of construction. Additional traffic during construction would include movement of excavated sediment. Movement of construction traffic would be limited within peak traffic times to reduce impacts on traffic flows.

Direct access for the barge to Throsby Creek is via Carrington boat ramp. Users of Carrington boat ramp may be temporarily delayed. The use of the barge for the proposal is not expected to adversely affect Carrington boat ramp users. The barge would be removed from Thorsby Creek daily and stored within the compound area.

Launching the barge via crane has been recommended as a secondary access option. The users of Islington Park and residences along Union Street are likely to experience some impacts associated with temporary disruptions to access and temporary increased traffic. Residents would be notified in advance of any disruptions to access and consultation would occur prior to work. Access impacts would be limited in duration within the first four weeks of construction due to the majority of the works being completed within this time. Residential access would remain made available however, where residential access is impacted, alternate access arrangements, such as parking on the street, would be offered.

A temporary compound area may be located within Islington Park in between O'Hara and Bell Street. The site is the most easily accessed location from the south of the site that is in the most discrete area of Islington Park as to not disturb access or create additional noise and visual impacts to park goers. The dual lane access provides sufficient parking for the workers so that residents would be unlikely to be impacted by the works.

Any potential impacts would be minimised through the implementation of the safeguards and mitigation measures outlined below.

#### Operation

Following the completion of construction, vehicle movements would return to pre-construction volumes.

### 5.5.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
Traffic and access impacts	<ul style="list-style-type: none"><li>• Implement a Traffic Control Plan (for land and water movements) prior to works commencing.</li><li>• Residences along Union Street, O'Hara Street and Bell Street Drive will be notified prior to works commencing. This notification will specify the planned duration and extent of the works</li><li>• Users of the Carrington Boat ramp will be notified via signage of scheduled barge launch periods and extent of works</li><li>• All heavy vehicles will travel within daylight hours</li><li>• Vehicle movements will be restricted to the minimum necessary to complete the proposed work</li></ul>

Impact	Safeguards and mitigation measures
	<ul style="list-style-type: none"> <li>• Vehicle movements will be programmed out of peak periods where possible</li> <li>• When on site, plant movements and construction parking will only occur within designated areas</li> <li>• Access impacts to residences shall be limited in duration.</li> </ul>

## 5.6 AIR QUALITY, RESOURCES AND WASTE

### 5.6.1 Policy setting

#### Air quality

Smoky emissions from construction plant and vehicles would be maintained to Australian Standards. The *Protection of the Environment Operations Act 1997* (POEO Act) requires that no vehicle shall have continuous smoky emissions for more than 10 seconds.

#### Waste

Legal requirements for the management of waste are established under the POEO Act and the *POEO (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under section 143 of the POEO Act.

Waste management would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The objectives of this Act are:

- (a) *to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,*
- (b) *to ensure that resource management options are considered against a hierarchy of the following order:*
  - i. *avoidance of unnecessary resource consumption,*
  - ii. *resource recovery (including reuse, reprocessing, recycling and energy recovery),*
  - iii. *disposal,*
- (c) *to provide for the continual reduction in waste generation,*
- (d) *to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste,*
- (e) *to ensure that industry shares with the community the responsibility for reducing and dealing with waste,*
- (f) *to ensure the efficient funding of waste and resource management planning, programs and service delivery,*
- (g) *to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis,*
- (h) *to assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997.*

## **5.6.2 Existing environment**

### **Climate and air quality**

The closest BoM weather monitoring site in the vicinity of the proposal is the Newcastle all weather station (AWS) (061390). The recorded mean maximum temperature in Newcastle is 21.8°C and the recorded mean minimum temperature is 14.3°C.

Within the Newcastle locality, the major air emissions and pollutant sources arise from vehicular and rail traffic, as well as existing agricultural and industrial activities in the Hunter region (Department of Industry, 2019).

### **Waste**

Throsby Creek is subject to a number of pollution issues, including:

- Litter accumulation amongst the mangroves and tidal sections of the catchment
- Grass clippings and garden wastes in close proximity to channels
- Sedimentation loads from denuded banks, roads and median strips (NNC, 2004).

A site visit on 13 March 2019 showed that the existing sources of waste at the proposal area include sediment, domestic rubbish from pedestrians or rubbish transported in the waters of Throsby Creek.

## **5.6.3 Potential impacts**

### **Construction**

#### **Climate and air quality**

During the proposed work, the following activities are likely to temporarily affect local air quality:

- Use of construction vehicles and equipment leading to the creation of exhaust fumes
- Minor excavation works associated with dredging
- Movement of vehicles and machinery along unsealed accesses

Dust and fumes associated with the above activities would be temporary. Sensitive receivers, predominantly residential properties, are located in close proximity to the proposed work. Dust generation would be limited to the construction phase of the project and would be minimised through the implementation of the mitigation measures below. It is considered that air quality impacts during construction would be highly manageable and temporary.

Construction activities involve several factors that can impact on global climate through the release of greenhouse gas emissions and reduction of the ability of the environment to take up carbon dioxide. These include:

- Burning of fossil fuels used in construction equipment
- Greenhouse gas emissions associated with the extraction or production of resources used in construction
- Generation of waste products that can release greenhouse gas emissions (depending on waste type and treatment)
- Removal of vegetation which would otherwise take up carbon dioxide for use in photosynthesis

Although the proposal is likely to contribute to global climate change as a result of these factors, the contribution of the activity is considered to be a very small part of a much wider issue, climate change is a



result of the cumulative effect of millions of similar activities.. Any potential impacts would be minimised through the implementation of the mitigation measures below.

### **Resources and waste**

Materials required for the works are not rare or in short supply. Fuel to operate machinery would be consumed during the construction phase of the project. In the long term, the proposal would not require any additional input of resources. Natural resource impacts are considered to be minor.

Waste produced as part of the construction of the proposed works would include:

- Cleared and trimmed vegetation
- Dredged sediment
- General waste from staff (lunch packaging etc).

Excavated sediment would be removed from site immediately following dredging via dump truck and disposed of at an appropriate waste facility.

If waste is not adequately managed, it can have a range of possible impacts, including a loss of potentially recoverable resources and contamination of the site and surrounding environment. Due to the nature and scale of the proposal, waste impacts would be minimal. Potential impacts would be minimised through the implementation of the mitigation measures below.

### **Operation**

No air quality or waste impacts are expected to be generated during the operation phase as a result of the proposed work.

#### **5.6.4 Safeguards and mitigation measures**

Impact	Safeguards and mitigation measures
<b>Dust generation</b>	<ul style="list-style-type: none"><li>• All loads of material transported to and from site will be covered.</li><li>• Construction activities that have the potential to generate dust shall cease in excessively windy conditions.</li></ul>
<b>Emissions</b>	<ul style="list-style-type: none"><li>• Vehicles will be maintained to manufacturer's standards and regular checks will be made to ensure there are no continuous exhaust emissions of 10 seconds or longer.</li><li>• The contractor will limit idle time of plant and equipment.</li></ul>
<b>Waste generation</b>	<ul style="list-style-type: none"><li>• General waste and recycling receptacles will be provided onsite.</li><li>• Working areas shall be maintained, free of rubbish and cleaned up at the end of each working shift</li><li>• All waste shall be managed in accordance with the <i>Protection of the Environment Operations Act 1997</i> and disposed of at facilities licensed to accept the waste.</li><li>• Mitigation measures described in Section 5.1.3 will be implemented for the removal of sediment.</li></ul>

## **5.7 SOCIO-ECONOMIC IMPACTS**

### **5.7.1 Existing environment**

The proposal is located in the suburb of Islington. As of 2016, the Newcastle LGA has a population of 155,411 (ABS, 2016a), while Islington had a population of 1,883 (ABS, 2016b). Further suburbs surrounding the proposal area include Tighes Hill and Maryville. As of 2016, Tighes Hill had a population of 1,680 (ABS

2016c), while Maryville had a population of 1,444 (ABS, 2016d). The locality has a mixture of residential dwellings to the north and east of the proposal and a mixture of business' and higher education facilities to the west.

The proposal area is surrounded by Islington Park which is on the edge of an urban area to the north and east. A public shared use path runs through the centre and north of Islington Park generally along the south bank of the creek. The Union Street Footbridge forms part of the boardwalk/cycleway located over the centre of the proposal area and is the main route for park users to move between Islington Park south of Throsby Creek and the north of Throsby Creek. The suburb of Tighes Hill is located north of the proposal area, which includes residential dwellings, while the suburb of Islington is located to the east and south of the proposal. Residences are also located to the east of the proposal area in Islington. Maitland Road is located to the south west of the proposal area and includes residence, small business and the Tighes Hill TAFE facility (see Figure 2-1).

Carrington Boat ramp is the main boat ramp to access Throsby Creek in the Newcastle area. The boat ramp is approximately 2 km downstream, east of the proposal area. The boat ramp is frequently used for recreational and commercial purposes.

Sediment accumulation and human pollutants, such as pollution from recreational users and runoff, has caused the creek to be polluted, resulting in poor water quality and the ban of recreational fishing in Throsby Creek. Landcare management in the area has planted mangroves on the edge of the creek and in the form of two mangrove islands to achieve natural catchment values (NNC, 2004). However, as a result, sediment has accumulated around both the mangrove islands, at times producing an odour from exposed sediment at low tide; complaints from residents about the odour have been received by HWC.

### **5.7.2 Potential impacts**

#### **Construction**

There is potential for temporary traffic disruptions to boat and motorists of Carrington boat ramp, however, this is likely to be negligible given the large size of the boat ramp area. These issues are discussed further in Section 5.5.2.

The park facilities, including the playground, picnic, fitness equipment and cycleway, would remain operational during construction. Users of Islington Park to the south and north west of the proposal and residences to the north and east of proposal may be subject to amenity impacts including noise and visual (discussed in Section 5.4 and Section 5.6, respectively). The proposal would not result in a direct impact on local businesses.

#### **Operation**

The proposal would improve the amenity and character of the area by improving the odours that are present with the current exposed sediment at low tide.

### **5.7.3 Safeguards and mitigation measures**

No additional safeguards or mitigation measures are required. Implement safeguards and mitigation measures as per Traffic and Access (Section 5.5).

## 5.8 LANDSCAPE CHARACTERISTICS AND VISUAL AMENITY

### 5.8.1 Existing environment

Throsby Creek is approximately 65 m wide within the Islington and Tighes Hill locality. The embankment of the study area is well vegetated with large mangroves established.

The proposal area is located in a residential area adjacent to Islington Park. To the north of Islington Park is a Council designated off-leash dog-friendly park, and to the south of the proposal is play equipment, cooking facilities, fitness equipment and a cycle track. Additional key sensitive receivers in the vicinity of the proposal area include:

- Residential area, directly north and east of the proposal area
- Road users of Maitland Road
- NSW TAFE higher education facility, approximately 100 m west of the proposal.

### 5.8.2 Potential impacts

#### Construction

Visual impacts during construction of the proposal would be experienced due to the removal of juvenile mangroves from the accumulated sediment surrounding the two mangrove islands, trimming of low hanging mangrove branches and the presence of works areas, including plant and equipment. Views of construction would primarily be available from Islington Park, residential properties within 50 m of the proposal area and users of Maitland Road. Views of the construction would also be available from the creek. The construction period is expected to be up to 12 weeks, however, work would be contained to ensure there would be minimal impacts to nearby residents. Any potential impacts would be minimised through the implementation of the mitigation measures below.

#### Operation

There would be minor changes to the visual characteristics of the site following the completion of the works, primarily associated with vegetation and sediment removal.

The existing mangrove screen would obscure the removed sediment and vegetation from north and south of the proposal. Residents and road users would not be directly impacted by the proposed works. As road users are transient receivers that are not very sensitive to change, impacts are considered negligible. The proposal would not be expected to have a detrimental impact on the visual amenity of the site and would be consistent with the existing activities and infrastructure.

### 5.8.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
Visual impacts	<ul style="list-style-type: none"><li>• Vegetation removal and site disturbance will be kept to a minimum</li><li>• Work areas shall be maintained in a tidy manner at all times</li></ul>

## 5.9 INDIGENOUS HERITAGE

### 5.9.1 Existing environment

A desktop assessment was undertaken to determine the Indigenous heritage values of any objects or places within the proposal area. Throsby Creek and the surrounding area are the location for a number of registered Aboriginal sites. A search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on 6 May 2019. The AHIMS search identified no Aboriginal sites and no Aboriginal places recorded within a 50 m buffer of the proposal area, while two sites were recorded with a 1 km buffer of the proposal area (refer to Appendix B). Consultation with the HWC Archaeologist did not identify any specific locations of cultural significance within the proposal area.

### 5.9.2 Potential impacts

#### Construction

The desktop assessment revealed that indigenous heritage items within the locality of Islington and Tighes Hill are located outside of the proposed works. The proposal would not impact on any known indigenous heritage item. Given the proposal area is highly disturbed, it is highly unlikely that indigenous archaeological remains may be discovered.

*The Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* outlines a range of landscape features that have higher potential to contain Aboriginal objects. These include land that is within 200 m of water (OEH, 2010). The creek, creekbank and at least 200 m from the creek would be considered a sensitive landform feature. However, as Throsby Creek is a modified water course and the works would be confined within the banks and would not require ground disturbance outside of the current high water mark, there is very low likelihood that the works would result in harm to Aboriginal objects. Any potential impacts would be mitigated with the implementation of safeguards in Section 5.9.3.

#### Operation

There would be no impacts to Indigenous heritage during operation.

### 5.9.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
<b>Indigenous heritage impacts</b>	<ul style="list-style-type: none"> <li>The site personnel shall receive basic training in the recognition of Indigenous Cultural Heritage material and sites as part of induction prior to works commencing</li> <li>When any sediment excavation removal activities are conducted, workers shall be observant and keep a look out for; surface shell, bone, rocks or any other Indigenous Cultural Heritage material</li> <li>In the event that an Aboriginal object (or objects) is uncovered during the proposed works, ground disturbance works should cease within 20 metres of the object(s) and the Hunter Water Archaeologist should be contacted. The Hunter Water Archaeologist will advise OEH and the relevant Aboriginal parties so that appropriate management strategies can be identified.</li> <li>If any suspected human remains are discovered and/or harmed, the following actions will be taken: <ul style="list-style-type: none"> <li>Work will immediately cease;</li> </ul> </li> </ul>

Impact	Safeguards and mitigation measures
	<ul style="list-style-type: none"> <li>○ No further harm will occur to the remains;</li> <li>○ The area will be secured to avoid further harm;</li> <li>○ the relevant manager of the proposed works will be informed and will contact the Hunter Water Archaeologist who will in turn contact local police, OEH and the Heritage Branch;</li> <li>○ if the remains are identified as forensic the area is deemed as crime scene;</li> <li>○ if the remains are identified as Aboriginal, the site is to be secured and OEH and all registered Aboriginal parties are to be notified in writing; or</li> <li>○ if the remains are non-Aboriginal (historical) remains, the site is to be secured and the Heritage Branch is to be contacted; and</li> <li>○ this process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (NSW Police Force, forensic anthropologist, OEH, Heritage Branch, registered Aboriginal parties etc) and in accordance with the <i>Public Health Act 1991</i>.</li> </ul>

## 5.10 NON-INDIGENOUS HERITAGE

### 5.10.1 Existing environment

A desktop assessment was undertaken to determine the heritage values of any objects or places within the proposal area, with a particular focus on the suburb of Islington and Tighes Hill. Heritage database searches were conducted on 17 March 2019 (refer to Appendix A) and included:

- The NSW State Heritage Inventory (SHI) (for items listed on the State Heritage Register, Heritage and Conservation Registers of State Government agencies and local heritage items on the Lake Macquarie City Council Heritage Schedule)
- The Australian Heritage Database (for items listed on the National and Commonwealth Heritage Lists and World Heritage List).

The breakdown of results of identified items is provided below.

Table 5-4 Summary of heritage findings

Register	Listings
Islington Local Heritage Schedule	18
Tighes Hill Local Heritage Schedule	9
National Estate	1

### 5.10.2 Potential impacts

#### Construction

The desktop assessment revealed that heritage items within the locality of Islington and Tighes Hill are located outside of the proposal area. The proposal would not impact on any known heritage item. It is also



considered unlikely that any previously undiscovered heritage items occur within the proposal area. Given the proposal area is highly disturbed, it is unlikely that archaeological remains would be discovered. Mitigation measures have been would be implemented in the event of an unexpected find.

## Operation

There would be no impacts to non-Indigenous heritage during operation.

### 5.10.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures
<b>Unexpected finds</b>	<ul style="list-style-type: none"><li>• Staff working at the site during construction will be instructed to stop work immediately on identification of any suspected heritage artefact</li><li>• If any items suspected of being of historic value are uncovered during the works, works must cease in the vicinity of the find, HWC contacted and advice sought from a suitably qualified heritage consultant.</li></ul>

## 5.11 CUMULATIVE IMPACTS

### 5.11.1 Policy setting

There is a requirement under Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* to take into account any cumulative environmental impacts with other existing or likely future activities. Cumulative impacts relate to the combined potential effects of different impact areas of the proposal as well as the potential interaction with other proposal in the local area.

### 5.11.2 Potential impacts

Key adverse cumulative impacts for the proposed works relate to the combined impact from proposed construction activities, namely community amenity and traffic and access impacts, coinciding with other development activities in the area.

Currently residential development is occurring on the bank to the south, approximately 200 m east of the proposal site. No other developments are known in the area. There is potential that further dredging in Throsby Creek would be undertaken at a future date.

The proposed works are located in an urban area where traffic, noise and general infrastructure works are moderate. Construction of the adjoining residential development would occur concurrently with this development, however, due to the short construction period, cumulative impacts are expected to be low. The effects would be minimal due to the limited scope of works for the activities covered in this REF. Potential impacts on the environment would be minimised with the implementation of the safeguards given in Section 6 in this REF.

### 5.11.3 Safeguards and mitigation measures

Adverse cumulative impacts relate to the construction phase of the proposed works. Cumulative impacts are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

## 5.12 PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

### 5.12.1 *The precautionary principle*

According to the precautionary principle, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be seen as a reason not to protect the environment. The use of the precautionary principle implies that proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

The precautionary principle has been applied in assessing conservation values and environmental threats and impacts associated with works proposed throughout this REF. The development of mitigation measures and safeguards to manage impacts aims to reduce the risk of serious and irreversible impacts on the environment.

Generally, throughout this assessment, there has been a low level of uncertainty in regard to the factors assessed.

### 5.12.2 *Inter-generational equity*

Inter-generational and intra-generational equity requires that the present generation would ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of the present and future generations. The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The proposed work would not impact on the health, diversity or productivity of the environment to a level that would impact on future generations.

### 5.12.3 *Conservation of biological diversity and ecological integrity*

Biological diversity and ecological integrity are fundamental considerations of ESD.

An assessment of the existing local environment has been undertaken in order to identify and manage any potential impacts of the proposal on local biodiversity.

### 5.12.4 *Appropriate valuation of environmental factors*

This principle requires that *“costs to the environment should be factored into the economic costs of a project”*.

This REF has examined the environmental consequences of the proposal and identified mitigation measures for factors which have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these mitigation measures would increase capital costs of the proposal. This signifies that environmental resources have been given valuation.

## 6 SUMMARY OF SAFEGUARDS AND MITIGATION MEASURES

Table 6-1 Key environmental safeguards

Major Issues	Key Environmental Objectives
<b>Topography, geology and soils</b>	<ul style="list-style-type: none"> <li>A Construction Environmental Management Plan (CEMP) shall be prepared prior to the commencement of work and implemented through all phases of construction. The CEMP would provide the framework for the management of all potential impacts resulting from the construction work and would detail the environmental mitigation measures to be implemented throughout construction.</li> <li>An Erosion and Sediment Control Plan (ESCP) will be prepared. The plan will be site specific, taking into account the specific nature of the work, such as including silt boom and curtain and sediment control fencing if required. The plan will be prepared in accordance with the Blue Book (Landcom, 2004)</li> <li>Sediment and erosion controls will be maintained during construction and adapted if required to ensure the objectives of the Blue Book (Landcom, 2004) are met</li> <li>A silt curtain will be used to fully contain all working sites including barge locations. Tidal influences will be considered when placing the curtain to avoid dragging and sediment disturbance.</li> <li>Areas of potential sediment exposure will be minimised</li> <li>Construction works will not be carried out in periods of forecast heavy rains or strong/gale wind warnings</li> <li>Sediments and vegetation would be disposed of at an appropriate licenced waste facility</li> <li>Vehicle and machinery movements will be restricted to established access tracks</li> <li>Vehicles and machinery must not be parked on native vegetated areas. Staff shall park at designated parking areas, existing cleared areas or exotic vegetated areas</li> <li>The barge would be launched from Carrington boat ramp or via crane to minimise soil disturbance</li> <li>Remediate disturbed areas to their pre-works condition as soon as practicable.</li> <li>Prepare and implement an Acid Sulfate Soils (ASS) Management plan. At a minimum it must include methods to: identify; handle and store; treat and dispose; and to capture runoff from ASS.</li> <li>Trucks and machinery will be checked for leaks as per maintenance schedule or pre-start checks and appropriate spill kits will be available onsite at all times</li> <li>All chemicals and fuels will be stored in suitable bunded areas away from Throsby Creek. The capacity of the bunded area will be at least 110 per cent of the largest chemical container stored within the bunded area</li> <li>The excavated sediment will be removed from site immediately and transported to a licensed waste facility</li> <li>The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas</li> </ul>

Major Issues	Key Environmental Objectives
	<ul style="list-style-type: none"> <li>• No refuelling will take place on the barge</li> <li>• Cease works immediately if contaminated soils are uncovered or suspected (due to odour or discolouration of soils). Contact the Hunter Water Project Manager to determine the appropriate management requirements.</li> <li>• Spill kits including a marine spill kit will be made available at the site at all times</li> <li>• All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills</li> <li>• The Project Manager and Hunter Water will be immediately notified if a pollution incident occurs.</li> </ul>
<b>Hydrology, catchment values and water quality</b>	<ul style="list-style-type: none"> <li>• As part of the construction environmental management plan (CEMP), a procedure will be prepared to identify potential flood threats and an evacuation procedure for dispersible materials, hazardous materials and equipment containing such materials. The procedure will include:               <ul style="list-style-type: none"> <li>○ Regular consultation of the Bureau of Meteorology website for weather forecasts and flood warnings</li> <li>○ Where possible, schedule activities to avoid high flow periods</li> <li>○ A process for removing equipment and materials off site and out of flood risk areas quickly</li> <li>○ Storing and use of fuels, chemicals and extracted materials away from the water's edge, in bunded areas.</li> </ul> </li> <li>• Protection (e.g. sedimentation fencing) shall be provided for Throsby Creek to minimise runoff from the crane work pad and compound location into waterways and waterbodies</li> <li>• Tidal changes will be monitored on a daily basis.</li> <li>• Works will only be completed within the low tide times of each workday.</li> <li>• The barge will be removed daily and stored within the compound area.</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>• Prior to the commencement of any work, a physical clearing boundary using stakes and flagging tape is to be demarcated and implemented. Clearing would not occur outside of the area identified in this assessment</li> <li>• Compound facilities and the crane staging area will be located in cleared areas outside the tree protection zone</li> <li>• All instream works will be undertaken in a manner that reduces potential for increased turbidity</li> <li>• An unexpected threatened species finds procedure will be developed prior to commencement of work, with detail included in site inductions and toolbox talks as to potential threatened species encountered, and actions to be taken when encountered</li> <li>• Vehicles and machinery are kept away from the banks of a waterway where possible.</li> <li>• Boats or other watercraft are used in a manner so as to avoid boat wash that could cause erosion of the banks.</li> <li>• Work will be undertaken in accordance with a permit issued under the FM Act for the removal of mangroves.</li> <li>• No mangroves will be removed that exceed 3 cm in diameter at a height of 60 cm.</li> <li>• Clearing will not occur during periods when flooding is likely to occur.</li> </ul>

Major Issues	Key Environmental Objectives
	<ul style="list-style-type: none"> <li>• Sediment control barriers within aquatic habitats will be removed as soon as practicable and in a manner that does not promote future channel erosion.</li> <li>• Work will be undertaken during low tide</li> <li>• Silt screens will be inspected each shift</li> <li>• Works will be restricted to calm weather conditions</li> <li>• Should any fish kills occur during construction, all work will stop and HWC and DPI (Fisheries) contacted immediately.</li> <li>• Silt booms will not extend across the creek from bank to bank to avoid blocking fish passage.</li> <li>• In the event priority weeds are identified within the proposal area, they will be treated prior to construction with methods and agents suitable for use near waterways</li> <li>• Construction machinery will be cleaned using a high-pressure washer (or other suitable device) prior to being transported to site.</li> </ul>
<b>Noise and vibration</b>	<ul style="list-style-type: none"> <li>• All employees, contractors and subcontractors are to receive an environmental induction and should instruct all persons at the site with regard to all relevant project specific and standard noise mitigation measures detailed herein including permissible hours of work; limitations on high noise generating activities; location of nearest sensitive receivers; construction employee parking areas; designated loading/unloading areas and procedures; site opening/closing times (including deliveries); and environmental incident procedures.</li> <li>• Construction will be undertaken during standard work hours only: <ul style="list-style-type: none"> <li>○ Monday to Friday – 7am – 6pm</li> <li>○ Saturday – 8am to 1pm</li> <li>○ No work Sundays</li> <li>○ Within low tide daily.</li> </ul> </li> <li>• If works are required outside the above standard construction hours additional approval from HWC will be sought prior to commencing out of hours work.</li> <li>• As per the RMS maintenance noise estimator, impacted residence are to be notified via: <ul style="list-style-type: none"> <li>○ Letter box notification</li> <li>○ Phone calls</li> <li>○ Respite offer</li> </ul> </li> <li>• Avoid unnecessary revving of engines and turn off plant that is not being used / required.</li> <li>• Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms.</li> <li>• Where possible, the use of tonal reverse alarms shall be avoided.</li> <li>• Site set up / movement of plant / delivery of materials / waste removal to site will be restricted to the standard construction hours.</li> <li>• Truck drivers are to be informed of site access routes, acceptable delivery hours and must minimise extended periods of engine idling.</li> <li>• Ensure there is no unnecessary shouting or loud stereos/radios on-site. There must be no dropping of materials from heights, throwing of metal items, or slamming of doors.</li> </ul>



Major Issues	Key Environmental Objectives
	<ul style="list-style-type: none"> <li>• Equipment must be inspected on a regular basis and maintained as necessary, to ensure it is in good working order. This must include inspections of the condition and performance of mufflers.</li> <li>• Use less noise intensive equipment where reasonable and feasible.</li> <li>• Where practical the crane will be positioned as far away as possible from sensitive receivers.</li> <li>• Use lower impact or low tonnage equipment where possible.</li> <li>• Routing, operating or locating high vibration sources as far away from sensitive areas as possible.</li> <li>• A dedicated person will form a point of contact for the dissemination of general information regarding site operations. Contact persons will also be defined to receive comment or complaints from the community.</li> <li>• Upon receiving any complaint regarding construction activities, the nominated contact must investigate the source of the complaint. The aim will be for a Project representative to initiate a complaint investigation and to respond to all complaints as soon as possible. Where practicable a visit should be made to the complainant to verify the nature of the complaint and if justified appropriate action should be taken to cease or amend the activity causing the complaint.</li> <li>• A Complaint Management procedure will be developed and implemented by the contractor. The Complaint Management procedure will at a minimum include</li> <li>• Notification to residents will be done at least 5 days prior to work commencing including the nature and estimated timescales for completion of the proposed work.</li> </ul>
<b>Traffic impacts</b>	<ul style="list-style-type: none"> <li>• Implement a Traffic Control Plan (for land and water movements) prior to works commencing.</li> <li>• Residences along Union Street, O'Hara Street and Bell Street Drive will be notified prior to works commencing. This notification will specify the planned duration and extent of the works</li> <li>• Users of the Carrington Boat ramp will be notified via signage of scheduled barge launch periods and extent of works</li> <li>• All heavy vehicles will travel within daylight hours</li> <li>• Vehicle movements will be programmed out of peak periods where possible</li> <li>• When on site, plant movements and construction parking will only occur within designated areas</li> <li>• Access impacts to residences shall be limited in duration.</li> </ul>
<b>Air quality, resources and waste</b>	<ul style="list-style-type: none"> <li>• All loads of material transported to and from site will be covered.</li> <li>• Construction activities that have the potential to generate dust shall cease in excessively windy conditions.</li> <li>• Vehicles will be maintained to manufacturer's standards and regular checks will be made to ensure there are no continuous exhaust emissions of 10 seconds or longer.</li> <li>• The contractor will limit idle time of plant and equipment.</li> <li>• General waste and recycling receptacles will be provided onsite.</li> <li>• Working areas shall be maintained, free of rubbish and cleaned up at the end of each working shift</li> </ul>

Major Issues	Key Environmental Objectives
	<ul style="list-style-type: none"> <li>All waste shall be managed in accordance with the Protection of the Environment Operations Act 1997 and disposed of at facilities licensed to accept the waste.</li> </ul>
<b>Landscape characteristics and visual amenity</b>	<ul style="list-style-type: none"> <li>Vegetation removal and site disturbance will be kept to a minimum</li> <li>Work areas shall be maintained in a tidy manner at all times</li> </ul>
<b>Indigenous heritage</b>	<ul style="list-style-type: none"> <li>The site personnel shall receive basic training in the recognition of Indigenous Cultural Heritage material and sites as part of induction prior to works commencing</li> <li>When any sediment excavation removal activities are conducted, workers shall be observant and keep a look out for; surface shell, bone, rocks or any other Indigenous Cultural Heritage material</li> <li>In the event that an Aboriginal object (or objects) is uncovered during the proposed works, ground disturbance works should cease within 20 metres of the object(s) and the Hunter Water Archaeologist should be contacted. The Hunter Water Archaeologist will advise OEH and the relevant Aboriginal parties so that appropriate management strategies can be identified</li> <li>If any suspected human remains are discovered and/or harmed, the following actions will be taken: <ul style="list-style-type: none"> <li>Work will immediately cease;</li> <li>No further harm will occur to the remains;</li> <li>The area will be secured to avoid further harm;</li> <li>the relevant manager of the proposed works will be informed and will contact the Hunter Water Archaeologist who will in turn contact local police, OEH and the Heritage Branch;</li> <li>if the remains are identified as forensic the area is deemed as crime scene;</li> <li>if the remains are identified as Aboriginal, the site is to be secured and OEH and all registered Aboriginal parties are to be notified in writing; or</li> <li>if the remains are non-Aboriginal (historical) remains, the site is to be secured and the Heritage Branch is to be contacted; and</li> <li>this process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (NSW Police Force, forensic anthropologist, OEH, Heritage Branch, registered Aboriginal parties etc) and in accordance with the Public Health Act 1991.</li> </ul> </li> </ul>
<b>Non-indigenous heritage</b>	<ul style="list-style-type: none"> <li>Staff working at the site during construction will be instructed to stop work immediately on identification of any suspected heritage artefact</li> <li>If any items suspected of being of historic value are uncovered during the works, works must cease in the vicinity of the find, HWC contacted and advice sought from a suitably qualified heritage consultant.</li> </ul>

## 7 SUMMARY OF LICENCES AND APPROVALS

Table 7-1 Summary of licences and approvals required

Legal Instrument	Licence or Approval
<b>FM Act (section 205)</b>	<ul style="list-style-type: none"><li>• A permit from DPI Fisheries under Part 7 of the FM Act is required for the removal of mangroves.</li></ul>
<b>FM Act (section 199)</b>	<ul style="list-style-type: none"><li>• Provide the Minister 21 days' notice for planned dredging activities and consider any feedback.</li></ul>

## 8 CONCLUSION

### 8.1 ENVIRONMENTAL IMPACTS

This REF has been prepared for HWC. The report presents the investigations undertaken into the environmental impacts of the proposed Throsby Creek sediment and mangrove removal at Tighes Hill.

The REF has been prepared with due consideration given to the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. A Clause 228 checklist has been completed and is provided at Appendix D.

This assessment found that once operational, the proposal would discourage future mangrove growth and reduce obstructions to water flow in the Throsby Creek stormwater system. The work would not result in any impacts to threatened species, populations or ecological communities listed on the NSW *Biodiversity Conservation Act 2016*, or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Having considered all the relevant factors documented in this document, it is concluded that the proposed work would not have a significant impact on the environment.

### 8.2 JUSTIFICATION OF THE PROPOSAL

The proposal would discourage future mangrove growth and reduce obstructions to water flow in Throsby Creek stormwater system.

The proposal would achieve the identified objectives and with the implementation of the mitigation measures identified within this REF, it is unlikely that the proposed works would result in a significant impact to the environment.

## 9 REFERENCES

- ABS (2016a) 2016 Census QuickStats – Newcastle Local Government Area, viewed 6/5/19, [https://quickstats.censusdata.abs.gov.au/census\\_services/getproduct/census/2016/quickstat/LGA15900?opendocument](https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA15900?opendocument).
- ABS (2016b) 2016 Census QuickStats – Islington, viewed 6/5/19, [https://quickstats.censusdata.abs.gov.au/census\\_services/getproduct/census/2016/quickstat/SSC11990?opendocument](https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC11990?opendocument).
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## APPENDIX A DATABASE SEACHES

### A.1 OEH WILDLIFE ATLAS (BIONET)

## **A.2 NSW WEEDWISE DATABASE**

## **A.3 EPBC ACT PROTECTED MATTERS SEARCH**

## **A.4 CONTAMINATED LANDS RECORD**

## **A.5 NOISE CALCULATOR**



## **A.6 NSW STATE HERITAGE INVENTORY**

## **A.7 AUSTRALIAN HERITAGE DATABASE**

## APPENDIX B CORRESPONDENCE

### B.1 ROADS AND MARITIME CONSULTATION



Hunter Water Corporation  
ABN 46 228 513 446

PO Box 5171  
HRMC NSW 2310  
36 Honeysuckle Drive  
NEWCASTLE NSW 2300  
hunterwater.com.au  
1300 657 657 (T)  
enquiries@hunterwater.com.au

21/8/2019

Our Ref: HW2016-523/55

Roads and Maritime Services  
8 Cowper Street  
Carrington NSW 2294

Dear Sir/Madam,

#### RE – Throsby Creek Mangrove and Sediment Removal (our ref: 19-146)

Hunter Water Corporation (HWC) is proposing to remove accumulated sediment and juvenile mangroves from Throsby Creek to reduce the risk of increasing flood levels in the Newcastle area. The removal of the sediment would:

- Improve water flow within Throsby Creek
- Manage flooding impacts
- Prevent future growth of mangroves on the accumulated sediment
- Manage mangrove communities and prevent spread of mangrove islands and sediment accumulation in Throsby Creek

A brief outline of the proposal is attached to this letter (refer to **Attachment A**). NGH Environmental has been engaged to undertake the environmental assessment and prepare the Review of Environmental Factors (REF).

Under clause 16 (2) of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), Hunter Water is required to give written notice of the intention to carry out the development (together with a scope of works) to Roads and Maritime Services regarding this proposal as the works would involve a floating structure in navigable waters.

Your comments on the proposal are welcomed and any comments provided within 21 days of the date of this letter will be taken into consideration in the REF. If further information is required, please contact the undersigned.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Jason Townsend".

Jason Townsend  
Project Manager

## APPENDIX C THREATENED SPECIES EVALUATIONS

The tables in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed for Throsby Creek in the *Atlas of NSW Wildlife*<sup>1</sup> and those identified as potentially occurring in the area according to the Commonwealth EPBC *Protected Matters Search Tool*<sup>2</sup>.

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

### **Presence of habitat:**

Present: Potential or known habitat is present within the study area

Absent: No potential or known habitat is present within the study area

### **Likelihood of occurrence**

Unlikely: Species known or predicted within the locality but unlikely to occur in the study area

Possible: Species could occur in the study area

Present: Species was recorded during the field investigations

### **Possible to be impacted**

No: The proposal would not impact this species or its habitats. No Assessment of Significance (AoS) is necessary for this species

Yes: The proposal could impact this species or its habitats. An AoS has been applied to these entities.

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<sup>1</sup> The *Atlas of NSW Wildlife* is administered by the NSW Department of Environment & Heritage (OEH) and is an online database of fauna and flora records that contains over four million recorded sightings.

<sup>2</sup> This online tool is designed for the public to search for matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is managed by the Commonwealth Department of the Environment and Energy.

## C.1 EVALUATION OF THE LIKELIHOOD AND EXTENT OF IMPACT ON THREATENED FLORA SPECIES

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
<b>Flora</b>							
Biconvex Paperbark <i>Melaleuca biconvexa</i>	V	V	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October and Resprouting occurs following fire.	1	Absent	None	Low
Black-eyed Susan <i>Tetratheca juncea</i>	V	V	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. Grows in forests with an overstorey of Angophora costata, Eucalyptus haemastoma, E. globoidea, Corymbia gummifera, and E. capitellata. Only T. thymifolia is known to grow in association with this species. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites and	210	Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			occurs on ridges, although it has also been found on upper slopes, mid- slopes and occasionally in gullies. Flowering occurs between July and December with the peak flowering period occurring between the start of September to the end of October. Seeds are produced in late spring and mature from November to February. Very cryptic.				
Coast Headland Pea <i>Pultenaea maritima</i>	V		Occurs in New South Wales and Queensland. Within NSW, the species has been recorded from Newcastle north to Byron Bay on 16 headlands. Populations vary from a few plants to larger populations of many hundreds of individuals where the species is a major component of the Kangaroo Grass Headland community. Five sites occur within conservation reserves. The species occurs in grasslands, shrublands and heath on exposed coastal headlands and adjoining low coastal heath. Found on clay or sandy loam or clay loam over sandstone at altitude 5–30m. Associated with <i>Banksia integrifolia</i> and <i>Themeda australis</i> .	4	Absent	None	Low
Heath Wrinklewort <i>Rutidosis heterogama</i>	V	V	Recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	11	Absent	None	Low



Specie	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Magenta Lilly Pilly <i>Syzygium paniculatum</i>	E	V	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. Has been recorded in widely scattered small populations along the NSW coast from Booti (near Forster) in the north to Conjola State Forest (near Jervis Bay) in the south. Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest. Associated species include <i>Alphitonia excelsa</i> , <i>Acmena smithii</i> , <i>Cryptocarya glaucescens</i> , <i>Toona ciliata</i> , <i>Eucalyptus saligna</i> , <i>Ficus fraseri</i> , <i>Syzygium oleosum</i> , <i>Acmena smithii</i> , <i>Cassine</i> sp., <i>F. blique</i> , <i>Glochidion ferdinandi</i> , <i>Endiandra sieberi</i> , <i>Synoum glandulosum</i> , <i>Podocarpus elatus</i> , <i>Notelaea longifolia</i> , <i>Guioa semiglauc</i> and <i>Pittosporum undulatum</i> . Is thought to tolerate wet and dry conditions on sands. 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. Flowers December to March, with fruit ripe from March to May, occasionally to September.	1	Absent	None	Low
Rough Doubletail <i>Diuris praecox</i>	V	V	Occurs between Ourimbah and Nelson Bay. There are records of the species in Munmorah State Conservation Area and Wyrabalong National Park. Grows on hills and slopes of near-coastal districts in open sclerophyll forests which have a grassy	1471	Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter. Flowers from July to early September.				
Scrambling Lignum <i>Muehlenbeckia costata</i>	V		Scattered distribution from Queensland to the Blue Mountains in NSW. Records on the New England Tablelands and North West Slopes include Bald Rock north of Tenterfield, Warra and Butterleaf National Parks near Glen Innes and Mt Kaputar.	1	Absent	None	Low
Scrub Turpentine <i>Rhodamnia rubescens</i>	E		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 <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m ASL in areas with rainfall of 1000-1600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	5	Absent	None	Low
<i>Grevillea shiressii</i>	V	V	Known only from two populations near Gosford, on tributaries of the lower Hawkesbury River north of Sydney (Mooney Creek and Mullet Creek). Both populations occur within the Gosford Local Government Area. Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils on Hawkesbury sandstone. Inhabits tall scrub or wet sclerophyll forest or shrub associations with <i>Eucalyptus deanei</i> , <i>Syncarpia glomulifera</i> , <i>Angophora floribunda</i> , <i>Tristaniopsis laurina</i> and <i>Lomatia myricoides</i> . Flowers mainly late winter to Spring (July-December), with seed released at maturity in October.	1	Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
<i>Zannichellia palustris</i>	E		A submerged aquatic plant. Leaves 2-7cm long by less than 1mm wide. In NSW, known from the lower Hunter and in Sydney Olympic Park.	3	Absent	None	Low
Charmhaven Apple <i>Angophora inopina</i>		V	Endemic to the Central Coast region of NSW. The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset. Occurs most frequently in four main vegetation communities: (i) Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina woodland/forest; (ii) Hakea teretifolia–Banksia oblongifolia wet heath; (iii) Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina sedge woodland; (iv) Eucalyptus capitellata–Corymbia gummifera–Angophora inopina woodland/forest.	0	Absent	None	Low
Thick-lipped Spider-orchid <i>Caladenia tessellata</i>		V	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations). Generally found in grassy sclerophyll woodland on clay loam or sandy soils.	0	Absent	None	Low
Dwarf Kerrawang <i>Commersonia prostrata</i>		E	Dwarf Kerrawang occurs on the Southern Highlands and Southern Tablelands (one plant at Penrose State Forest, one plant at Tallong, a small population near the Corang and about 2000 plants at Rowes Lagoon), a larger population in the	0	Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			Thirlmere Lakes area (particularly among the dying reeds at the edge of the water), and on the North Coast (less than 100 plants at the Tomago sandbeds north of Newcastle).				
Leafless Tongue-orchid <i>Cryptostylis hunteriana</i>		V	This species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forested communities. The soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. The larger populations typically occur in woodland dominated by Scribbly Gum ( <i>Eucalyptus sclerophylla</i> ), Silvertop Ash ( <i>E. sieberi</i> ), Red Bloodwood ( <i>Corymbia gummifera</i> ) and Black Sheoak ( <i>Allocasuarina littoralis</i> ); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid ( <i>C. subulata</i> ) and the Tartan Tongue Orchid ( <i>C. erecta</i> ).	0	Absent	None	Low
White-flowered Wax Plant <i>Cynanchum elegans</i>		E	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree <i>Leptospermum laevigatum</i> – Coastal Banksia <i>integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; Forest Red Gum <i>Eucalyptus tereticornis</i> aligned open forest and woodland; Spotted Gum <i>Corymbia maculata</i> aligned open forest and woodland; and Bracelet Honeymyrtle <i>Melaleuca armillaris</i> scrub to open scrub. Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa	0	Absent	None	Low

Specie	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			in the Illawarra region. Flowering occurs between August and May, with a peak in November.				
Camfield's Stringybark <i>Eucalyptus camfieldii</i>		V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Occurs in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Grows 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. Associated species frequently include stunted species of <i>E. oblonga</i> Narrow-leaved Stringybark, <i>E. capitellata</i> Brown Stringybark and <i>E. haemastoma</i> Scribbly Gum.	0	Absent	None	Low
Earp's Gum <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>		V	There are two separate meta-populations of <i>E. parramattensis</i> subsp. <i>decadens</i> . 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 Williamstown and Tomago in the south. Flowers from November to January. Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high.	0	Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Small-flower Grevillea <i>Grevillea parviflora</i> subsp. <i>parviflora</i>		V	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo (and possibly further south to the Moss Vale area). Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including <i>Eucalyptus fibrosa</i> , <i>E. parramattensis</i> , <i>Angophora bakeri</i> and <i>Eucalyptus sclerophylla</i> . Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks. Flowering has been recorded between July to December as well as April to May.	0	Absent	None	Low
Lesser Swamp-orchid <i>Phaius australis</i>		E	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie. Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. Flowering September-October.	0	Absent	None	Low
Prasophyllum <i>Prasophyllum</i> sp. <i>Wybong</i>		CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest	0	Absent	None	Low



Specie	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			number of individuals. A perennial orchid, appearing as a single leaf over winter and spring. Flowers in spring and dies back to a dormant tuber over summer and autumn. Known to occur in open eucalypt woodland and grassland.				
Illawarra Greenhood <i>Pterostylis gibbosa</i>		E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). In the Illawarra region, the species grows in woodland dominated by Forest Red Gum <i>Eucalyptus tereticornis</i> , Woollybutt <i>E. longifolia</i> and White Feather Honey-myrtle <i>Melaleuca decora</i> . Near Nowra, the species grows in an open forest of Spotted Gum <i>Corymbia maculata</i> , Forest Red Gum and Grey Ironbark <i>E. paniculata</i> . In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark <i>E. crebra</i> , Forest Red Gum and Black Cypress Pine <i>Callitris endlicheri</i> . Spring flowering.	0	Absent	None	Low
<b>EECs</b>							
Central Hunter Grey Box Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	E	CE	Central Hunter Grey Box-Ironbark Woodland occurs in the Central Hunter Valley between about Singleton and Muswellbrook. It is known to occur in the Cessnock, Singleton and Muswellbrook LGAs but may occur elsewhere within the Sydney Basin Bioregion. Central Hunter Grey Box-Ironbark Woodland occurs in areas of relatively low rainfall and high temperatures. It is associated mostly with Permian lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls.		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Central Hunter Ironbark Spotted Gum Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	E	CE	Central Hunter Ironbark-Spotted Gum-Grey Box Forest occurs in the central Hunter Valley mainly between Maitland and Muswellbrook. It has been recorded from Singleton, Cessnock and Muswellbrook LGAs but may occur elsewhere within the North Coast and Sydney Basin Bioregions. Central Hunter Ironbark-Spotted Gum-Grey Box Forest occupies undulating country including low rises and slopes, occurring on all aspects. It may also occur on alluvial and colluvial soils in valleys.		Absent	None	Low
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	V	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans. This community occurs in the intertidal zone along the NSW coast.		Absent	None	Low
Coastal Upland Swamp in the Sydney Basin Bioregion	E	E	Coastal Upland Swamps occur primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture. The Coastal Upland Swamp is generally associated with soils that are acidic and vary from yellow to grey mineral sandy loams with a shallow organic horizon to highly organic spongy black peats with pallid subsoils		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Known from along the majority of the NSW coast. However, it is distinct from Sydney Freshwater Wetlands which are associated with sandplains in the Sydney Basin bioregion. Extensively cleared and modified.		Absent	None	Low
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E		Hunter Floodplain Red Gum Woodland has been recorded from the local government areas of Maitland, Mid-Western, Muswellbrook, Singleton, and Upper Hunter but may occur elsewhere within the NSW North Coast and Sydney Basin Bioregions. Mapped occurrences include few remnants greater than 10 hectares and many small remnants less than 10 hectares, indicating severe fragmentation. Within the Central Hunter Valley geographic distribution is estimated to have been reduced by more than 90% of its pre-European extent.		Absent	None	Low
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E		Cessnock in the Lower Hunter in the Sydney Basin and North Coast bioregions. It has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs, but may occur elsewhere in these bioregions. Probably less than 500 hectares of this community remains. Hunter Lowland Redgum Forest occurs on the Permian sediments of the Hunter Valley floor. Much of the remaining community is disturbed and fragmented. The floristic composition and structure of the community is influenced by both the size and disturbance history of the remaining fragments. Consequently at heavily disturbed		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			sites only some of the species which characterise the community may be present.				
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	V	CE	Hunter Valley Footslopes Slaty Gum Woodland mainly occurs on the southern side of the Hunter Valley from near Bulga to the Bylong/Goulburn River National Park area. It occurs on colluvial soils on exposed footslopes associated with the interface between Triassic Narrabeen sandstones and Permian sediments. Hunter Valley Footslopes Slaty Gum Woodland is known to occur in Singleton, Muswellbrook and Upper Hunter LGAs, and may occur in the Mid-western Regional LGA. Hunter Valley Footslopes Slaty Gum Woodland occurs on colluvial soils derived from Triassic sandstones and conglomerates that has covered the underlying Permian.		Absent	None	Low
Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions	E		Hunter Valley Vine Thicket typically forms a low forest, usually less than 10 m tall, with a closed canopy dominated by small trees. The canopy may include <i>Elaeodendron australe</i> (Red Olive Plum), <i>Geijera parviflora</i> (Wilga), <i>Notelaea microcarpa</i> var. <i>microcarpa</i> (Native Olive), <i>Alectryon oleifolius</i> subsp. <i>elongatus</i> (Western Rosewood), <i>Melia azedarach</i> (White Cedar) and <i>Brachychiton populneus</i> subsp. <i>populneus</i> (Kurrajong). Emergent eucalypts are common and include <i>Eucalyptus albens</i> (White Box), <i>E. dawsonii</i> (Slaty Box) and <i>E. crebra</i> (Narrow-leaved Ironbark). A shrub stratum is usually present and includes <i>Olearia elliptica</i> subsp. <i>elliptica</i> (Sticky Daisy Bush) and <i>Rhagodia parabolica</i> (Mealy Saltbush). Vines are common and include		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			Cissus opaca (Small-leaved Water Vine), Marsdenia flavescens (Hairy Milk Vine), Parsonsia eucalyptophylla (Gargaloo) and Pandorea pandorana subsp. pandorana (Wonga Vine). Ground cover is generally sparse and includes Urtica incisa (Stinging Nettle) and Austrostipa verticillata (Slender Bamboo Grass).				
Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	CE	CE	Hunter Valley Weeping Myall Woodland of the Sydney Basin bioregion is currently known from parts of the Muswellbrook and Singleton Local Government Areas, but may occur elsewhere in the bioregion. It may also occur in the Upper Hunter Local Government Area within the Brigalow Belt South bioregion, although its presence has not yet been confirmed there. A section of the community which occurs in heavy, brown clay soil at Jerry's Plains in the Hunter Valley is also listed by the Commonwealth as Critically Endangered. This community is associated with heavy clay soils on depositional landforms in the south-western part of the Hunter River valley floor.		Absent	None	Low
Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion	CE		Kincumber Scribbly Gum Forest is restricted to a small area on the Bouddi Peninsula on the NSW Central Coast south of Kincumber. It occurs in the Gosford LGA. The total remaining area of Kincumber Scribbly Gum Forest to thought to be less than 100 ha. within an area of about 4 km <sup>2</sup> . Occurs on gently undulating areas on sandy soils of the Erina soil landscape, derived from sandstones of the Triassic Narrabeen group.		Absent	None	Low
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	E		Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			and a shrubby understorey. The overstorey is usually dominated by <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (Parramatta Red Gum) and <i>Angophora bakeri</i> (Narrow-leaved Apple) while other tree species that occur less frequently include <i>E. racemosa</i> (Narrow-leaved Scribbly Gum), <i>E. fibrosa</i> (Red Ironbark), <i>E. sp. aff. agglomerata</i> and <i>Corymbia gummifera</i> (Red Bloodwood). The shrub layer is typified by <i>Banksia spinulosa</i> (Hairpin Banksia), <i>Dillwynia retorta</i> , <i>Jacksonia scoparia</i> (Dogwood), <i>Hakea dactyloides</i> (Finger Hakea), <i>Acacia ulicifolia</i> (Prickly Moses), <i>Grevillea parviflora</i> subsp. <i>parviflora</i> , <i>Melaleuca nodosa</i> (Prickly-leaved Paperbark), <i>A. elongata</i> (Swamp Wattle) and <i>Lambertia formosa</i> (Mountain Devil). The common ground species include <i>Entolasia stricta</i> (Wiry Panic), <i>Ptilothris deusta</i> , <i>Pimelea linifolia</i> (Slender Rice Flower), <i>Aristida warburgii</i> , <i>Lomandra cylindrica</i> (Needle Mat-rush), <i>Lomandra glauca</i> (Pale Mat-rush) and <i>Anisopogon avenaceus</i> (Oat Speargrass). Known to occur in the Kurri Kurri–Cessnock area of the Cessnock LGA in the lower Hunter Valley, but it may occur elsewhere.				
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	CE	Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. Littoral Rainforest is very rare and occurs in many small stands. Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their		Absent	None	Low



Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			windward sides. Most stands occur within two kilometres of the sea, though are occasionally found further inland within reach of the maritime influence.				
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin Bioregion	E		Known to occur only near Norah Head, east of Wilfred Barrett Drive, within the Wyong Local Government Area, on the Central Coast of NSW. None of this community is represented within a conservation reserve. Occurs on indurated (hardsetting) sand with a range of local variation in drainage conditions. Restricted to swales behind higher aeolian dunes.		Absent	None	Low
Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	V		Lower Hunter Valley Dry Rainforest mainly occurs on the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hillslopes with south facing aspects. It is also known from south of the Hunter River at Mt Bright and Mt View. Lower Hunter Valley Dry Rainforest has been recorded from the local government areas of Cessnock, Maitland and Port Stephens, and is also likely to occur or have occurred in Muswellbrook, Singleton, Upper Hunter and Dungog LGAs. Lower Hunter Valley Dry Rainforest typically occurs on Carboniferous sediments in gullies and on steep hillslopes with south facing aspects. It is generally found at elevations less than 300 m ASL with a mean annual rainfall less than 900 mm.		Absent	None	Low
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E	CE	Lowland Rainforest on Floodplain generally occupies riverine corridors and alluvial flats with rich, moist silts often in subcatchments dominated by basic volcanic substrates. Major		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			examples once occurred, and remnants remain, on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. Other minor river systems also support the community.				
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	E		Occupies gentle slopes and rises on a residual sand deposit overlying the Permian clay sediments of the Hunter Valley floor. Currently known from only a small area between Quorrobolong and Mulbring in the Cessnock local government area, but may also occur elsewhere within the Hunter Valley. The current known extent is about 70 hectares; the pre-European extent is estimated to have been only 160 hectares, reflecting the limited area of the sand deposit on which it occurs. Not known to occur within any conservation reserves.		Absent	None	Low
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically form mosaics with other floodplain forest communities and treeless wetlands, and often fringe treeless floodplain lagoons or wetlands with semi-permanent standing water.		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered tree.		Absent	None	Low
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.		Absent	None	Low
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E		Largely restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplains such as those of the Warriewood and Tuggerah soil landscapes. Swampy areas on alluvium with a saline influence do not fall within this community.		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
<i>Themeda</i> Grassland on Seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E		The community is found on a range of substrates, although stands on sandstone are infrequent and small. Larger stands are found on old sand dunes above cliffs, for example at Cape Banks and Henry Head in Botany Bay National Park, and on metasedimentary are rarely adamellite headlands on the north coast. Individual stands of the community are often very small, a few square metres, but at some sites larger stands of up to several hectares or tens of hectares occur. Overall, the community therefore has a highly restricted geographic distribution comprising small, but widely scattered patches.		Absent	None	Low
Umina Coastal Sandplain Woodland in the Sydney Basin Bioregion	E		Largely restricted to coastal sands on the Umina, Woy Woy and Ettalong Sandplain, a beach ridge system within the Gosford local government area. Including ecotonal areas, less than 10% (being less than 10 hectares) of the community's estimated original cover of about 80 hectares remains. This comprises four main remnants at Umina, while a few smaller remnant patches and scattered trees around Pearl Beach and Patonga and elsewhere on the 'Peninsula' indicate its former distribution. Occurs on sandy soils (iron podzols) of the Woy Woy Soil Landscape which are distinguished from the humus podzols generally associated with foothill talus slopes further away from the coast on which <i>Angophora costata</i> predominates.		Absent	None	Low
Warkworth Sands Woodland in the Sydney Basin Bioregion	E	CE	Warkworth Sand Woodland occurs on aeolian sand deposits south of Singleton in the Hunter Valley. The species composition of a site will be influenced by the size of the site, recent rainfall		Absent	None	Low

Speciese	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			or drought condition, and by its disturbance (including fire) history. Warkworth Sands Woodland is confined to a small area near Warkworth, about 15 km south-west of Singleton in the Hunter Valley. Only approximately 800 hectares of Warkworth Sands Woodland remains, none of which occurs within a conservation reserve. Due to the extent of vegetation clearing and modification, this is estimated to be as little as 13% of its pre-settlement extent. Currently known to occur only in the Singleton LGA, but may occur elsewhere in the Sydney Basin Bioregion.				
White Box Yellow Box Blakely's Red Gum Woodland	E	CE	It occurs in the tablelands and western slopes of NSW. An intact native ground layer with a high diversity of native plant species but no remaining tree layer.		Absent	None	Low

## C.2 EVALUATION OF THE LIKELIHOOD AND EXTENT OF IMPACT ON THREATENED FAUNA

Note: Large marine mammals have been excluded from this evaluation.

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
<b>Aves</b>							
Australasian Bittern <i>Botaurus poiciloptilus</i>	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes ( <i>Typha</i> spp.) and spikerushes ( <i>Eleocharis</i> spp.)	1	Absent	None	Low
Black-necked Stork <i>Ephippiorhynchus asiaticus</i>	E		Black-necked Storks are 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 Buladelah. 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.	1	Absent	None	Low
Black-tailed Godwit <i>Limosa limosa</i>	V		The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter	29	Marginal	Low	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			River estuary), with occasional records elsewhere along the coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed. The species has been recorded within the Murray-Darling Basin, on the western slopes of the Northern Tablelands and in the far north-western corner of the state. Primarily a coastal species, it is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps. Individuals have been recorded in wet fields and sewerage treatment works. Roosts and loafs on low banks of mud, sand and shell bars. Also frequently recorded in mixed flocks with Bar-tailed Godwits.				
Broad-billed Sandpiper <i>Limicola falcinellus</i>	V		The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayment's, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or	37	Marginal	Low	Low



Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.				
Bush Stone-curlew <i>Burhinus grallarius</i>	E		The Bush Stone-curlew is 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 south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. The species is largely nocturnal, being especially active on moonlit nights.	3	Absent	None	Low
Comb-crested Jacana <i>Irediparra gallinacea</i>	V		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 Phillippines, south and east through Sulawesi, the Moluccas and Lesser Sunda Islands, to the Aru Islands, New Guinea and New Britain.	3	Absent	None	Low
Curlew Sandpiper <i>Calidris ferruginea</i>	E	CE	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few	1020	Marginal, foraging only	Low	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			days during migration. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.				
Eastern Curlew <i>Numenius madagascariensis</i>		CE	In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	68	Marginal, foraging only	Low	Low
Eastern Grass Owl <i>Tyto longimembris</i>	V		Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Eastern Grass Owl numbers can fluctuate greatly, increasing especially during rodent plagues.	1	Absent	None	Low
Eastern Osprey <i>Pandion cristatus</i>	V		Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species also favours coastal areas, especially the mouths of large rivers, lagoons and lakes. 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.	8	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Flesh-footed Shearwater <i>Ardenna carneipes</i>	V		A large blackish-brown shearwater with flesh-coloured feet. The large bill is straw coloured with a dark tip and the eyes are brown. Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia.	4	Absent	None	Low
Great Knot <i>Calidris tenuirostris</i>	V	CE	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms.	8	Absent	None	Low
Greater Sand-plover <i>Charadrius leschenaultii</i>	V	V	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. 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.	3	Absent	None	Low
Grey-crowned Babbler (eastern subspecies)	V		The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the	1	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
<i>Pomatostomus temporalis</i>			south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands.				
Lesser Sand-plover <i>Charadrius mongolus</i>	V		Found along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms.	154	Marginal, foraging only	Low	Low
Little Lorikeet <i>Glossopsitta pusilla</i>	V		The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Occupies isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	2	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Little Tern <i>Sternula albifrons</i>	E	C	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 kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	282	Marginal, foraging only	Low	Low
Magpie Goose <i>Anseranas semipalmata</i>	V		The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW.	19	Absent	None	Low
Masked Booby <i>Sula dactylatra</i>	V		Widely distributed through the tropical and subtropical seas of the world. The breeding population on Lord Howe Island is the most southerly breeding colony in the world.	1	Absent	None	Low
Pied Oystercatcher <i>Haematopus longirostris</i>	E		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. 'Pied' Oystercatchers are occasionally recorded on Lord Howe island but it is uncertain	21	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			which species is involved. The species favours intertidal flats of inlets and bays, open beaches and sandbanks.				
Powerful Owl <i>Ninox strenua</i>	V		In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub-canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials. Roosts in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Species commonly used for roosting include the She-oaks <i>Allocasuarina</i> spp., rainforest species such as Coachwood <i>Ceratopetalum apetalum</i> , Lilly Pilly <i>Acmena smithii</i> and Sassafras <i>Doryphora sassafras</i> , Black Wattle <i>Acacia melanoxylon</i> , Turpentine <i>Syncarpia glomulifera</i> and eucalypts.	31	Absent	None	Low
Red Knot <i>Calidris canutus</i>		E	In NSW it is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary. This environment is used as a staging area for birds to rest and replenish fat resources; large numbers arrive in September then most move south to Victoria by October. The Red Knot is a rare visitor to wetlands away from	68	Marginal, foraging only	Low	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			the coast with a few records (mostly during southward migration) as far west as Lake Menindee and the Riverina. Mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps. Birds roost on sandy beaches, spits, islets and mudflats close to feeding grounds, usually in open areas. Rarely found on inland lakes or swamps.				
Sooty Owl <i>Tyto tenebricosa</i>	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. Nests in very large tree-hollows.	5	Absent	None	Low
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	V		Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. The species favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	20	Marginal	None	Low



Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Square-tailed Kite <i>Lophoictinia isura</i>	V		<p>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. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.</p> <p>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.</p>	1	Absent	None	Low
Superb Fruit-Dove <i>Ptilinopus superbus</i>	V		<p>The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.</p>	2	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Swift Parrot <i>Lathamus discolor</i>	E	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between March and October. No breeding in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> .	1	Absent	None	Low
Terek Sandpiper <i>Xenus cinereus</i>	V		In Australia, has been 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 10 km inland around brackish pools. Generally roosts communally amongst mangroves or dead trees, often with related wader species. Breaks up into smaller flocks or even solitary birds when feeding in open intertidal mudflats.	247	Marginal	Low	Low
Turquoise Parrot <i>Neophema pulchella</i>	V		The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	2	Absent	None	Low
Varied Sittella <i>Daphoenositta chrysoptera</i>	V		In NSW most individuals have a grey head and are streaked with dark brown, but in the extreme north-east they have a white	1	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			head, and in the extreme south-west a black cap. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades.				
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	V		The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. The species also occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	10	Absent	None	Low
White-fronted Chat <i>Epthianura albifrons</i>	V		The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in	13	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.				
Wompoo Fruit-Dove <i>Ptilinopus magnificus</i>	V		Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Three subspecies are recognised, with the most southerly in NSW and south-eastern Queensland. It used to occur in the Illawarra, though there are no recent records. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	1	Absent	None	Low
Regent Honeyeater <i>Anthochaera phrygia</i>		CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The	0	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and She oaks.				
Greater Sand Plover <i>Charadrius leschenaultii</i>		V	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. 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.	0	Absent	None	Low
Eastern Bristlebird <i>Dasyornis brachypterus</i>		E	There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount	0	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			importance to this species. The Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, habitat in northern NSW requires frequent fires to maintain habitat condition and suitability. The northern fire regimes is between 3-6 years and of variable intensity depending on the habitat condition.				
Red Goshawk <i>Erythrorhynchus radiatus</i>		V	The Red Goshawk is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. Breeding is likely to be in spring and summer in southern Queensland and NSW. The birds lay clutches of 1-2 eggs between July and September, in a stick nest in a tall tree (>20 m tall) within 1 km of a watercourse or wetland. Young fledge around November and December.	0	Absent	None	Low
Painted Honeyeater <i>Grantiella picta</i>		V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland.	0	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.				
<b>Mammals</b>							
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V		Eastern Bent-wing 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.	7	Absent	None	Low
Eastern Freetail-bat <i>Mormopterus norfolkensis</i>	V		The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	3	Absent	None	Low
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	V		The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New	2	Absent	None	Low



Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			England Tablelands, however does not occur at altitudes above 500 m. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.				
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban 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.	24	Marginal	None	Low
Koala <i>Phascolarctos cinereus</i>	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.	2	Absent	None	Low
Little Bentwing-bat <i>Miniopterus australis</i>	V		Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bent-wing bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bent-wing bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large	6	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			maternity colony of Common Bentwing-bats ( <i>M. schreibersii</i> ) and appears to depend on the large colony to provide the high temperatures needed to rear its young.				
Squirrel Glider <i>Petaurus norfolcensis</i>	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.	1	Absent	None	Low
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>		V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin ( <i>Petrochelidon ariel</i> ), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.	0	Absent	None	Low
Spot-tailed Quoll <i>Dasyurus maculatus</i> (SE mainland population)		E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. The range of the Spotted-tailed Quoll has	0	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.				
Greater Glider <i>Petauroides volans</i>		V	Arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	0	Absent	None	Low
Long-nosed Potoroo <i>Potorous tridactylus</i>		V	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. 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. Breeding peaks typically occur in late winter to early summer and a single young is born per litter. Adults are capable of two reproductive bouts per annum.	0	Absent	None	Low
New Holland Mouse <i>Pseudomys novaehollandiae</i>		V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks	0	Absent	None	Low

Species	BC Act	EPBC Act	Description of habitat	Number of records within 10km (BioNet)	Presence of habitat	Likelihood of occurrence	Possible impact?
			in abundance during early to mid stages of vegetation succession typically induced by fire.				
<b>Amphibia</b>							
Green and Golden Bell Frog <i>Litoria aurea</i>	E	V	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes ( <i>Typha</i> spp.) or spikerushes ( <i>Eleocharis</i> spp.), Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow ( <i>Gambusia holbrooki</i> ), have a grassy area nearby and diurnal sheltering sites available.	2	Absent	None	Low
<b>Fish</b>							
Black Rockcod <i>Epinephelus daemeli</i>		V	The Black Cod's entire range includes warm temperate and subtropical waters of the south-western Pacific, including south-eastern Australia and the North Island, Kermadec Islands and Poor Knights Islands of New Zealand. Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50m, but are occasionally recorded from deeper waters. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs.		Absent	None	Low

## APPENDIX D CLAUSE 228 CHECKLIST

A checklist of factors that should be considered in the assessment of impacts prior to its determination is included within Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. This clause identifies sixteen issues that need to be addressed. The following text provides summary details of each of the issues, the majority of which have been addressed within the body of this document.

Factor	Minor or Major Impact
<p>a. <b>Any environmental impact on a community?</b></p> <p>During construction, there would be short term minor negative impacts on the community. Potential impacts include traffic and transport, noise and vibration and changes to landscape character. These impacts have been addressed in Chapter 5.</p> <p>Positive impacts would be achieved in the long term for the community with an increase in capacity of Throsby Creek, resulting in decreased flood levels rising in the surrounding storm water systems.</p>	Minor
<p>b. <b>Any transformation of a locality?</b></p> <p>During construction, there would be short term minor negative impacts on the Islington and Tighes Hill locality due to the introduction of construction vehicles and activities leading to disruption to noise and changes to visual and landscape character. These impacts would be temporary and mitigated with the implementation of safeguards discussed in Chapter 5.</p> <p>There would be no long-term transformation of locality.</p>	Minor
<p>c. <b>Any environmental impact on the ecosystems of the locality?</b></p> <p>The proposed works would require removal of juvenile mangroves along the banks of the two islands in Throsby Creek. The assessment has identified that the works would be unlikely to impact on the biological diversity and ecological integrity of the locality, with the effective implementation of the management measures specified in Chapter 5 of this REF.</p>	Nil
<p>d. <b>Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</b></p> <p>There would be temporary minor negative visual and socio-economic impacts due to visibility during construction (refer Section 5). The site is not known to be used for scientific purposes. Construction would be temporary, and with the implementation of safeguards, the works are not likely to reduce the environmental quality or value of the site in the long term.</p>	Minor
<p>e. <b>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?</b></p> <p>There would be no impacts 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, in the long term effects on aesthetic values would be positive.</p>	Nil

Factor	Minor or Major Impact
<p>f. <b>Any impact on the habitat of protected fauna (within the meaning of the <i>Biodiversity Conservation Act 2016</i>)?</b></p> <p>Minimal habitat for protected fauna is present within the proposed works site. Higher quality habitat is located approximately 1.5 km north east of the proposed work area, however, some fauna may utilise the proposed work area on occasion for foraging. During construction, there is low to very low potential for impact on protected fauna. Measures to reduce impacts have been recommended in Section 5, primarily, confining the works areas and impacts as much as possible and restoring disturbed areas as soon as practical.</p>	Nil
<p>g. <b>Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</b></p> <p>The proposal would not endanger any species of animal, plant or other form of life. Measures to reduce risks have been recommended in Section 5, primarily, confining the works areas and impacts as much as possible and restoring disturbed areas as soon as practical.</p>	Nil
<p>h. <b>Any long-term effects on the environment?</b></p> <p>The proposal would remove accumulated sediment and reduce flooding levels within the Throsby Creek stormwater catchment.</p>	Nil
<p>i. <b>Any degradation of the quality of the environment?</b></p> <p>The proposal would temporarily degrade small areas of the environment during construction, however, the potential impacts would be minimised with the implementation of the safeguards discussed in Chapter 5. In the long term the proposal would improve water flow within Throsby Creek and prevent flood levels rising in the surrounding stormwater systems.</p>	Minor
<p>j. <b>Any risk to the safety of the environment?</b></p> <p>The proposed is (construction and operation) unlikely to pose a risk to the safety of the environment with the implementation of the proposed mitigation measures outlined in Chapter 5.</p>	Nil
<p>k. <b>Any reduction in the range of beneficial uses of the environment?</b></p> <p>There would not be a reduction in the range of beneficial uses of the environment as a result of the proposal.</p>	Nil
<p>l. <b>Any pollution of the environment?</b></p> <p>The proposed works could generate pollution risks for water during construction works. These risks would be confined to the construction phase and are manageable with implementation of the safeguards outlined in Section 5.</p>	Nil
<p>m. <b>Any environmental problems associated with the disposal of waste?</b></p> <p>Section 5.6 discusses the waste products associated with the proposal. Specific protocols are set out to manage waste and waste disposal. The proposal is unlikely to have any environmental problems associated with the disposal of waste.</p>	Nil
<p>n. <b>Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</b></p> <p>The proposal does not require resources that are in short supply.</p>	Nil

Factor	Minor or Major Impact
<p><b>o. Any cumulative environmental effect with other existing or likely future activities?</b></p> <p>The cumulative impacts of the proposal are discussed in Section 5.11. The proposal may contribute to traffic and noise impacts during construction, particularly in conjunction with the residential development adjacent to the proposal, however, the effects of this would be minimal due to the temporary nature and small extent of the works.</p>	Minor
<p><b>p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</b></p> <p>No coastal processes or hazards would be impacted upon.</p>	Nil



## APPENDIX E MNES

### Matters of National Environmental Significance (MNES)

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
<b>a) Any impact on a World Heritage property?</b> There are no world heritage listed items located near the proposal area that would be affected as part of the proposed works.	Nil
<b>b) Any impact on a National Heritage place?</b> There are no national heritage listed places located near the proposal area that would be affected as part of the proposal.	Nil
<b>c) Any impact on a wetland of international importance?</b> The proposed works would not impact on a wetland of international importance. The closest wetland of international importance is the Hunter Estuary Wetlands, located more than 1.5 km upstream.	Nil
<b>d) Any impact on a listed threatened species or communities?</b> The proposed works would not impact on a nationally listed threatened species, ecological community or migratory species.	Nil
<b>e) Any impacts on listed migratory species?</b> Although a number of migratory species have been recorded within a 10 km radius of the proposal site, it is unlikely that the works would affect any of these species.	Nil
<b>f) Any impact on a Commonwealth marine area?</b> The proposed works would not impact on a Commonwealth marine area.	Nil
<b>g) Any impact to the Great Barrier Reef Marine Park?</b> The proposed works would not impact on the Great Barrier Reef Marine Park.	Nil
<b>h) Does the proposal involve a nuclear action (including uranium mining)?</b> The proposed works would not involve a nuclear action.	Nil
<b>i) Any impact on a water resource, in relation to coal seam gas development and large coal mining development?</b> The proposed works would not impact on a water resource in relation to coal seam gas or large coal mining development.	Nil

Factor	Impact
<p><b>j) Additionally, any impact (direct or indirect) on Commonwealth land?</b></p> <p>The proposed works would not have an impact, direct or indirect, on Commonwealth land.</p>	Nil