



# Peat Island Mooney Mooney Riparian Constraints Assessment

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**Property & Development NSW**

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## Abbreviations

Abbreviation	Description
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCAR	Biodiversity Certification Assessment Report
BOS	Biodiversity Offsets Scheme
CAA	Controlled Activity Approval
CM Act	<i>Coastal Management Act 2016</i>
CM SEPP	<i>State Environmental Planning Policy (Coastal Management) 2018</i>
DAWE	Department of Agriculture, Water and the Environment
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
ELA	Eco Logical Australia Pty Ltd

Abbreviation	Description
FM Act	<i>Fisheries Management Act 1994</i>
FPL	Flood Planning Level
KFH	Key Fish Habitat
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NRAR	Natural Resources Access Regulator
OEH	Office of Environment and Heritage
OISAS	NSW Oyster Industry Sustainable Aquaculture Strategy
VRZ	Vegetated Riparian Zone
WM Act	<i>Water Management Act 2000</i>
WSUD	Water Sensitive Urban Design

# 1. Introduction

Eco Logical Australia Pty Ltd (ELA) were engaged by Property & Development NSW to prepare a Riparian and Aquatic Constraints Assessment. The assessment is to accompany a Planning Proposal to rezone a 34 ha land parcel and align it with the proposed masterplan to redevelop Peat Island and Mooney Mooney in the Central Coast region of NSW. The marina indicated on the concept plan is a concept only and does not form part of the Planning Proposal. It will be subject to a future planning proposal, however, land based impacts of marina facilities have been considered in this assessment. However, it has been included in this assessment to provide preliminary assessment on the indicative footprint.

This report outlines the methods, results, constraints and recommendations of the desktop review and field survey of the Hawkesbury River and adjacent riparian zones within the Study Area. This includes a recommendation for the proposed location of the riparian buffers.

## 1.1 Background

In November 2017, Central Coast Council received feedback from the then Office of Environment and Heritage (OEH) (DOC17/481728-49) regarding the Planning Proposal, which included several requests for additional information including:

*The general planning considerations and specific planning policies and recommended strategies of SREP 20 (for biodiversity, wetlands, water quality and quantity, scenic qualities and Aboriginal cultural heritage) should be considered and addressed as part of the planning proposal.*

Property & Development NSW have been provided with two differing pieces of advice regarding riparian buffers required as part of the proposed development. In October 2017, Government Property & Development NSW received feedback from Department of Primary Industries (DPI) Fisheries regarding riparian setbacks and dredging considerations, and included the following comments:

1. *The 40 metre riparian buffer zone described in section 6.1 of the Flooding and Water-cycle plans should be determined by the standardized elevation contour of +1.0 metre AHD rather than the “inside edge of the mangroves” as proposed. This elevation approximates the highest astronomic tide delineation generally used by the Office of Water within estuaries and also provides a consistent benchmark for laying out riparian buffers across the site. All residential property ownership should terminate at the landward edge of this 40m riparian boundary. Land below +1m AHD should be set into an Asset Protection Zone (APZ) to accommodate expected sea level rise. Additionally, Riparian buffer zones should be clearly delineated (e.g. fences or other markers) and well managed to avoid degradation (e.g. weeds and public access management). The buffer zone should not be used for other asset protection purposes (e.g. as a bushfire or mosquito buffer).*
2. *NSW DPI will not approve the removal of marine vegetation for private facilities in areas where there are continuous, healthy saltmarsh communities, stands of mangroves or beds of seagrass. Such applications establish a precedent for further requests for additional private facilities by adjoining landholders resulting in cumulative losses of the habitat values of these areas over time. NSW DPI will consider alternative proposals for community facilities servicing multiple users such as the proposed marina adjacent to Peat Island. DPI Fisheries would also consider smaller riparian buffer*

*widths in the footprint of the marina and accepts the exclusion of Peat Island for Riparian setback requirements.*

## 1.2 Subject site

The subject site comprises 34 hectares of Government owned land on the Mooney Mooney Peninsula in the Central Coast Council Local Government Area (LGA). The site encompasses a mixture of developed and cleared land, as well as native vegetation patches of varying quality. The proposed development is adjacent to an estuarine reach of the Hawkesbury River (Figure 1) Mangroves are present along most banks of the river. Small patches of Swamp Oak Floodplain Forest and Freshwater Wetland are present adjacent to mangroves in low lying areas. Large areas in the west of the study area have been cleared and now contain exotic grassland. In the south-west and north-west of the site, where the topography slopes upwards, Wet Sclerophyll Forest is the dominant vegetation. A concept plan for the redevelopment of the site has been developed (Figure 2) and the footprint has been realigned to reduce impacts to the inner vegetated riparian zone.

Location Map

Peats Island Mooney Mooney Planning Proposal

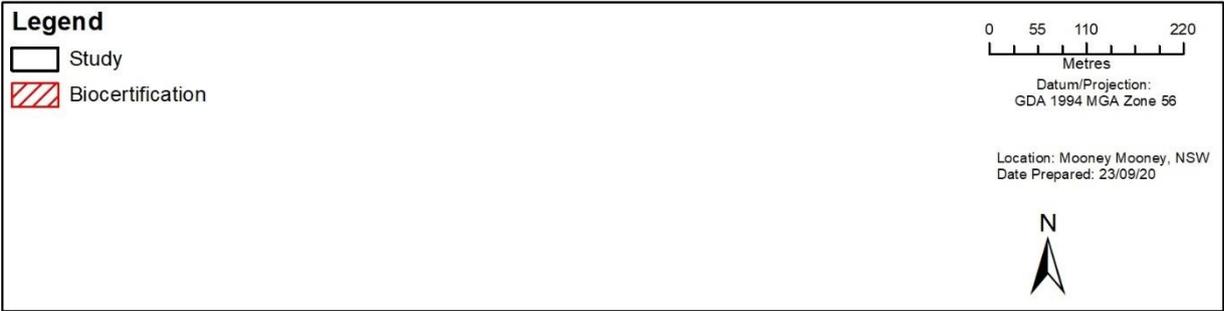


Figure 1: Location of the development and extent of the study area



Figure 2: Mooney Mooney and Peat Island Concept Plan

## 2. Methods

A literature review was carried out to determine if any threatened aquatic species were likely to occur in the study area. The following databases were searched:

- Department of Planning, Industry and Environment (DPIE) Atlas of NSW Wildlife
- NSW Threatened Species Profile Database
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool
- NSW Fisheries threatened and protected species and populations, including species profiles, 'Primefact' publications and expected distribution maps (*Riches et al. 2016*).
- A review of legislation applicable to the study area was also carried out. This included a review of the following:
  - DPI Fisheries *Policy and guidelines for fish habitat conservation and management* (Fairfull, 2013)
  - *Coastal Management Act 2018*
  - *State Environmental Planning Policy (Coastal Management) 2018*
  - *State Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2-1997)*
  - *Fisheries Management Act 1994*
  - *Water Management Act 2000*.

A field survey was carried out by two ELA aquatic ecologists on 7<sup>th</sup> September 2018. The first component of the field survey was carried out with a boat, used to travel around Peat Island and along the western shore of the mainland. This was carried out at low tide to provide greater chance of observing any seagrass in the area. An underwater camera was used to record footage of the river bed between Peat Island and the mainland, where the water was shallow enough for seagrass to occur.

The second part of the field survey was completed by walking around Peat Island and along the mainland waterfront edges to determine the condition of the mangroves and the proposed riparian areas, and to validate the results obtained from the database searches and literature reviews.

## 3. Results

### 3.1 Literature review

#### 3.1.1 Threatened species

A search of the BioNet database, Fisheries threatened and protected species and populations, Fisheries Spatial Portal and Matters of National Environmental Significance (MNES) was carried out to identify which threatened aquatic species and migratory and wading birds had been recorded or could be recorded in the area (Table 1). A map of BioNet records of threatened and migratory waterbirds within 20 km of the study area is shown in Figure 3.

**Table 1: Threatened species known to occur near the site or having habitat within 5 km.**

Species	Common name	FM Act	BC Act	EPBC Act
<i>Chelonia mydas</i>	Green turtle		Vulnerable	Vulnerable
<i>Dugong dugon</i>	Dugong		Endangered	-
<i>Petalura gigantean</i>	Giant Dragonfly		Endangered	-
<i>Epinephelus daemeli</i>	Black Rockcod	Vulnerable	-	Vulnerable
<i>Maccullochella peelii</i>	Murray Cod		-	Vulnerable
<i>Macquaria australasica</i>	Macquarie Perch	Endangered	-	Endangered
<i>Prototroctes maraena</i>	Australian Grayling	Endangered	-	Vulnerable
<i>Balaenoptera musculus</i>	Blue Whale		-	Endangered
<i>Eubalaena australis</i>	Southern Right Whale		-	Endangered
<i>Botaurus poiciloptilus</i>	Australasian Bittern		Endangered	Endangered
<i>Calidris tenuirostris</i>	Great Knot		Endangered	Critically Endangered
<i>Charadrius leschenaultii</i>	Greater Sand Plover		Vulnerable	Vulnerable
<i>Charadrius mongolus</i>	Lesser Sand Plover		Vulnerable	Endangered
<i>Esacus magnirostris</i>	Beach-stone Curlew		Critically Endangered	
<i>Caretta caretta</i>	Loggerhead Turtle		-	Endangered
<i>Chelonia mydas</i>	Green Turtle		-	Vulnerable
<i>Dermochelys coriacea</i>	Leatherback Turtle,		-	Endangered
<i>Eretmochelys imbricata</i>	Hawksbill Turtle		-	Vulnerable
<i>Natator depressus</i>	Flatback Turtle		-	Vulnerable
<i>Carcharias taurus</i>	Grey Nurse Shark (east coast population)			Critically endangered
<i>Carcharodon carcharias</i>	White Shark			Vulnerable

Species	Common name	FM Act	BC Act	EPBC Act
<i>Rhincodon typus</i>	Whale Shark			Vulnerable
<i>Fregetta grallaria</i>	White-bellied Storm-Petrel			Vulnerable
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle		Vulnerable	Migratory
<i>Hieraaetus morphnoides</i>	Little Eagle		Vulnerable	
<i>Ixobrychus flavicollis</i>	Black Bittern		Vulnerable	
<i>Limicola falcinellus</i>	Broad-billed Sandpiper		Vulnerable	
<i>Limosa limosa</i>	Black-tailed Godwit		Vulnerable	
<i>Numenius madagascariensis</i>	Eastern Curlew			Critically endangered, Migratory
<i>Pandion cristatus</i>	Eastern Osprey		Vulnerable	Migratory
<i>Pterodroma neglecta</i>	Kermadec Petrel (western)			Vulnerable
<i>Rostratula australis</i>	Australian Painted Snipe		Endangered	Endangered
<i>Sternula albifrons</i>	Little Tern		Vulnerable	
<i>Xenus cinereus</i>	Terek Sandpiper		Vulnerable	
<i>Actitis hypoleucos</i>	Common Sandpiper			Migratory
<i>Anous stolidus</i>	Common Noddy			Migratory
<i>Apus pacificus</i>	Fork-tailed Swift			
<i>Ardenna carneipes</i>	Flesh-footed Shearwater			Migratory
<i>Calidris acuminata</i>	Curlew Sandpiper			Migratory
<i>Calidris cantus</i>	Red Knot			Endangered, Migratory
<i>Calidris ferruginea</i>	Curlew Sandpiper			Critically endangered, Migratory
<i>Calidris melanotos</i>	Pectoral Sandpiper			Migratory
<i>Gallinago hardwickii</i>	Latham's Snipe			Migratory
<i>Hirundapus caudacutus</i>	White-throated Needletail			Migratory
<i>Monarcha trivirgatus</i>	Spectacled Monarch			Migratory
<i>Tringa nebularia</i>	Common Greenshank			Migratory

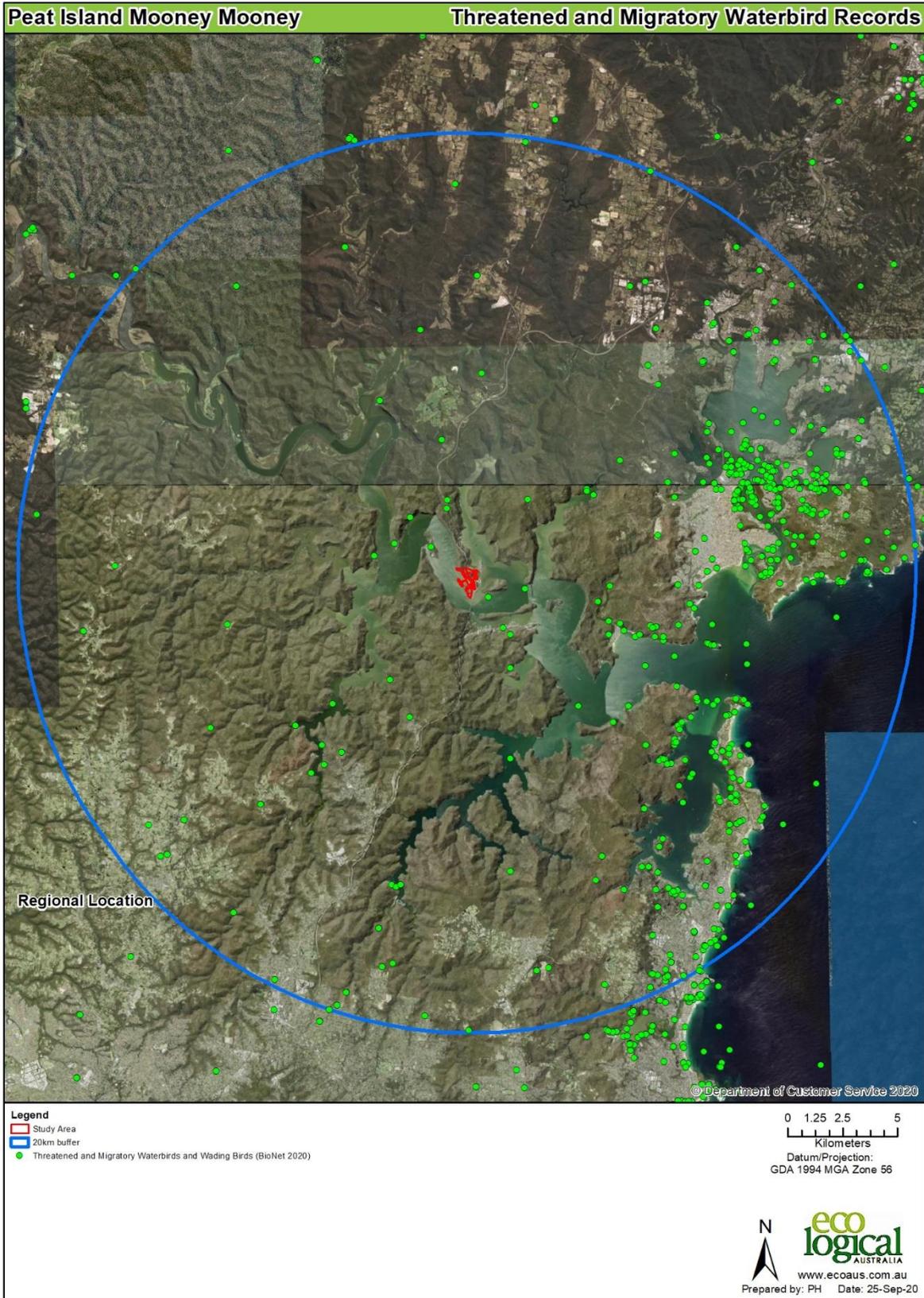
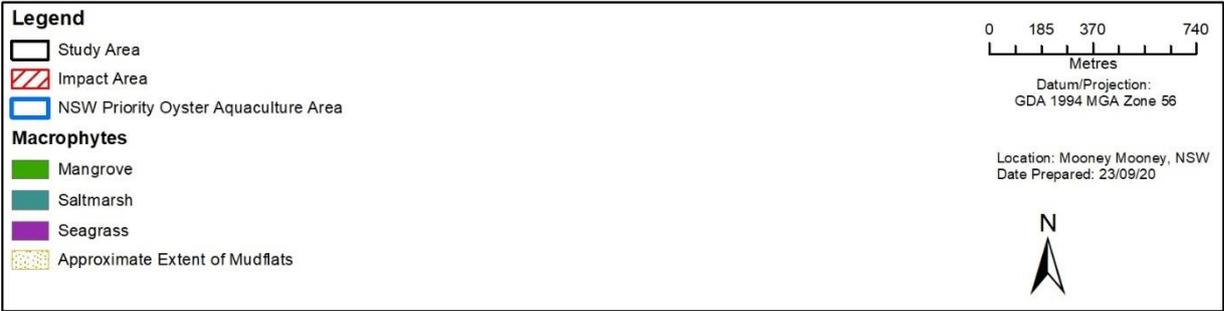
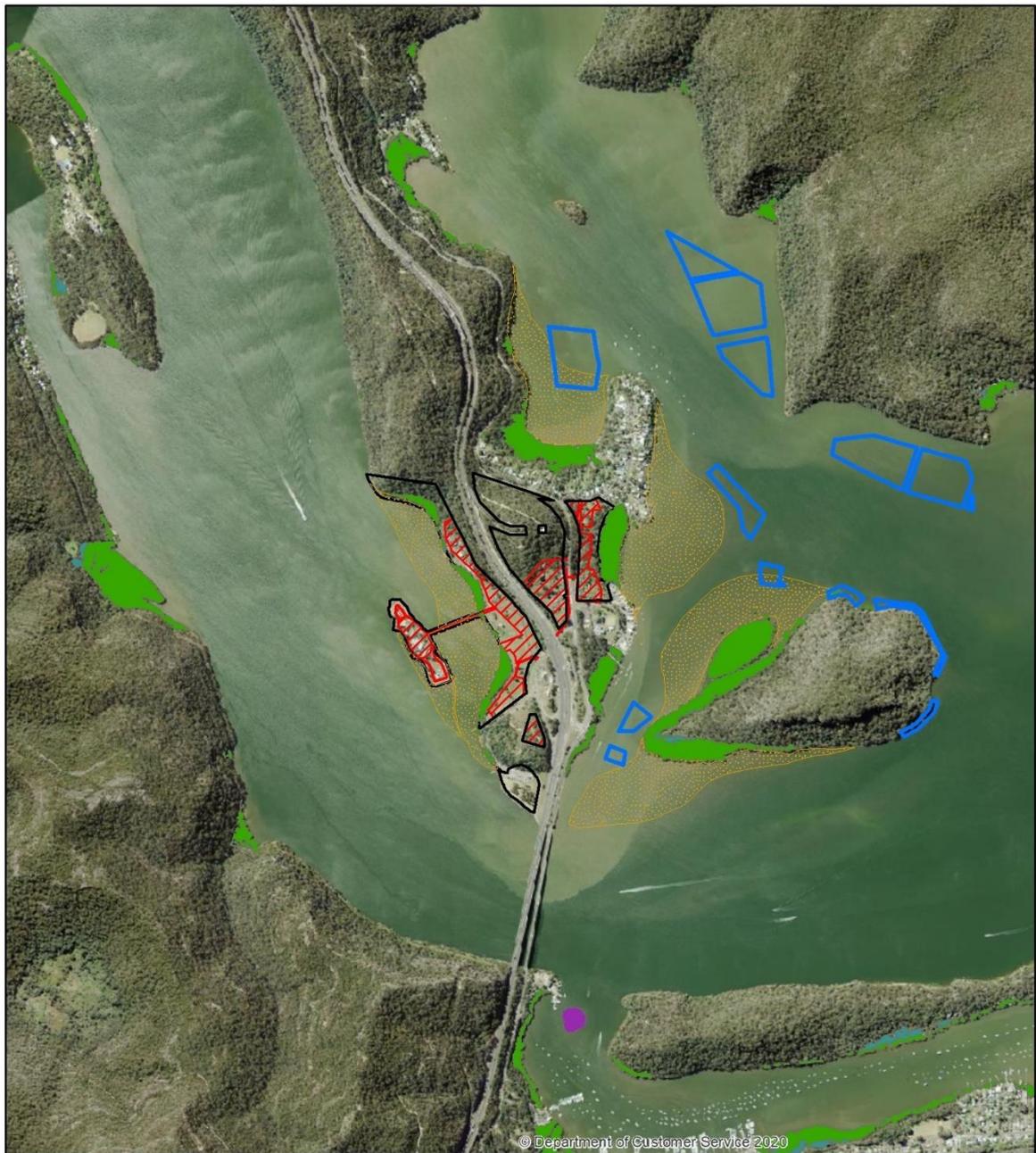


Figure 3: Threatened and migratory waterbirds and wading birds within 20 km of the site

### 3.2 Aquaculture leases

A search of the DPI Fisheries Spatial Data Portal showed the location of aquaculture leases on the eastern side of the Mooney Mooney mainland (Figure 4).

**Macrophytes and Aquaculture**      **Peats Island Mooney Mooney Planning Proposal**



**Figure 4: Priority Oyster Aquaculture Areas, Aquatic vegetation as mapped by DPI Fisheries**

### 3.3 Statutory context

A review of Commonwealth and State legislative and planning documents was carried out to determine what components of these Acts and planning policies were relevant to the subject site. Table 2 summarises these and their relevance to the aquatic and riparian habitat of Peat Island and Mooney Mooney.

**Table 2: Legislation relevant to study area**

Name	Relevance to the project	Section in this report
Commonwealth		
<p><i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)</p>	<p>The <i>Environment Protection and Biodiversity Conservation Act 1999</i> is Commonwealth legislation that aims to protect Matters of National Environmental Significance (MNES). Impacts to MNES are assessed through application of a significance assessment. Where a development or activity has the potential to have a significant impact on a MNES, a referral is made to the Department of Agriculture, Water and the Environment (DAWE). The Department determines whether the activity can proceed with no further assessment by the Commonwealth, or whether it will be a controlled action for which an Environmental Impact Assessment must be supplied.</p> <p>MNES have been identified within the study area. Whilst Planning Proposals are not considered an ‘action’, future Development Applications will need to ensure that impacts to MNES are considered to determine if significant impacts on them are likely.</p>	<p>Table 1</p>
State		
<p><i>Biodiversity Conservation Act 2016</i> (BC Act)</p>	<p>The planning proposal is to be assessed as a Biodiversity Certification under the BC Act. A Biodiversity Certification Assessment Report (BCAR) has been prepared by ELA to be submitted with the planning proposal.</p> <p>Aquatic species protected under the BC Act have been identified as having potential habitat within the site. The Flora and Fauna Assessment prepared by ELA (2018) assessed the impacts on terrestrial species as a result of the proposed development.</p>	<p>Table 1</p>
<p><i>Coastal Management Act 2016</i></p>	<p>Mangroves and aquatic vegetation are protected under FM Act and the impacts to mangroves assessed under BC Act.</p> <p>The objectives of the <i>Coastal Management Act 2016</i> (CM Act) are to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State.</p> <p>The <i>State Environmental Planning Policy (Coastal Management) 2018</i> (CM SEPP) gives effect to the objectives of the CM Act from a land use planning perspective, by defining the four coastal management areas listed in the CM Act and</p>	<p>Figure 6</p>

Name	Relevance to the project	Section in this report
	<p>specifying the assessment criteria that are tailored for each coastal management area.</p> <p>Part 2 of the CM Act identifies objectives related to four coastal management areas of the ‘coastal zone’:</p> <ul style="list-style-type: none"> <li>• Coastal wetlands and littoral rainforests area</li> <li>• Coastal vulnerability area</li> <li>• Coastal environment area</li> <li>• Coastal use area.</li> </ul>	
<p><i>Fisheries Management Act 1994</i> (FM Act)</p>	<p>The <i>Fisheries Management Act 1994</i> (FM Act) is the principal piece of legislation protecting aquatic habitat in NSW. The Act aims to conserve fish stocks, key fish habitat, aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and communities are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. Impacts on threatened species listed under the FM Act would require Assessments of Significance in accordance with the Act.</p> <p>A permit under Part 7 of FM Act may be required for the following activities that:</p> <ul style="list-style-type: none"> <li>• have a direct or indirect impact to marine vegetation (including mangroves)</li> <li>• require dredging or excavation of the bed or bank</li> <li>• block fish passage</li> <li>• involve land reclamation.</li> </ul> <p>Whilst a Planning Proposal is not an ‘activity’, it can facilitate certain activities and therefore the objects of the Act are relevant to the Planning Proposal.</p> <p>NSW DPI assesses activity and development proposals in relation to the general policies stated above and with consideration for the sensitivity of the affected fish habitat. Key Fish Habitat (KFH) is not defined under the FM Act, however the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI, 2013) outline what constitutes a Type 1, 2 and 3 KFH depending on the sensitivity of the habitat (Appendix A). NSW DPI will generally not approve new developments or activities that will harm TYPE 1 and TYPE 2 marine vegetation without adequate mitigation and compensation measures in place.</p>	<p>Figure 4</p>
<p><i>Water Management Act 2000</i> (WM Act) and <i>Water Management (General) Regulation 2018</i> (WM Reg)</p>	<p>The NSW <i>Water Management Act 2000</i> (WM Act) aims to provide for the sustainable and integrated management of water sources for NSW. The Act requires developments on waterfront land to be ecologically sustainable, and recognises the benefits of aquatic ecosystems to agriculture, fisheries, and recreation.</p>	<p>Section 3.3.1</p>

Name	Relevance to the project	Section in this report
	<p>Approvals under Section 91 are required for controlled activities on waterfront land. Under the WM Act, a controlled activity means:</p> <ul style="list-style-type: none"> <li>the erection of a building or the carrying out of a work (within the meaning of the <i>Environmental Planning and Assessment Act 1979</i>),</li> <li>the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise,</li> <li>the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or</li> <li>the carrying out of any other activity that affects the quantity or flow of water in a water source.</li> </ul> <p>Section 91E (1) of the WM Act identifies that it is an offence to carry out a controlled activity in, on or under waterfront land without gaining a controlled activity approval. Whilst a Planning Proposal is not an ‘activity’, it can facilitate certain activities and therefore the objects of the Act are relevant to the Planning Proposal.</p>	
<b>Planning instruments</b>		
<p><i>Gosford Local Environmental Plan 2014</i></p>	<p>The <i>Gosford Local Environmental Plan (LEP) 2014</i> makes local environmental planning provisions for land in the Central Coast Local Government Area (LGA). The proposed LEP zonings for Peat Island and Mooney Mooney are shown in Figure 5.</p> <p>The LEP also maps the probability of acid sulphate soils within the study area. Surrounding the area of proposed development, there is a high probability of occurrence for acid sulphate soils (Figure 7).</p>	<p>Figure 5 and Figure 7</p>
<p><i>State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP)</i></p>	<p>The Coastal Management SEPP aims to manage development within coastal zones and protect the environmental assets of the coast. In accordance with Section 5 of the CM Act, the term coastal zone is defined as any area of land that is comprised of the following coastal management areas:</p> <ul style="list-style-type: none"> <li>Coastal wetlands and littoral rainforests</li> <li>Coastal vulnerability areas</li> <li>Coastal environment areas</li> <li>Coastal use areas.</li> </ul> <p>Under the NSW Department of Planning and Environment Coastal Management SEPP Interactive Map, the study area is mapped as Coastal Wetland, Proximity Area for Coastal Wetlands and a Coastal Use Area and Coastal Environment Area. Clause 11(1) of the Coastal Management SEPP states that:</p>	<p>Figure 6</p>

Name	Relevance to the project	Section in this report
<p><i>State Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2-1997)</i></p>	<p>1. <i>Development consent must not be granted to development on land identified as “proximity area for coastal wetlands” or “proximity area for littoral rainforest” on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on:</i></p> <ul style="list-style-type: none"> <li>a. <i>the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or</i></li> <li>b. <i>the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.</i></li> </ul> <p>Whilst a Planning Proposal is not an ‘activity’, it can facilitate certain activities and therefore the outcomes sought by the SEPP are relevant to the Planning Proposal.</p> <p>The aim of the <i>State Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2-1997)</i> is to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context. Part 2 Clause 6 includes a number of specific planning policies and recommended strategies relevant to the site at Mooney Mooney:</p> <p><b>1) Total catchment management</b></p> <p><u>Policy:</u> Total catchment management is to be integrated with environmental planning for the catchment.</p> <p><u>Strategies:</u></p> <ul style="list-style-type: none"> <li>a) Refer the application or other proposal for comment to the councils of each adjacent or downstream local government area which is likely to suffer a significant adverse environmental effect from the proposal.</li> <li>b) Consider the impact of the development concerned on the catchment.</li> <li>c) Consider the cumulative environmental impact of development proposals on the catchment.</li> </ul> <p><b>2) Environmentally sensitive areas</b></p> <p><u>Policy:</u> The environmental quality of environmentally sensitive areas must be protected and enhanced through careful control of future land use changes and through management and (where necessary) remediation of existing uses.</p> <p><u>Strategies:</u></p> <ul style="list-style-type: none"> <li>a) Rehabilitate parts of the riverine corridor from which sand, gravel or soil are extracted so that</li> </ul>	

Name	Relevance to the project	Section in this report
	<p>attached aquatic plant beds are replaced and water quality and faunal habitats improved</p> <ul style="list-style-type: none"> <li>b) Minimise adverse impacts on water quality, aquatic habitats, riverine vegetation and bank stability</li> <li>c) Protect wetlands (including upland wetlands) from future development and from the impacts of land use within their catchments.</li> <li>d) Consideration should be given to the impact of the development concerned on the water table and the formation of acid sulphate soils.</li> <li>e) New development in conservation area sub-catchments should be located in areas that are already cleared.</li> </ul>	

### 3) Water quality

Policy: Future development must not prejudice the achievement of the goals of use of the river for primary contact recreation (being recreational activities involving direct water contact, such as swimming) and aquatic ecosystem protection in the river system. If the quality of the receiving waters does not currently allow these uses, the current water quality must be maintained, or improved, so as not to jeopardise the achievement of the goals in the future. When water quality goals are set by the Government these are to be the goals to be achieved under this policy.

Strategies:

- a) Quantify, and assess the likely impact of, any predicted increase in pollutant loads on receiving waters.
- b) Consider the need to ensure that water quality goals for primary contact recreation and aquatic ecosystem protection are achieved and monitored.
- c) Approve development involving primary contact recreation or the withdrawal of water from the river for human contact (not involving water treatment), such as showers, only in locations where water quality is suitable (regardless of water temperature).
- d) Do not carry out development involving on-site disposal of sewage effluent if it will adversely affect the water quality of the river or groundwater. Have due regard to the nature and size of the site.
- e) Develop in accordance with the land capability of the site and do not cause land degradation.
- f) Consider the need for an Erosion and Sediment Control Plan (to be in place at the commencement

Name	Relevance to the project	Section in this report
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- of development) where the development concerned involves the disturbance of soil.
- g) Minimise or eliminate point source and diffuse source pollution by the use of best management practices.
  - h) Site and orientate development appropriately to ensure bank stability. Plant appropriate native vegetation along banks of the river and tributaries of the river, but not so as to prevent or inhibit the growth of aquatic plants in the river and consider the need for a buffer of native vegetation.
  - i) Consider the impact of the removal of water from the river or from groundwater sources associated with the development concerned.
  - j) Protect the habitat of native aquatic plants.

#### 4) Water quantity

Policy: Aquatic ecosystems must not be adversely affected by development which changes the flow characteristics of surface or groundwater in the catchment.

Strategies:

- a) Future development must be consistent with the interim or final river flow objectives that are set for the time being by the Government.
- b) Ensure the amount of stormwater run-off from a site and the rate at which it leaves the site does not significantly increase as a result of development. Encourage on-site stormwater retention, infiltration and (if appropriate) reuse.
- c) Consider the need for restricting or controlling development requiring the withdrawal or impoundment of water because of the effect on the total water budget of the river.
- d) Consider the impact of development on the level and quality of the water table.

#### 7) Riverine Scenic quality

Policy: The scenic quality of the riverine corridor must be protected.

Strategies:

- a) Maintain areas of extensive, prominent or significant vegetation to protect the character of the river.

Name	Relevance to the project	Section in this report
	<ul style="list-style-type: none"> <li>b) Ensure proposed development is consistent with the landscape character as described in the Scenic Quality Study.</li> <li>c) Consider the siting, setback, orientation, size, bulk and scale of and the use of unobtrusive, non-reflective material on any proposed building or work, the need to retain existing vegetation, especially along river banks, slopes visible from the river and its banks and along the skyline, and the need to carry out new planting of trees, and shrubs, particularly locally indigenous plants.</li> <li>d) Consider the need for a buffer between new development and scenic areas of the riverine corridor shown on the map as being of significance beyond the region (which are also scenic areas of significance for the region) or so shown as being of regional significance only.</li> <li>e) Consider the need for controls or conditions to protect those scenic areas.</li> <li>f) Consider opportunities to improve riverine scenic quality.</li> </ul>	

### Management plans and strategies

<p><i>Lower Hawkesbury Estuary Management Plan - November 2008</i></p>	<p>Lower Hawkesbury Estuary Management Plan (LHEMP) aims to provide an integrated whole of estuary approach for management of the waterway and surrounding environment. This Plan provides the strategic direction for future management of the estuary and its associated assets. The LHEMP recognises that the risks influencing the sustainability of estuarine assets are a direct consequence of the health of the catchments within which it lies.</p>	
<p><i>NSW Oyster Industry Sustainable Aquaculture Strategy Third Edition 2016</i></p>	<p>The vision of the strategy is to achieve the sustainable production of 7,500 tonnes of premium NSW oyster products for domestic and export markets by 2020. The strategy outlines requirements which must be considered for land use planning and Development Applications (DA) which may affect oyster aquaculture areas. The strategy states:</p> <p><i>When considering an application for development that, because of its proposed location, may affect a priority oyster aquaculture area or oyster aquaculture outside such an area, the consent authority must:</i></p> <ol style="list-style-type: none"> <li>1. Give the Director-General of the NSW DPI written notice of the development application and take into consideration any written submissions made in response to the notice within 21 days after notice was given, and</li> <li>2. Take into consideration the provisions of OISAS.</li> <li>3. Consider any issues that are likely to make the development incompatible with oyster aquaculture and</li> </ol>	<p>Section 3.2 and Section 4, Figure 4</p>

Name	Relevance to the project	Section in this report
	<p><i>evaluate any measures that the applicant has proposed to address those issues. Examples of potential land use incompatibility issues include access to oyster aquaculture leases being limited by the development or the risk of adverse impacts of the development on water quality and, consequently, on the health of oysters and on the health of consumers of those oysters.</i></p> <p>A number of Priority Oyster Aquaculture Areas (POAA) are present downstream from the subject site within the Hawkesbury River. Potential impacts have been discussed in this assessment and must be assessed in detail at the DA stage in accordance with the strategy.</p>	
<p><i>Hawkesbury-Nepean River System Coastal Management Program</i></p>	<p>Hornsby Shire Council, along with Hawkesbury City, Northern Beaches, The Hills Shire, Central Coast and Ku-ring-gai Councils are preparing a Coastal Management Program (CMP) that will detail the long-term strategy for the coordinated management of the coastal zone along the Hawkesbury. The program will focus on achieving coastal management objectives at a local level whilst, also achieving the objectives of the Coastal Management Act 2016, the State Environmental Planning Policy (Coastal Management) 2018 and the NSW Coastal Management Manual. This plan has currently completed Stage 1- Scoping Study. As there are Coastal Management areas within and adjacent to the proposed development site (Figure 6), once the final CMP is adopted, the development site at Peat Island and Mooney Mooney will be subject to this plan.</p>	<p>Figure 6 and Section 4.1</p>
<p><i>NSW Coastal Design Guidelines 2003</i></p>	<p>The document is designed to provide a framework for discussion and decision making involving coastal planning, design and development proposals between all stakeholders in the context of caring for the natural beauty and amenity of coastal beaches, headlands, waterways and ecologies upstream. It includes design principles for coastal settlements that are relevant to development control plans (DCPs).</p>	<p>Section 4.1</p>
<p><i>Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions</i></p>	<p>The framework is a protocol that decision-makers, such as councils and environmental regulators, can use to help manage the impact of land-use activities on the health of waterways in New South Wales. For the development at Mooney Mooney, the framework could be used to develop specific development controls for stormwater management which could be included in a new DCP or water cycle management plans.</p>	<p>Sections 4.5 and 4.7.4</p>

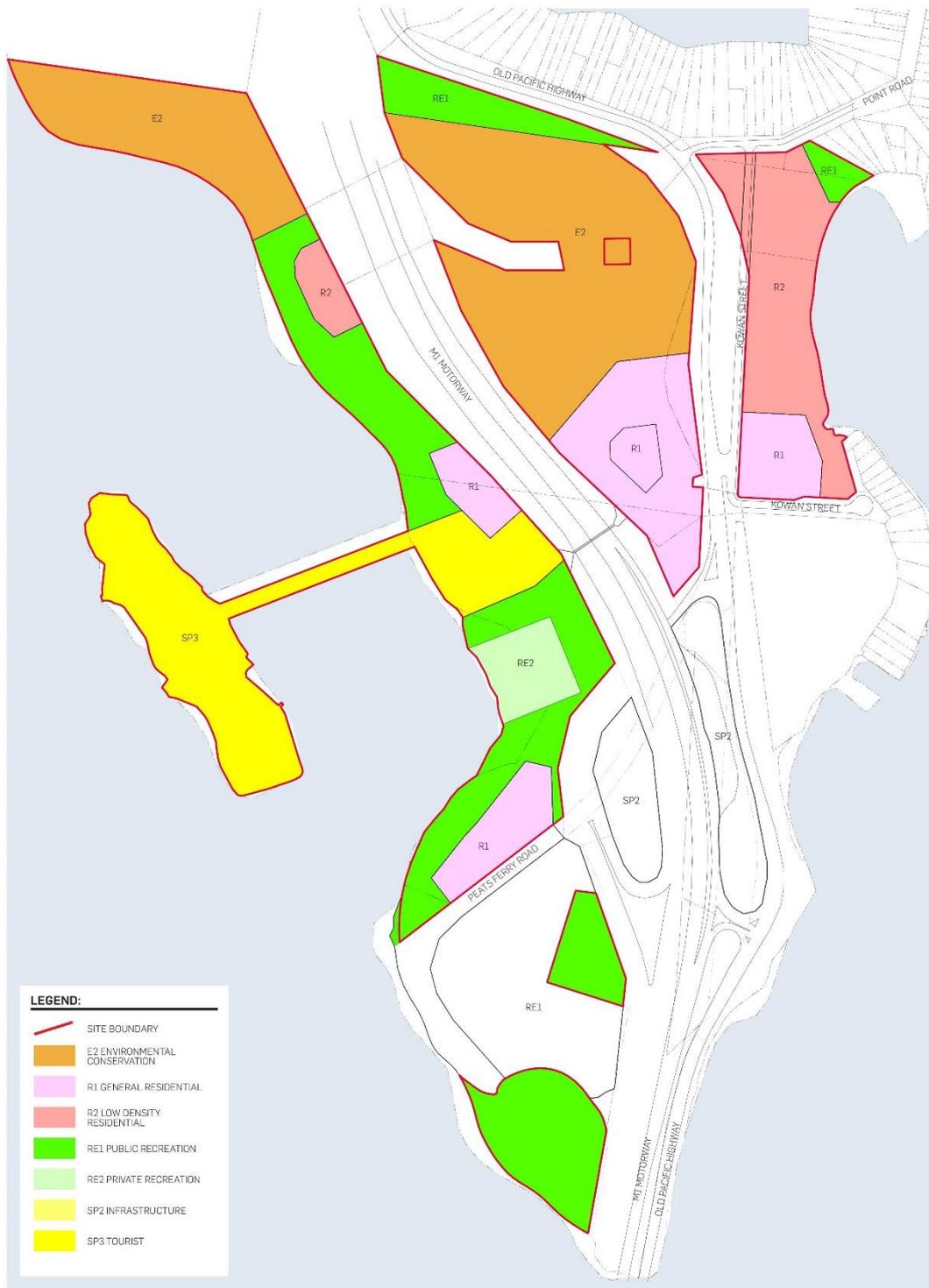


Figure 5: Proposed zoning plan for the development site



Figure 6: Coastal Management areas mapped within the study area



Figure 7: Probability of occurrence of Acid Sulphate Soils near proposed development

### 3.3.1 Water Management Act 2000

The Natural Resources Access Regulator (NRAR) (formerly DPI Water) administers the NSW *Water Management Act 2000* (WM Act) and is required to assess the impact of any proposed work on waterfront land. This includes the bed and bank of any river, lake or estuary and land within 40 m of the highest bank. Certain activities within waterfront land are defined as ‘Controlled Activities’ which require a Controlled Activity Approval (CAA) if they are associated with local development under Part 4 of the *Environmental Planning and Assessment Act 1979*.

The NRAR’s *Guidelines for Controlled Activities on waterfront land—Riparian corridors* (NRAR 2018) outline the need for a Vegetated Riparian Zone (VRZ) adjacent to the channel to provide a transition zone between the terrestrial environment and watercourse. This vegetated zone helps maintain and improve the ecological functions of the aquatic environment, whilst providing habitat for terrestrial flora and fauna. The VRZ plus the channel (bed and banks of the watercourse to the highest bank) constitute the ‘riparian corridor’ (Figure 8 below). All streams have a predetermined VRZ width based on their Strahler Order (Table 3).

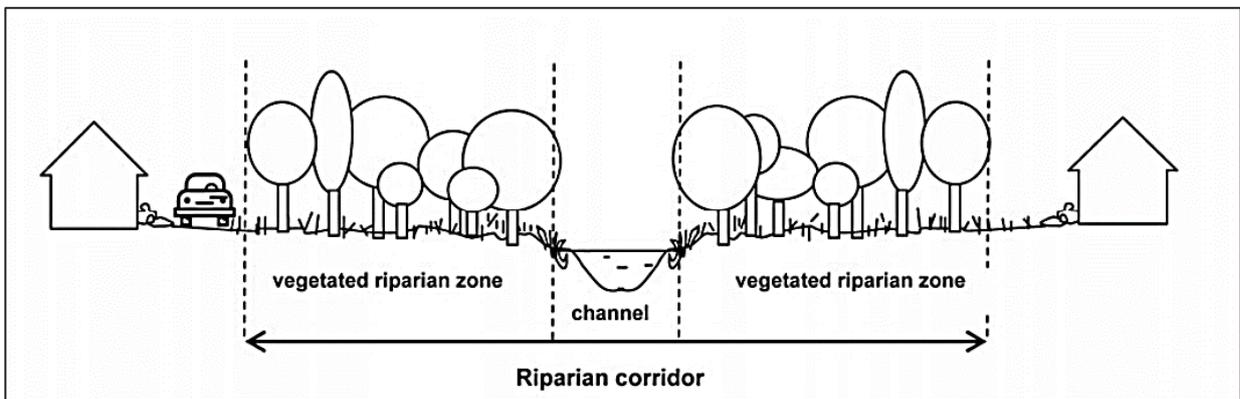


Figure 8: VRZ and watercourse channel comprising the riparian corridor (NRAR 2018).

Table 3: Recommended riparian corridor width as per Strahler (NRAR, 2018).

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1 <sup>st</sup> order	10 metres	20 m + channel width
2 <sup>nd</sup> order	20 metres	40 m + channel width
3 <sup>rd</sup> order	30 metres	60 m + channel width
4 <sup>th</sup> order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Non-riparian uses can be authorised by NRAR within the outer 50% of the VRZ as long compensation (1:1 offset) is achieved within the site, with the exception of permissible uses listed in Table 4. The outer

VRZ that is impacted must be offset elsewhere on site using the ‘averaging rule’ (Figure 9 below). The inner 50% of the VRZ must be fully maintained and vegetated with native riparian species.

Table 4: Riparian corridor (RC) matrix (NRAR 2018)

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1 <sup>st</sup>	10m	•	•	•	•	•	•			
2 <sup>nd</sup>	20m	•	•	•	•	•				
3 <sup>rd</sup>	30m	•	•	•		•			•	•
4 <sup>th</sup> +	40m	•	•	•		•			•	•

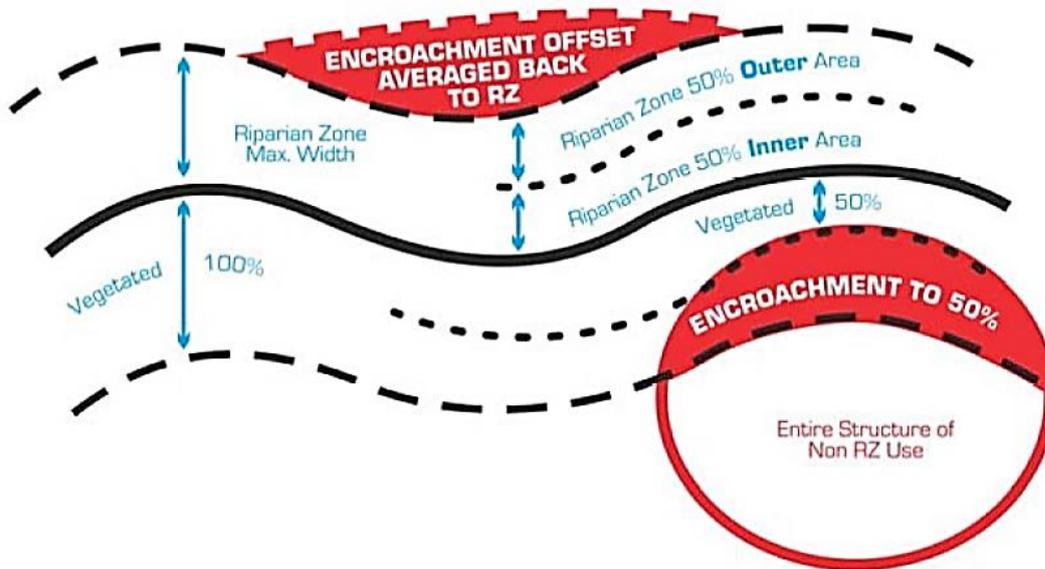


Figure 9: Riparian ‘averaging rule’ for offsetting encroachment into the outer 50% of the VRZ (NRAR 2018).

The VRZ has been applied to the site at Peat Island and Mooney Mooney, starting from the edge of the mangroves, validated as part of the Flora and Fauna Assessment completed for this site by ELA (July, 2018) (Figure 10). This map shows a number of areas where the current construction footprint encroaches on, not only the outer VRZ, but the inner VRZ as well.

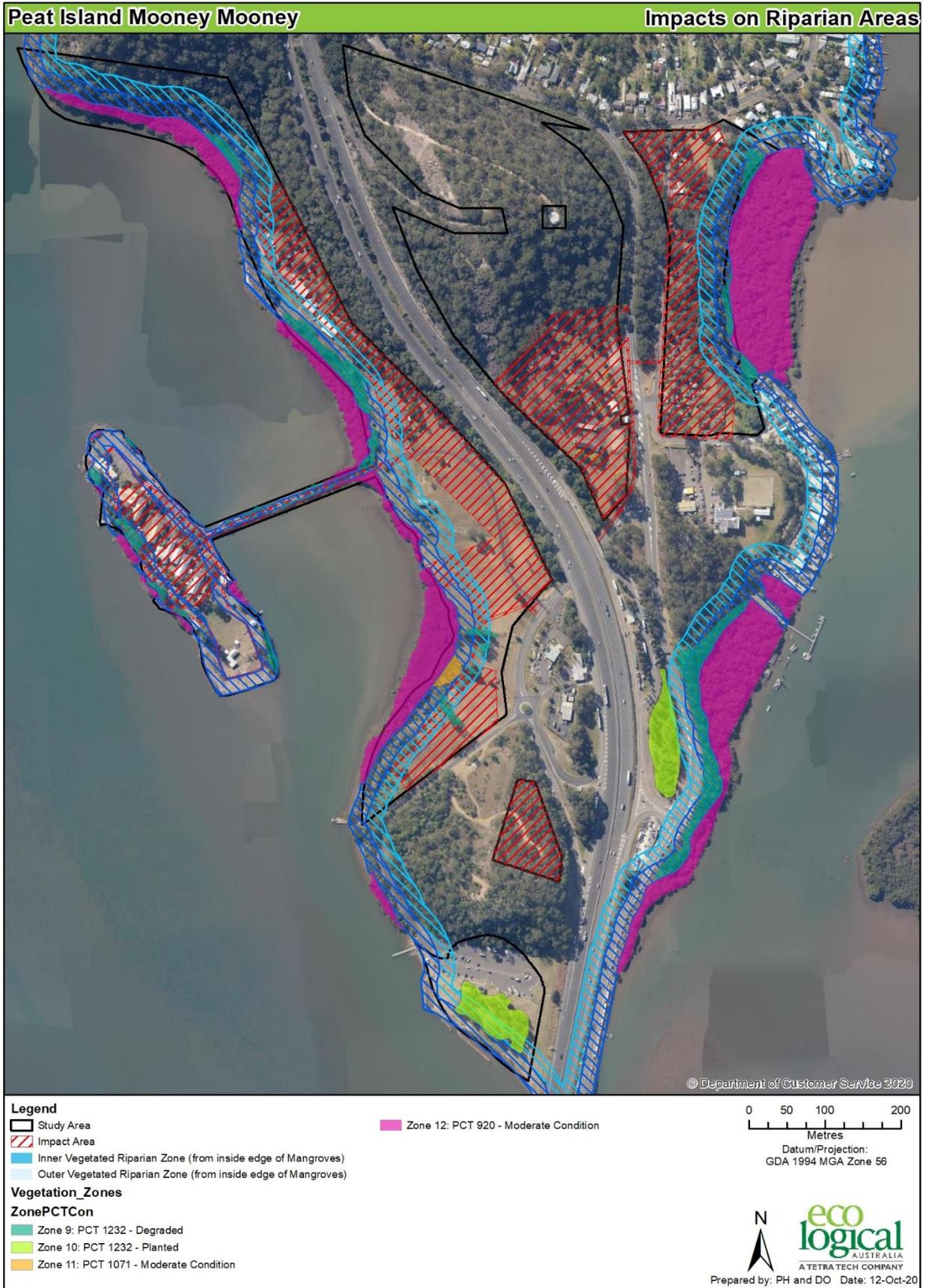


Figure 10: Recommended vegetated riparian zones as per NRAR guidelines

### 3.4 Field survey

The results of the field survey are split into the following four areas:

- Waterbody
- Peat Island
- Western mainland area
- Eastern mainland area.

#### Waterbody

A small boat was used to travel around Peat Island, in between Peat Island and the mainland, and around the southern tip of the mainland to the western side. At low tide, the waterway between the island and the mainland was very turbid and no seagrass was observed within this area nor was it observed on the footage from the underwater camera. Seagrass requires shallow areas of water with plenty of light reaching the bed. The waterbody around Peat Island and the mainland of Mooney Mooney was not considered suitable habitat for seagrass.

The mudflat exposed at low tide between Peat Island and the mainland (Figure 11) was observed to be foraging habitat for wading birds including *Egretta novaehollandiae* (White-faced heron) and *Threskiornis molucca* (Australian White Ibis). Pneumatophores extended about halfway into the mudflat. A few live oysters were observed in this area.

Some *Sargassum* sp. (Brown Macroalgae) was located floating in the water on the eastern side of Peat Island (Figure 12). Some macroalgae was also located in the low branches of mangroves and deposited on the mudflat on the eastern side of the channel between Peat Island and the mainland.



**Figure 11: Mudflat exposed at low tide between Peat Island and Mooney Mooney mainland; looking south**



**Figure 12: *Sargassum* sp. located on the western shore of Peat Island**

### Peat Island

The majority of Peat Island is cleared (Figure 13) and only a few patches of vegetation are present. Some mangroves are present on the western and eastern side of the island (Figure 14), but they are not in a continuous corridor as they are on the adjacent mainland shore.

Some parts of the Peat Island foreshore are unvegetated and consist of imported rock and rubble. Oyster shells were attached to this rocky shore. A thin riparian zone exists where mangroves and *Casuarina glauca* (Swamp Oak) species are growing.



**Figure 13: Unvegetated riparian zone on eastern side of Peat Island; looking south.**



**Figure 14: Mangrove stand on western side of Peat Island; looking east**

### Western mainland area

The longest continuous strip of mangroves within the site was on the western side of the Mooney Mooney mainland, where two species were present: *Aegiceras corniculatum* (Black Mangrove) and *Avicennia marina* (Grey Mangrove).

On the landward side of the mangroves, a low rock retaining wall existed in most areas (Figure 15), restricting the spread of the mangroves inland. On the eastern side of this rock wall, the area that would be considered within the riparian buffer, it was either dominated by exotic species including *Erythrina x*

*sykesii* (Cockspur Coral Tree) (Figure 16) and *Lantana camara* (Lantana), or mown and slashed pasture grasses (Figure 17). A number of man-made drainage channels channelled water from the existing roads across the grassed area and into the mangrove area (Figure 18).



**Figure 15: Retaining wall at inside edge of mangroves; looking south**



**Figure 16: Coral trees located on inside edge of mangroves**



**Figure 17: Unvegetated riparian zone on eastern side of mangroves; looking south**



**Figure 18: Man-made drainage channel discharging straight into mangroves; looking west**

### Eastern mainland area

The eastern area of the mainland had already been developed in some areas, and residential blocks and commercial oyster farms were located in this area. There was a small amount of remnant vegetation in this area, including some mangroves, but also Swamp Oak trees. The understorey of the riparian areas was generally dominated by exotic species.



Figure 19: Key fish habitat types within and surrounding the study area

## 4. Constraints and opportunities

There are two main constraints to development of the site: mangroves and tidal mudflats. This section describes the constraints and potential mitigation measures.

### 4.1 Mangroves and seagrass

Mangroves provide important fish habitat and nutrient filtering in estuarine environments. The current location of the ancillary structures for the indicative marina development would largely avoid direct impacts to mangroves but may impact of approximately 0.03 ha of mangroves between the mainland and Peat Island. Impacts to mangroves have been restricted to the indicative marina/jetty access area and additional impacts to mangroves have been avoided through revision of the concept plan. The marina does not form part of the planning proposal and would be subject to a separate future planning proposal if it is to proceed. This would include a detailed environmental assessment of the impacts. Although it is intended to retain all the mangroves, for the purposes of this report an impact area of 0.03 ha has been included as a precautionary measure. Where direct impacts occur on mangroves, offsets should be considered through rehabilitation or replanting of more degraded areas of mangroves. Opportunity exists in the north west of the site. No seagrass was observed in the indicative location of the marina. The water in this area is likely to be too turbid to support seagrass, so seagrass is not likely to be a constraint within this area.

The mangroves observed on the site show signs of active recruitment and plants of multiple ages, indicating the community is very healthy and actively growing. To minimise direct and indirect impacts to the mangroves ELA recommends buffer of 40 m from the landward edge of the mangroves to prevent or minimise disturbance. The extent of this buffer is shown in Figure 10. This buffer should be revegetated with native species that typically form an 'ecotone' from terrestrial system to aquatic. For example, the area in the north-west of the site should be revegetated to restore Swamp Oak Floodplain Forest. Where there are no mangroves present (and in some cases no riparian vegetation), the riparian buffer should start at the top of the bank of the river, which in most of the foreshore areas, is the top of the rock retaining wall.

Incorporation of boardwalks and structures that would allow light to reach the water and mudflats below into the detailed designs would be recommended to ensure that where encroachment into the mangroves or mudflats is proposed, there would still be the opportunity for growth of marine vegetation below.

Consultation with DPI Fisheries should take place to determine if offsetting of mangroves can take place to ensure no net loss of fish habitat. This approach is consistent with the objectives of the *Guidelines for Controlled Activities on waterfront land (DPI, 2012)*, including:

- Seek to maintain or rehabilitate the RC/VRZ with fully structured native vegetation (in accordance with Table 3);
- Locate services and infrastructure outside of the RC/VRZ. If services must cross the waterway, provide an easement to support multiple services and/or use road crossings where possible; and
- Treat stormwater run-off before discharging into the RC/VRZ.

The NRAR Guidelines provide for non-riparian corridor works and activities within the outer riparian corridor, so long as the average width of the vegetated riparian zone can be achieved over the length of the watercourse within the development site. That is, where appropriate, 50% of the outer vegetated riparian zone width may be used for non-riparian uses including asset protection zones, recreational areas, roads, development lots and infrastructure. However, an equivalent area connected to the riparian corridor must be offset on the site and the inner 50% of the vegetated riparian zone must be fully protected and vegetated with native, endemic, riparian plant species. The averaging rule should generally be applied to land already lacking tree cover (the majority of the outer 50% VRZ was cleared) and seek to preserve existing natural vegetation. A vegetated buffer is imperative for the protection of the mangroves, the tidal/mud flat area and downstream oyster farms, as it would provide a protective barrier between the proposed development and the waterway, helping to filter nutrients from stormwater and overland flow. Table 4 identifies what structures may be allowed to be constructed within the VRZ. The current construction footprint (Figure 1) encroaches the outer 50%, and in some cases, the inner 50% of the riparian buffer of the Hawkesbury River (Figure 10).

The impact area encroaches into 0.81 ha of the inner riparian buffer and 1.08 ha of the outer riparian buffer. This encroachment into the inner VRZ is predominantly located on existing hard stand surfaces on the island and causeway (0.73 ha). A small area of undeveloped inner VRZ will be impacted for infrastructure associated with a potential future marina development (0.08 ha) (any future marina activities are subject to a future planning proposal). No impacts to inner VRZ are associated with the proposed residential development. Impacts to the inner riparian buffer have been reduced through redesign of the concept plan, avoiding impacts to the inner buffer from carparks, residential areas and the pedestrian path. Following the *Guidelines for Controlled Activities on waterfront land*, ELA recommends an offset area (as illustrated in Figure 9) to preserve the average width of the riparian corridor and retain native vegetation that exists along the river banks. This offset area presents the opportunity for rehabilitation of the native vegetation community and maintenance of a wildlife corridor. During detailed planning, opportunities to link riparian zones to other patches of restored vegetation on the site should be investigated. The proposed development should be positioned in areas where the VRZ is already cleared or in a degraded state and there would be less of an impact on remnant vegetation. Riparian offsets should be located where remnant, good quality native vegetation can be expanded upon or linked together.

ELA understands that Peat Island is considered exempt from the requirement to maintain a riparian buffer width as per NRAR guidelines. However, in order to protect the adjacent waterbody from degradation of water quality through stormwater runoff from the island once it is developed, it is recommended that a riparian buffer as wide as possible be established in these areas. This would act as a filter to protect the adjacent waterbody and contribute to river bank stability.

While the current riparian area on the mainland is disturbed or vegetated only with grass or exotic species, it would need to be rehabilitated and revegetated as a part of proposed works. This would help protect adjacent aquatic areas and improve chances of conforming with NRAR guidelines.

The mangroves are also where the mapped locations of the Coastal Management Areas are within and adjacent to the site. Development within these areas needs to be in accordance with Part 2, Division 1, Section 10 of the Coastal Management SEPP for coastal wetlands and Part 2, Division 1, Section 11 for

proximity to coastal wetlands. The development should also be developed with consideration of the NSW Coastal Design Guidelines 2003.

Once the CMP for the Hawkesbury-Nepean River System Coastal Management Program is adopted, any development within the Coastal Management Areas will be subject to the requirements of the CMP.

ELA understands former Gosford City Council adopted a sea level rise planning level. The high level rise scenario is an increase Central Coast Council has mapped sea level rise of 1.06 m AHD by 2100. When locating building setbacks and riparian buffers, considerations of this increase in sea level should be included in the planning.

## 4.2 Tidal mudflats

The study area contains tidal mudflats which provide habitat for shorebirds. Birds were observed during field survey foraging for food when the tide was low including *Egretta novaehollandiae* (White-faced Heron) and *Threskiornis molucca* (Australian White Ibis). These species are not listed as Migratory Shorebirds under the Commonwealth EPBC Act 1999. An indicative area of mudflat in the vicinity of the site is shown in Figure 19.

A list of wading and migratory birds that may use the site as habitat or feeding areas have been included in Figure 3. If a marina was to be proposed in the future, dredging activities and construction associated with a marina development (subject to a future planning proposal) is likely to lead to direct impacts such as habitat loss and temporary or indirect impacts including noise, vibration and changes to water quality which may affect the availability of fish and other aquatic species which are food for these species. Figure 3 demonstrates that records of threatened and migratory waterbirds in proximity to the study area are sparse. Within the region, waterbird records are concentrated around Brisbane Water and coastal areas, with records relatively sparse moving upstream in the Hawkesbury River.

Future design of a marina development should consider potential mitigation measures and the impact assessment criteria in EPBC Policy Statement 3.21 Industry Guidelines for assessing and mitigating impacts on EPBC Act listed migratory shorebird species. If the impact is significant, a Controlled Action under the EPBC is likely to be declared and approval from the Commonwealth would be required before undertaking the action.

ELA would also recommend that for a future marina development (subject to a future planning proposal), more detailed biodiversity study be carried out during that planning proposal stage, and within the September-March survey period, to determine if there would be any impacts particularly on migratory and wading bird species that are likely to use the mudflats and mangroves. This may include targeted bird surveys to determine exactly what species are using the area where the marina is proposed to be built. Regarding significant flora species likely to be located under the water, it is unlikely that seagrass would be located in the area between Peat Island and the mainland as the water is too turbid.

## 4.3 Key Fish Habitat

As shown in Figure 19, areas of KFH have been validated within the study area, according to the table in Appendix A. As the indicative marina location impacts on TYPE 2 KFH, consultation with DPI Fisheries regarding the proposal is required. DPI Fisheries has published *Policy and Guidelines for fish habitat*

*conservation and management* (2013) which outlines the specific policies that apply to harming marine vegetation, including:

Where harm to marine vegetation is approved, a management plan will generally be required as a condition of consent, dependent on the scale of the works proposed and the adequacy of the environmental assessment provided with the application

NSW DPI will generally not approve developments or activities that do not incorporate foreshore buffer zones of 50-100 m width adjacent to TYPE 1 marine vegetation and at least 50 m width adjacent to TYPE 2 marine vegetation. Where a buffer of at least 50 m is physically unachievable due to land availability constraints, the available buffer width must be maximised to achieve protection of TYPE 1 and 2 marine vegetation (i.e. from edge effects, changes to water quality, flood protection and to allow for climate change adaptation).

The mitigation measures recommended for the planning proposal (and any future planning proposal for a marina) are in accordance with the NSW DPI policy and guidelines regarding buffer widths and protection of mangroves where possible. It would be necessary to develop a management plan for the mangroves within the study area to ensure their continued protection.

#### 4.4 Acid sulfate soils

The likelihood of potential acid sulfate soils occurring within and adjacent to the study area have been mapped within the study area and would most likely be disturbed when any construction activity in or on the river bed sediment takes place. Figure 7 indicates the areas where high probability of acid sulphate soils are likely to occur. Exposing acid sulfate soils can cause acidic conditions in the water and impact on aquatic biodiversity as well as nearby oyster leases if not managed carefully. An acid sulphate soil management plan would need to be prepared for those developments located within at-risk areas to ensure that any impacts of exposing acid sulphate soils on the nearby aquatic fauna are mitigated. Management of potential acid sulphate soils is to be in accordance with the *Acid Sulphate Soils Manual* (Acid Sulfate Soils Management Advisory Committee, 1998).

#### 4.5 Water quality

Disturbance to sediment to construct the ancillary structures for any future marina development would likely create significant turbidity in the waterway and mobilise fine bed sediments. It may also expose acid sulphate soils and affect channel hydrology between Peat Island and Mooney Mooney.

Drainage and overland flow from the site must be considered when planning the layout of the entire site. Any increase in volume, or decline in quality of the water leaving the site, could adversely affect the health of the adjacent aquatic environment.

Water quality targets for stormwater management should be developed and incorporated as part of an overarching DCP for the site using the Risk Based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions as outlined in Table 2. There also needs to be consideration of the velocity of stormwater discharged from the site to prevent any localised scouring and erosion of the adjacent riverbed.

On site stormwater management such as level spreaders or biofiltration systems should be implemented to improve the quantity of water delivered to the estuary following development. This is in line with the 'Water Quantity' strategy component of the *State Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2-1997)* (Table 2). Stormwater management is discussed in more detail in Section 4.7.

Section 2.10 of the Mott Macdonald report (2018) mentions that the environment type is unlikely to include sensitive habitats including oyster beds or have importance for commercial species. During ELA's field survey, a small number of live oysters were located on the western side of the mainland in amongst the areas where oyster shells were located on rocky substrate near the mangroves. In addition to this, aquaculture leases are located in the vicinity of the site (Figure 4) and DPI Fisheries advice to Property & Development NSW (October 2017) was that there will be potential impacts for adjacent oyster farms and the Hawkesbury Estuary general fishery and Prawn trawlers. It is essential that as part of the assessment of impacts of the future marina, nearby stakeholders must be included in the planning process.

Section 3.3 of the Mott Macdonald technical note (2018) includes reference to the possibility of creating vertical concrete stable batter slopes. ELA recommends that any bank stabilisation works required as part of the proposed development should utilise natural materials such as sandstone rather than concrete, sheet piles or other smooth surfaces. Sandstone blocks can be used to create sloping revetment banks and this material can also provide habitat for aquatic fauna and seepage of groundwater through the joints in the sandstone.

Additional information relating to water quality and quantity as a result of future development was provided by Mott MacDonald (2021) and has been summarised in Section 4.7 of this report.

#### 4.6 Offsetting requirements

There are offsetting options under the FM Act for encroachment into mangroves and under the WM Act for encroachment into the outer VRZ. Under the current proposed layout, approximately 0.03 ha of mangroves would be directly impacted. Offsetting of mangroves impacted as a result of the proposed development could take place via establishing mangroves elsewhere within the study area, as discussed above. Consultation with DPI Fisheries is recommended before detailed planning regarding this offsetting option is prepared.

The impact area encroaches into 0.81 ha of the inner VRZ. This is predominantly located on existing hard stand surfaces on the island and causeway (0.73 ha). A small area of undeveloped inner VRZ will be impacted for infrastructure associated with a potential future marina development (0.08 ha) (any future marina activities are subject to a future planning proposal). No impacts to inner VRZ are associated with the proposed residential development. The footprint of the proposed future development footprint (including residential and recreational areas) encroaches into 1.08 ha of the Outer VRZ, partially along existing roads and hardstand surfaces in the north-west of the study area. Encroachment into the inner VRZ should be avoided where possible, as this buffer provides immediate protection to the mangroves and estuarine ecosystem. Encroachment into the outer VRZ can be offset as per Figure 9, following consultation with NRAR.

## 4.7 Water Cycle Management Review

In August 2021, Mott MacDonald prepared a Water Cycle Management Review to accompany the Planning Proposal, the key findings relating to riparian ecology and hydrological impacts are outlined below.

### 4.7.1 Flood Planning

Regarding flood planning, Mott Macdonald states the following.

*A portion of The Site on the western coastline on the mainland (south of the Peat Island Causeway) currently lies within the 100 year ARI flood affectation area. It is proposed that this area is raised to at least the proposed minimum Flood Planning Level (FPL). In effect, this area will no longer be within the 100 year ARI flood zone, and therefore is likely to change from being classified in the higher range of flood hazard to a lower range flood hazard. The proposed area to be raised will be occupied by a non-habitable boat shed minimising the risk to human life.*

The location of the proposed fill area is shown in Figure 20. The flood level should not be raised within the Inner Riparian Zone, except where required for the marina supporting infrastructure, which is subject to a future planning proposal. According to the report, the filling works will not impact proposed localised overland flow paths or drainage routes and will not affect other land within the subject land.

### 4.7.2 Sedimentation and erosion

The report states that a Sedimentation and Erosion plan will be conducted at the detailed design phase of this project to ensure appropriate measures are implemented. The plan will ensure the surrounding environment is not adversely affected as a result of the development.

### 4.7.3 Stormwater Quantity Management

It is noted that the increase in impervious surfaces will result in an increase in the volume of runoff. However, Mott MacDonald states that the proximity of The Site to the Hawkesbury River and Mooney Mooney Creek allows near direct stormwater discharge of The Site and the change in land use is not expected to adversely impact downstream properties due to the regional context and tidal influence. Through discussions with Council, it was determined that On-Site Detection will not be required for the site.

### 4.7.4 Stormwater Quality Management

Mott MacDonald has considered Water Sensitive Urban Design (WSUD) principles to ensure the water quality of stormwater runoff from the site meets the targets outlined in Wyong Shire Councils Water Sensitive Urban Design Technical Guidelines (2010). Two water quality strategies have been proposed to manage water quality (Figure 21):

**1. Communal Treatment** – *Catchments which will meet the water quality objectives by discharging stormwater runoff to a communal water quality facility. The communal water quality facilities may be shared by multiple developments within The Site. Maintenance of the water quality facilities will be through Council or the respective proprietary product owner and is to be confirmed at the detailed design phase of development.*

**2. On-Site Treatment** – *Catchments which will meet the water quality objectives by providing on-site treatment of stormwater runoff prior to discharging to the Hawkesbury River. Typically, these catchments are constrained topographically and cannot practically drain towards a communal facility location, therefore individual on-site treatment will be required. The water quality treatment measures will be provided on a lot-by-lot basis and landowners will be expected to maintain their own water quality devices. It is recommended that Council enforces a site specific DCP for the on-site treatment areas identified in Figure 13. A condition of consent will be applied to these lots to enforce a treatment train which meets the water quality objectives specified in Section 8.1 of this report.*

More detailed analysis of water cycle management is required at the DA stage to ensure the water quality requirements are met with respect to future development of the site.

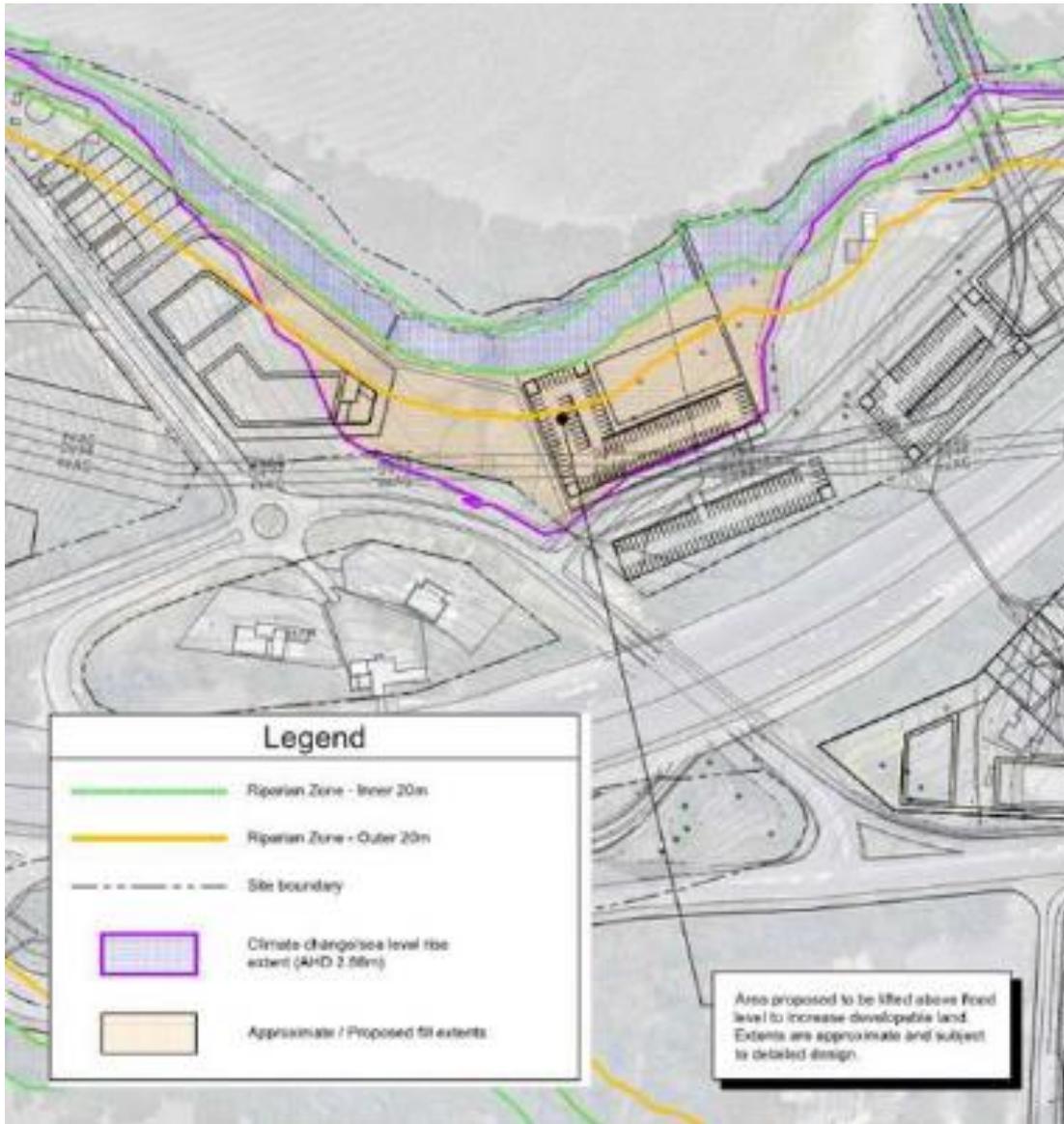


Figure 20: Proposed fill area (Mott Macdonald, 2021)

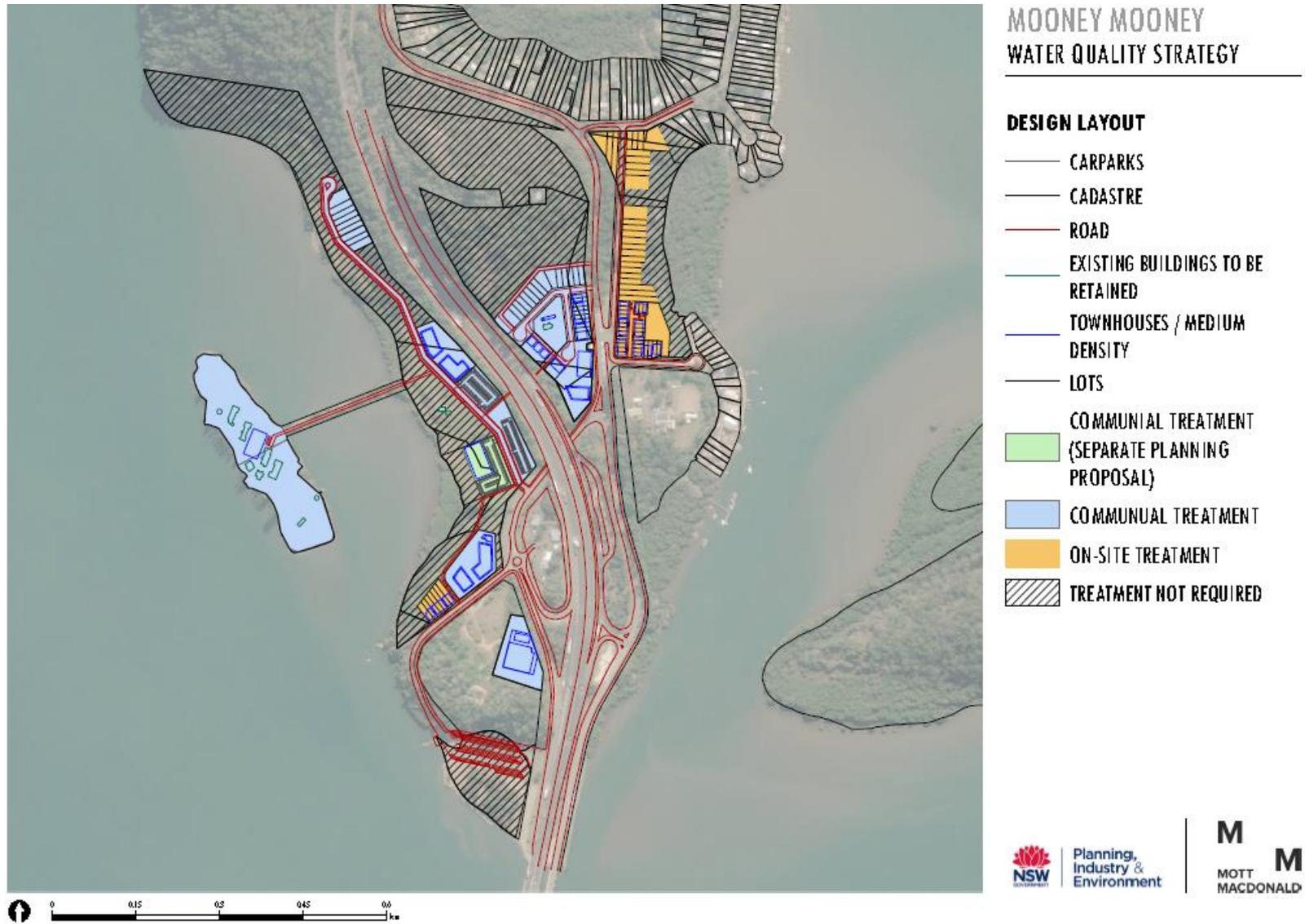


Figure 21: Water Quality Strategy (Mott MacDonald, 2021, Figure 13)

## 4.8 Concluding Statement

This riparian constraints assessment was prepared to accompany a Planning Proposal to rezone the 34 ha land parcel and realign it with the proposed masterplan to redevelop Peat Island and Mooney Mooney in the Central Coast region of NSW. The assessment has outlined key constraints of development occurring in the foreshore area and riparian zone, provides recommendations to minimise potential disturbance to be incorporated during detailed development design and outlines potential mitigation measures. Key recommendations including undertaking detailed assessment of future marina facilities (under a future planning proposal), avoiding impacts on sensitive riparian areas and incorporating appropriate mitigation measures should be implemented in order to minimise long-term environmental impacts in proceeding with the Planning Proposal.

## 5. References

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## Appendix A - Key Fish Habitat types

### **TYPE 1 - Highly sensitive key fish habitat:**

- *Posidonia australis* (strapweed)
- *Zostera*, *Heterozostera*, *Halophila* and *Ruppia* species of seagrass beds >5m<sup>2</sup> in area
- Coastal saltmarsh >5m<sup>2</sup> in area
- Coral communities
- Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)
- Marine park, an aquatic reserve or intertidal protected area
- SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia<sup>2</sup>
- Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants
- Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act
- Mound springs

### **TYPE 2 – Moderately sensitive key fish habitat:**

- *Zostera*, *Heterozostera*, *Halophila* and *Ruppia* species of seagrass beds <5m<sup>2</sup> in area
- Mangroves
- Coastal saltmarsh <5m<sup>2</sup> in area
- Marine macroalgae such as *Ecklonia* and *Sargassum* species
- Estuarine and marine rocky reefs
- Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan)
- Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
- Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
- Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
- Weir pools and dams up to full supply level where the weir or dam is across a natural waterway

### **TYPE 3 – Minimally sensitive key fish habitat may include:**

- Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna
- Coastal and freshwater habitats not included in TYPES 1 or 2
- Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

