

# EPBC Act referral



Australian Government  
Department of Agriculture, Water and the Environment

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<b>Title of proposal</b>	<b>2020/8849 - Southern Redland Bay Wastewater Treatment Plant</b>
<b>Section 1</b>	
<b>Summary of your proposed action</b>	
<b>1.1 Project industry type</b>	Waste Management (sewerage)
<b>1.2 Provide a detailed description of the proposed action, including all proposed activities</b>	
<p>The referral area is approximately 45ha of rural land located at Longland Road, Redland Bay within Redland City Council. The site is bound by Logan River to the south, Serpentine Creek to the west and is subject to broadscale clearing for rural purposes. The proposed action will involve:</p> <ul style="list-style-type: none"><li>- construction of a permanent wastewater treatment plant on an approximate 1.75ha footprint and ancillary infrastructure (i.e. storage lagoon, mains connection and access roads) on cleared and degraded land</li><li>- creation of a 9.85ha mangrove wetland (natural filtration system and nutrient offset for treated wastewater).</li></ul> <p>The wastewater treatment plant will have capacity to service 13,500 equivalent persons (EP) or up to 5,000 dwellings, and is intended as a sub-regional sewerage infrastructure solution for the Southern Redland Bay catchment. The wastewater treatment plant will be operated &amp; owned by Redland Water, a business entity of Redland City Council.</p> <p>The mangrove wetland will be created on low-lying open paddock adjoining the Logan River. The purpose of the mangrove wetland is to 'polish' the treated wastewater and 'offset' the remaining nutrient load. Earthworks will be necessary to create a land profile that will allow the wetland to be hydrologically linked to the Logan Estuary through a culvert inlet and outlet. The establishment of a wetland is considered best practice in recycled water management, and provides ancillary benefits such as carbon sequestration, a net gain in marine plants and habitat for terrestrial and aquatic flora and fauna species.</p> <p>Proposed Infrastructure (Appendix B Proposal Plans of the Environmental Assessment Report (Saunders Havill Group November 2020))</p> <ol style="list-style-type: none"><li>1. Wastewater treatment plant (WWTP) A new WWTP.</li><li>2. Pipeline New staged pipelines (2) are required to connect the WWTP to the reticulated sewer network to be constructed in Serpentine Creek Road and Longland Road. Additional recycled water mains (2) will be constructed for transfer of water back to the Southern Redland Bay area for re-use and temporary irrigation.</li><li>3. Storage lagoon There is an existing water storage west of the proposed WWTP. It is proposed that some additional earthworks be undertaken to increase the volume of this storage in order for it to accommodate WWTP discharges. Recycled water from the WWTP will flow into the storage lagoon and then eventually into the northern portion of the constructed mangrove wetland.</li><li>4. Mangrove wetland A new mangrove wetland will be established on 9.85ha of land to the west of the WWTP. This will be facilitated by earthworks to lower contours of the land to allow for tidal inflows from the Logan River. An existing tidal inlet from the Logan River will be connected to the newly created tidal [mangrove] area. An 'outlet' will be facilitated via a connection to Serpentine Creek at the western end of the site.</li><li>5. Ancillary structures Ancillary structures will be required including a sediment forebay on the inlet and a maintenance access track to access the sediment forebay and inlet/outlet areas for routine maintenance. A new driveway access will be required to Longland Road to provide access to the WWTP.</li><li>6. Temporary disposal area It is proposed that during the early stages of the project when the mangrove wetland is being established, discharges from the WWTP will occur to a temporary disposal area north of the site and inside the current Shoreline residential development area. The proposal for temporary irrigations was included as part to the EPBC 2016/7776 approval. Inflows to the WWTP during the temporary irrigation period will be relatively low due to the rate of construction of new dwellings.</li></ol> <p><b>Wastewater Treatment Plant</b></p> <p>The WWTP will be an advanced membrane bioreactor (MBR) system; a proven treatment process that will remove nutrients and pathogens to a level that is as low, or lower than, most existing plants in South East Queensland. The MBR will remove at least 99.9% of pathogens prior to discharge. Recycled water from the WWTP will be treated to equal or better than that required under the Australian and Queensland Recycled Water Guidelines (Class A) and suitable to irrigate parks and sports fields.</p> <p>An Environmental Relevant Activity (ERA 63(3)) issues under the Queensland Government Environmental Protection Act 1994 must be obtained to operate the WWTP, and permits the point of discharge from the plant to the storage lagoon.</p> <p>The MBR will consist of the following processes:</p>	



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- coarse screening (5mm)
- grit removal
- fine screening (2mm)
- flow balancing
- bioreactor treatment
- membrane filtration, including associated facilities for flushing and chemical cleaning
- sodium hypochlorite dosing
- sodium bisulphite dosing (if required)
- odour control
- biosolids processing.

The size of the WWTP footprint will require approximately 1.75ha and is designed service an expected maximum population of 13,500 EP, or 5,000 homes. The WWTP is expected to generate close to 2.7ML/d of treated wastewater when the development is fully occupied.

The WWTP will be staged with 3 major stages for a total of 13,500 EP for a 20 year operational timeframe:

- Stage 1 (1A) – commence Year 1 for 3,375 EP
- Stage 1 (1B) – commence Year 6 for 6,750 EP
- Stage 2 – commence Year 11 for 13, 500 EP.

The Recycled Water Strategy prepared by Stantec (2020) (refer Appendix I of the Environmental Assessment Report (Saunders Havill Group November 2020)) sets out a disposal staging plan that is compliant with the development staging plan. The strategy sets out four phases for disposal over a 7 year construction period:

Phase 1: Construction

Year 1- Stage 1A of the WWTP is constructed.

Sewerage is tankered for the first 200 lots.

Mangrove forest constructed and planting occurs to assist establishment during construction of the WWTP.

Phase 2: No Discharge to Mangrove Wetland

Year 2 - Wastewater transport (tankering) ceases and Stage 1A of the WWTP produces recycled water which is used to supply water for construction, landscaping and irrigation.

There is no excess recycled water and no discharge to mangrove wetlands.

Phase 3: Increasing Discharge to Mangrove Wetland

Years 3 & 4

The recycled water storage is established. Recycled water is used to supply water for construction, landscaping and irrigation.

Additional recycled water is used for temporary irrigation.

A small discharge (in extreme wet weather) is proposed through the lagoon storage to the mangrove wetlands.

Year 5 & 6

Discharge is increased to the mangrove wetlands, with levels of discharged monitored adapted and depending on success temporary irrigation may be ceased. Stage 1B of the WWTP will be constructed.

Phase 4: Ultimate Scheme

Year 7 – Recycled water discharge is managed between the mangrove wetland and irrigation of sports parks and ovals and other suitable users (e.g. construction, nurseries). Stage 2 of the WWTP will be constructed in line with market demand.

**1.3 What is the extent and location of your proposed action?**

See Appendix B

**1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland)**

The land is located to the south of Longland Road at Redland Bay, on an outer bend of the Logan River, about 5.7km upstream from the mouth of the river. The site is partly bounded by Rocky Passage Road, to the east, with residential property located beyond. Agricultural properties are located to the west of the subject site which is bounded by Serpentine Creek. The Logan River forms the southern boundary of site. The site is within the Redland City Council (RCC) local government area. Serpentine Creek is located adjacent to the site to the west and this forms the boundary between the administrative areas of RCC and Logan City Council areas. The site has been subject to broadscale clearing and contains cleared land for rural land use, an existing dwelling, dams and ancillary infrastructure. The eastern extent of the site is predominately vegetated and comprised of both remnant and regrowth woodland. Marine plants (mangroves and salt couch) are present in the western part of the site.



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**1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?**

The referral area is approximately 45ha. Within this area the disturbance footprint is approximately 26ha and the avoidance area is 19ha. The disturbance footprint is comprised of the following components:

- mains infrastructure along Serpentine Creek Road and Longland Road (in road reserve)
- mains infrastructure between road reserve and wastewater treatment plant
- wastewater treatment plant
- created mangrove wetland
- storage lagoon
- Bushfire buffer

**1.7 Proposed action location**

Other - 38 Longland Road & road reserve from this premise to 275 Serpentine Cree Road Redland Bay

**1.8 Primary jurisdiction**

Queensland

**1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?**

Yes  No

**1.10 Is the proposed action subject to local government planning approval?**

Yes  No

**1.11 Provide an estimated start and estimated end date for the proposed action**

Start Date 01/04/2021

End Date 31/03/2031

**1.12 Provide details of the context, planning framework and state and/or local Government requirements**

Ministerial Infrastructure Designation (MID)

The project will be assessed by the Queensland Government under a MID. The MID process takes a 'whole of government' approach to assessing and deciding critical community supporting infrastructure. It involves multiple State technical agencies and public consultation. The MID provides for all approvals required under the Queensland's Planning Act 2016. The MID team within Queensland Treasury assesses applications.

To be assessed under the MID, the Minister must consider the following prior to endorsement:

- indicative proposal plans indicating built form (including existing and proposed heights) and any proposed demolition
- project value and funding source
- list of any preliminary/technical assessments that have been undertaken
- a list of the technical reports to be provided in support of the request
- approximate change to the number of site users
- outcomes of pre-engagement consultation with the council and key stakeholders (as determined by Queensland

Treasury), including:

- actions and stakeholders notified
- matters/issues raised
- how these matters/issues have been directly addressed (i.e. design changes or mitigation measures)
- the approval/s history for the site, to ensure that the designation does not conflict with any ongoing obligations from previous development approvals, including: a summary of the approvals' history for the site (all approvals/judgements/orders); the status of the above (which have been carried out, which have not, which have lapsed, etc); an analysis of the ongoing obligations of those approvals (i.e. conditions that are not 'discharged' – 'operational' or 'maintain' conditions); and commentary as to how the designation proposes to deal with any ongoing obligations or former - operational conditions to avoid any conflict



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- 'desired' designation date and relationship to the delivery programs etc
- any further additional information, preliminary plans or details that may assist.

The proposal, applicable state interests, key issues, required technical material and proposed consultation strategy are to be assessed in the Environmental Assessment Report. The Environmental Assessment Report must address outcomes of pre-engagement consultation with the council and key stakeholders (as determined by Queensland Treasury). The Environmental Assessment Report must address the approval/s history for the site, to ensure that the designation does not conflict with any ongoing obligations from previous development approvals over the site. Queensland Treasury can review the above-mentioned consultation material as it is prepared. Queensland Treasury has an interest in ensuring the material is fit-for-purpose, suited to the audience, and clearly outlines the proposal. Queensland Treasury have undertaken a preliminary assessment (as well as review technical reports in draft format) prior to lodgement of the Environmental Assessment Report to ensure no major issues or concerns and request clarifications as required. Following preliminary assessment, Queensland Treasury will prepare the Minister's consultation material for the Minister's consideration and signing. The Final Environmental Assessment Report must address all submissions made during the consultation process and provide evidence of how these concerns any outstanding issues have been addressed. A flow chart illustrating the MID process is provided in Appendix A.

#### MNES and MSES

The project is sought be assessed under a streamlined MID, pursuant to Chapter 2, Part 5, section 36 of the Planning Act 2016. The project will be assessed under the Minister's Guidelines and Rules (MGR), Chapter 7 – Guidelines for the process for environmental assessment and consultation for making or amending a Ministerial designation. Designated infrastructure becomes Accepted Development under the Planning Act 2016. Importantly, under the MID process, the MID team will also involve Commonwealth DAWE in assessment of the Environmental Assessment Report to ensure Biodiversity State Interest 1 "development is located in areas to avoid significant impacts on matters of national environmental significance and considers the requirements of the EPBC Act" is demonstrated. A copy of the Environmental Assessment Report submitted for the MID is included as part of the referral documentation.

#### Environmental Authority

Separate to the MID process, the operational licence for the plant will require an Environmental Authority (permit) under the Environmental Protection Act 1994.

#### Pipeline Infrastructure

The pipeline infrastructure will be ultimately located within state-controlled road reserve and subject to a Section 33 approval under the Transport Infrastructure Act 1994 & in accordance with exemptions under the Planning Regulation 2017.

### **1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders**

A comprehensive pre-consultation on the proposal has already been undertaken. This consultation involved informal pre-consultation, formal pre-consultation and ongoing pre-consultation with State agencies, local government, elected representatives, technical consultants, academic experts, Native Title partners and special interest groups.

The following stakeholders were identified for proposed infrastructure designation –

Federal Government elected representatives: Dr Andrew Lamming MP – Member for Bowman (LNP) and The Hon Stewart Robert MP – Member for Fadden (LNP) and Minister

Queensland Government:

-Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP); Department of Environment and Science (DES); Department of Agriculture and Fisheries (DAF); Department of Transport & Main Roads (DTMR); Department of Natural Resources, Mines and Energy (DNRME)

-Elected representatives:

Ms Kim Richards MP, Member for Redlands

Ms Melissa McMahan MP, Member for Macalister

Mr Michael Crandon MP, Member for Coomera

The Hon Cameron Dick MP, Minister for State Development, Manufacturing, Infrastructure and Planning

The Hon Leeanne Enoch, Minister for Environment and Great Barrier Reef, Minister for Science and Minister for the Arts

The Hon Mark Furner, Minister for Agricultural Industry Development and Fisheries

Local Government:

-Redland City Council (RCC); Cr Karen Williams – Redland City Mayor and all Councillors across the 10 divisions

CEO, CMO and General Manager – Infrastructure and Operations

-Redland Water

-Gold Coast Council

-Logan City Council

Business: Australian Prawn Farmers Association; Redlands City Council Chamber of Commerce; Queensland Seafood Industry Association; Aquaculture Association of Queensland; CSIRO; Logan river prawn farms; Research Fishfarm; Coomera House boats; Alberton Gem bait and tackle

-Landowners: Adjoining, directly affected and surrounding landowners as identified by the MID team

-Native Title Stakeholders & Cultural Heritage Management Plan in place

-Community / Special Interest Groups: Redlands City; Logan City; Eagleton, Alberton, Woongoola; Healthy Land and Water; Australian Marine Conservation Society



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South East Queensland Catchments Members Association; Wildlife Bayside (Wildlife Preservation Society of Queensland); Redlands 2030; Community Alliance for Responsible Planning – Redlands; Balance.org; Birkdale Progress Association; Alberton and District Progress Association; St Peters Lutheran Hall; Albert and Logan River Fishing Fanatics; Logan River Fishing Group; Alberton Road / Beltz Road Public Boat Ramp users.

Refer to Section 13 of the Environmental Assessment Report for details of the consultation process.

Refer to Appendix Z for Pre-consultation and refer to Appendix AA for Consultation Strategy prepared by Three Plus.

**1.14 Describe any environmental impact assessments that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts of the project**

The project will be assessed under a MID pursuant to Chapter 2, Part 5, section 36 of the Planning Act 2016 which involves the preparation of an Environmental Assessment Report (EAR) to demonstrate environmental impacts of the proposed action have been carefully considered with appropriate response measures investigated by technical consultants to avoid, mitigate or offset throughout the life of the development. A number of technical assessments have been carried out to support the EAR including:

- Shoreline Mangrove Offset Program Due Diligence
- Academic assessment of Shoreline Mangrove Offset Program Due Diligence
- Options Assessment & Concept Design
- Site Based Management Plan
- Mangrove Design and Receiving Environmental Assessments
- Construction and Operational Environmental Management Plan
- Moreton Bay Wetland SIA
- Cultural Heritage Management Plan
- MNES & MSES Assessment
- Vegetation Clearing & Fauna Management Plan
- Aquatic Constraints

No approvals granted.

**1.15 Is this action part of a staged development (or a component of a larger project)?**

Yes  No

**1.16 Is the proposed action related to other actions or proposals in the region?**

Yes  No

**1.16.1 Identify the nature/scope and location of the related action (Including under the relevant legislation)**

While the proposed action will service the Shoreline residential development (EPBC 2016/7776) it is intended to service the whole southern Redland Bay catchment (beyond the Shoreline development) as a sub-regional wastewater solution that will be owned and operated by Redland Water.



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## Section 2

### Matters of national environmental significance

2.1 Is the proposed action likely to have any direct or indirect impact on the values of any World Heritage properties?

Yes  No

2.2 Is the proposed action likely to have any direct or indirect impact on the values of any National Heritage places?

Yes  No

2.3 Is the proposed action likely to have any direct or indirect impact on the ecological character of a Ramsar wetland?

Yes  No

### Wetland

The Moreton Bay Ramsar site is located in and around Moreton Bay and near the city of Brisbane, in South East Queensland. It extends approximately 110km from Bribie Island in the north to the northern wall of the Gold Coast Seaway in the south, and is 35km at its widest extent. The main body of the Moreton Bay Ramsar site is located approximately 5.7km downstream of the referral area. The Moreton Bay Ramsar site is nationally and internationally significant as one of the largest estuarine bays in Australia, enclosed by barrier islands of vegetated dunes, which together with the permanent lakes of the sand island components provide a diverse and rich suite of wetland habitats. Moreton Bay contains a complex system of intertidal flats totalling 23,000ha at low tide. In relation to terrestrial fauna species, the wetlands are particularly significant as habitat for wetland birds, particularly migratory shorebirds, regularly supporting more than 50,000 waterbirds.

\*\*Continued Below\*\*

### Impact

\*\*Continued from Above\*\*

The Carbrook Wetlands Conservation Park 2, part of the Moreton Bay Ramsar site, is to the north, upstream of the referral area. The Carbrook Wetlands provide an abundance of year-round food resources and water for wildlife. The area is the southern extension of the Mount Cotton- Venman Bushland National Park bushland corridor and is an important lowland retreat for many species during their seasonal migrations. Corridor linkages exist north to Mount Cotton, west to Cornubia and Venman Bushland National Park, south to the Logan River and east to Redland Bay via the Sheldon-Mount Cotton corridor. The Carbrook melaleuca wetlands form part of the Native Dog Creek/Logan River floodplain. Native Dog Creek is a tributary of the Logan River which flows into southern Moreton Bay. The east and west branches of Native Dog Creek have their origins on the southern foothill slopes of Mt. Cotton. The catchment is relatively undisturbed with a few areas cleared for grazing. The mid reaches of both tributaries pass through melaleucas, the lower reaches are tidal.

#### Lower Logan Catchment

Reporting by Water Technology (2020) (refer Appendix K) included comprehensive analysis of existing water quality the Lower Logan Catchment. The report states that in the Lower Logan Sub-catchment, water quality is heavily influenced by land use, including stormwater runoff. Water quality is also heavily influenced by point source impacts such as sewage treatment plants, septic tank seepage and stormwater discharge. In the overall Logan sub-catchment there are several sewage treatment plants, including Kooralbyn, Boonah, Beaudesert, Flagstone, Jimboomba, Eagleby, Loganholme and Mount Cotton, all of which discharge directly or indirectly into the Logan River. Of these, the Lower Logan sub-catchment treatment plants at Loganholme (estimated >200,000 EP capacity) and Mount Cotton (10,000 – 50,000 EP capacity) discharge into the Logan River and Beenleigh Water Reclamation Facility (50,000 - 100,000 EP capacity) discharge into the Albert River.

Based on Logan City Council Factsheets it is estimated that at full capacity, the total peak daily capacity of the Loganholme and Beenleigh treatment plans is approximately 495,000 EP, equivalent to 82 ML/day. If the maximum discharge capacity from the Mount Cotton plant was also considered (50,000 EP), and upon assuming a discharge rate of 200 L/EP/Day, the total daily discharge can be estimated to be ~92 ML/day with release points for all three plants located within 17km of the mouth of the Logan River Estuary.

Due to the existing discharges and other influences (e.g. urban stormwater runoff), the estuarine reaches of the Logan-Albert sub-catchment are identified by Healthy Land and Water's South East Queensland Report Card 2019 as in poor (Grade



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C) quality conditions, experiencing high turbidity, high nutrient concentrations and low dissolved oxygen. The turbidity of the lower Logan River appears to be related to sediment inputs from the catchment and tidal interactions.

#### Baseline water quality monitoring

Baseline water quality monitoring and reporting was undertaken by Water Technology (2020). The water quality assessment was based on data collected by the following:

- Ecosystem Health Monitoring Program (EHMP) by Healthy Land and Water, which is used by Healthy Land and Water to quantify annual waterway health using state-of-the-art receiving water quality models; and
- Water quality monitoring that was specifically implemented for this project to verify existing water quality in the Logan River in the vicinity of the Southern Redland Bay Wastewater Monitoring Project Site, and against available EHMP data and corresponding water quality guidelines. The monitoring consisted of two rounds of insitu measurements and sample collection for a total of three (3) analysis sites, which were located:

- o Approximately 1km upstream of the proposed discharge location (upper reach)
- o Approximately 1km downstream of the proposed discharge location (lower reach) and
- o Adjacent 1km downstream of the proposed discharge location.

For each location, one round of monitoring occurred during high tide and low tide.

Baseline water quality results from Water Technology (2020) indicated water quality in the Logan River is poor in terms of nutrient levels at all locations. Total Nitrogen and Total Phosphorus concentrations reduced towards the lower reaches of the Logan River Estuary, which is expected with tidal flushing. Water Technology conclude that due to the existing discharges and other influences (e.g. urban stormwater runoff, agricultural run off), the estuarine reaches of the Logan -Albert sub-catchment can experience poor water quality conditions, including high turbidity, high nutrient concentrations and low dissolved oxygen. Further details of water quality baseline modelling area are provided within Appendix K.

## Wetland

### \*\*Start of Impacts and Mitigation Measures\*\*

#### Changes in water quality

Environmental Values (EVs) for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use. Water quality guidelines defined in the Environmental Protection (Water) Policy 2009 (EPP Water) are numerical concentration levels or statements for indicators that protect a stated environmental value. Under the EV setting process contained in the EPP Water, water quality guidelines are used as an input to the development of Water Quality Objectives (WQO).

\*\*continued below\*\*

## Impact

### \*\*Impacts and Mitigation Measures Continued\*\*

- Water Quality Objectives (WQO) means the WQOs specified to support EVs for waters identified, which in this case is the Logan Estuary. WQO are long term water quality management goals. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect designated EVs for those waters.

- Water Quality Indicators means a property that is able to be measured or decided in a quantitative way. Examples of water quality indicators include physical indicators (e.g. temperature), chemical indicators (e.g. nitrogen, phosphorus, metals) and biological indicators (e.g. macroinvertebrates, seagrass, fish).

The EVs and WQOs for the wastewater treatment plant site are government by the EPP Water and apply to fresh, estuarine and marine surface waters and groundwaters draining to the Logan River catchment.

The site is located 5.7km upstream the mouth of the Logan River Estuary. The site has no frontage to High Ecological Value (HEV) sites. Changes to hydrology and water quality due to the proposal have the potential to affect the ecological and water quality characteristics of:

- The Logan River Estuary; and
- Immediate waterways including the estuarine reaches of Serpentine Creek, which is adjacent to the site.

It is important to note WQO governed by EPP Water are not site-specific but are rather generic scheduled objectives for the region. In the context of this development, Water Technology (2020) notes that given the unique nature of the project (WWTP and mangrove wetland) a methodology for assessing the impact of treated recycled water on the receiving environment using standardised WQO is not easily defined. However, site-specific objectives can be generated for the site based on ANZECC water quality guidelines in the presence of a robust water quality management plan.

Further, based on the expected wastewater generation and the requirements to allow up to 5 years for the mangrove establishment prior to receipt of recycled water, proposed pathways (e.g. temporary irrigation, watering open space etc) are sufficient to accommodate zero discharge to the mangroves until Year 4 after which time a minor discharge could occur during the wettest conditions. Average discharge to the storage lagoon and mangrove forest is anticipated to reach 20.8% by the end of Year 6. At ultimate development approximately 20% of the recycled water could be reused with the remaining 80%



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discharged to the wetlands.

There is potential for the project to result in changes in water quality from recycled water discharge into the receiving environment being:

- The mangrove wetlands,
- Logan River Estuary, and
- Moreton Bay.

Under the State Government-issued Environmental Authority, the WWTP will be subject to meeting the Australian Recycled Water Guidelines and National and State water quality objectives for pathogens, nutrient and sediment loads and physio-chemical parameters to ensure impacts on the immediate receiving environment (i.e. mangrove wetlands) will be managed. However, once mixed with tidal waters from the Logan River, this will have the potential to alter the water quality of the catchment. Avoidance, mitigation and management measures with respect to potential changes in water quality in the receiving environment and potential impacts on MNES and MSES are discussed below.

#### Recycled Water Discharge

In 2008, Australia was the first country to develop national guidelines for portable reuse with the release of Phase 2 of the Australian Guidelines for Water Recycling (AGWR): Augmentation of Drinking Water Supplies (EPHC 2008). The AGWR provides a risk management framework, rather than simply relying on end-product (reclaimed water) quality testing as the basis for managing water recycling schemes. They include concentration based numerical guideline for at least 86 pharmaceuticals in reclaimed water. The guideline concentrations are based on the application of a safety factor of 1,000 to 10,000 relative to a single therapeutic dose. These are not mandatory and have no formal legal status, but they were provided as nationally consistent guidance for those recycling projects. In general, the guideline concentrations are far higher than concentrations found in drinking water or reclaimed water.

Recycled water will be treated to better than Class A quality with a minimum total nitrogen and phosphorus level of 3 and 1mg/L, respectively (Stantec 2020). The treated wastewater is of high quality and is equal to or better than required under the Queensland and Australian Recycled Water Guidelines.

\*\*continued below\*\*

#### Wetland

\*\*Impacts and Mitigation Measures Continued\*\*

Assessment by Stantec (2020) considers risks and consequences associated with the disposal of treated wastewater including:

- Surface water (eutrophication, pathogens and sediment transport)
- Groundwater (eutrophication, pathogens and drainage)
- Wetlands (eutrophication, pathogens and regime change)
- Flora and fauna (death, habitat change, life cycle / breeding / feeding)
- Land (salinization, sodification, erosion, disturbance and nutrient imbalance)
- Air (odour and pathogens)
- Waste (generation)
- Noise and vibration (nuisance)
- Human health (exposure)

The assessment concluded the risks associated with the above parameters have been reduced considerably due to the level of treatment at the proposed WWTP which results in very low levels of residual nutrients and pathogens in recycled water.

\*\*continued Below\*\*

#### Impact

Under the State Government-issued Environmental Authority, the WWTP will be subject to best practice National and State water quality objectives for pathogens, nutrient and sediment loads and physio-chemical parameters. The Environmental Authority conditions require the WWTP to develop and implement the following plans and systems at a minimum:

- Construction Environmental Management Plan (CEMP)
- Operational Environmental Management Plan
- Adherence to standard air quality and noise limits
- Environmental Management Program for land disposal of waste
- Annual monitoring reports; and
- Monitoring of contaminant release to waters (e.g. parameters: 5 day biological oxygen demand, suspended solids, dissolved oxygen, pH, electricity conductivity, faecal coliforms, total nitrogen, ammonia, total phosphorus, free chlorine and chlorophyll a).

A specific Site Based Management Plan (CEMP) will apply to the mangrove wetland and storage lagoon areas has been



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developed by Water Technology (Appendix Y). This plan supports the maintenance of existing environmental values alongside compliance activities relating to the Environmental Authority. The wetland will act as a secondary filtration of further 'polish' recycled water discharged from the WWTP. The process will offset nutrient loads. Modelling estimates that the mangrove and saltmarsh wetland is expected to further reduce total nitrogen, total phosphorus and carbon to offset 100% of nutrient loads under the proposal.

The Environmental Authority holder will be responsible for water quality monitoring under the licence. In discussions with Queensland Government, the nominated location of monitoring from this system will be the discharge from the WWTP with broader ecosystem condition monitoring being required to address the role of the mangrove forest as an 'active' offset. This will likely take the form of annual surveys of mangrove biomass.

Given nearby sensitive receptors (e.g. threatened species in the Logan River, adjoining aquaculture industry) additional monitoring, otherwise not required under the license, will be undertaken within the tidal wetland. Monitoring of the same measures for pathogens, nutrient and sediment loads and physio-chemical parameters, at set points within the tidal wetland, inlet and outlet, will occur to identify any changes within these as a result of the recycled water mixing with tidal flows from the Logan River. Initial modelling (Appendix K) indicates that these parameters are within National and State water quality objectives and on release from the wetlands, will be of higher water quality than present in the Logan River (Healthy Land and Water Report Card 2019).

Annual reporting required under the licence will be made publicly available. Importantly, any changes to water quality parameters can be made within the first 4 years before water is discharged into the wetland.

#### Uncontrolled Release of Wastewater

The highest risk associated with the disposal of recycled water through the storage lagoon and mangrove wetland relates to its establishment and the potential for erosion and sediment transport to be released to the Logan River in the event of an uncontrolled release of treated wastewater. This can be mitigated by early use of the recycled water while mangroves establish in the first 4 years. An assessment of the risks following proposed mitigation measures provides an overall "low" residual risk rating. For both plant breakdowns and high rainfall events, the plant has the following for preventing uncontrolled release of wastewater:

1. Equipment and hydraulic structures sized with wet weather flows accounted for – different wet weather scenarios have been allowed for at different stages;
2. Redundancy includes in all processes in the main plant flow path for all project stages;
3. Membranes sized for 5xADWF for Stages 1A and 1B (first 10 years of operation approx.), which will be confirmed against pumped flows in preliminary design;
4. After approximately 10 years (at Stage 2), inlet balance tank sized to hold short duration 5 x ADWF event from Stage 2 (when the membranes are only treating 3 x ADWF);
5. Back-up generator to be provided which at a minimum would provide power to equipment in the main flow path (screens, membrane systems) in the event of a power outage for several hours;
6. SCADA monitoring of plant process performance and power supply including communications with the plant at all times. Any failures of comms would result in attendance at the plant by operations crew;
7. Regular monitoring of the plant performance through discharge sampling;
8. Storage at the pumping stations feeding the plant;
9. Any discharge from the plant will enter a 10ML storage lagoon prior to being discharged to the mangrove wetland.

In the unlikely event of a plant breakdown, potential impacts have been managed to a very low level with the above contingencies in place as required under the licence.

\*\*continued below\*\*

## Wetland

### Wet Weather Bypass

The proposed WWTP has been designed to fully treat 5 average dry weather flow days, however under heavy rainfall conditions, bypass flows will pass through coarse screens and be discharged to any storage available prior to being discharged into the environment. Modelling by Water Technology (2020) shows that no adverse impacts on the Logan River will occur from short-term, intermittent, spikes of discharge. Similarly, dilution, nutrient processing and assimilation within the downstream system area expected to show no adverse impacts in these areas.

Further, Water Technology (2020) conclude that any risk of pathogens entering the mangrove wetland is expected to be minimal due to the proposed tertiary UV treatment of the recycled water discharge. It is noted event-based chlorination and de-chlorination of wet weather flows (up to 5 times a year) should have minimal impact on the health of the on-site mangrove wetland and subsequently HES wetlands and MSES habitat.

## Impact

\*\*continued from above\*\*

### Changes in Nutrients

Water Technology (2020) modelled expected changes in the Logan River Estuary attributable the WWTP under three scenarios:



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- An existing case, which is the undeveloped case wherein the site is in its existing state;
- A base case, with fully constructed mangrove / salt marsh habitat in the mangrove wetland and no WWTP recycled water discharge; and
- A developed case, with a fully constructed mangrove / salt marsh habitat in the mangrove wetland and recycled water discharged from the WWTP.

For the study the resolution of the Healthy Land and Water Logan River water quality model was meshed with the proposed parameters of the WWTP and then utilised to simulate nutrient, sediment and salinity plumes resulting from the WWTP recycled water discharge into the mangrove wetland and eventually the Logan River Estuary.

The model was developed in an interactive manner with earthworks considerations to ensure that water levels within the mangroves were maintained to ensure that the mangroves were inundated for approximately 25% of the time. It should be noted that given the extremely low flow velocity within the mangrove forest, any impact of Mannings 'n;' values on flow passage through the system will be trivial (i.e. the mangroves will be predominately subject to inundation).

The comparisons for water quality between the existing case, base case and the developed case were made using box - plots generated from results extracted ID-channel in the Logan River adjacent to the mouth of Serpentine Creek. Results were extracted from the upper 0.5m of the water column and calculated over a period of 1 months during a period for which there were no significant freshwater inflows from the catchment. Results from modelling showed:

- Minimal impacts from the proposed recycled (fresh) water discharge into the mangrove wetlands.
- Median salinity (~25 g/L) within the mangroves shows a slight decrease in the areas immediately surrounding the point of entry of recycled water which will not affect establishment of mangroves of saltmarsh. The discharge had negligible impacts on salinity levels in the Logan River, which were shown to remain at ~30 g/L.
- Levels of total nitrogen within the Logan River Estuary, in the vicinity of and attributable to the mangrove wetland showed no significant change in the developed case.
- Median total phosphorus decreases slightly from the existing case to the base case and equivalent to the existing case at the developed case. Therefore, the discharge had negligible impacts on the levels of total phosphorus in the Logan River.
- Medium dissolved oxygen slightly increases from the existing case to the base case but is equivalent to the existing case at the developed case. Therefore, the discharge had negligible impacts on the levels of total phosphorus in the Logan River.

The report concluded that with proposed site-based management considerations the WWTP will either maintain existing conditions in the Logan River, or add benefit.

Increased nutrients can have positive impacts on the productivity of mangrove communities, commonly there is an increase in growth and productivity associated with low levels of nutrient (e.g. Clough et al. 1993, Dunstan, 1999).

Modelling by Water Technology (2020) concludes:

- Recycled water discharge in the mangrove wetland will have a small effect on the salinity level in the mangroves. This will not impact the growth and propagation of the mangroves.
- Recycled water flows into the mangroves from the WWTP have been projected to grow linearly after an initial 4-6 year establish period before they reach full capacity. This gradual change in the flows will provide ample time for mangrove establishment.
- Sediment influx into the mangrove wetland will not negatively impact on mangrove growth and will in fact assist in the very gradual soil accretion within the mangrove wetland which would assist in mangrove growth, mitigation of impacts from sea level rise and climate change.

The sediment forebay was incorporated into the wastewater treatment plant design to:

- Regulate tidal inflows into the mangrove area at the inlet culvert; and
- Trap sediments by slowing down incoming tidal inflow and thereby facilitating gravity separation of suspended solids.

It is noted that suspended sediments are particularly important to mangrove health.

\*\*continued below\*\*

## Wetland

### Waterborne Pathogens and Viruses

Water Technology sought advice from CSIRO to provide a site-specific assessment of the risks associated with the viruses that would be present in the recycled water discharge which may potentially pass through different treatment processes and enter the Logan River. The main concerns were:

- The risk of white spot syndrome
- The likelihood of any enteric (relating to or occur in the human intestine) viruses.

TUFLOW-FV modelling was used to inform a pathogen tracer study with guidance from Griffith University experts in the field. The modelling results were reviewed by the academic experts who provided an assessment of potential risk from enteric pathogens from the proposed WWTP release.

\*\*continued below\*\*

## Impact



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Modelling by Water Technology (2020) concludes that in the unlikely scenario where a white spot syndrome viral particle was able to reach the WWTP, due to its larger size and morphology, and capacity of the WWTP with MBR and wetlands reduce viral numbers by an expected minimum of 32 and 1 log removals respectively (4 log combined), it was considered probable that any white spot syndrome virus that could be present would be effectively removed by these treatment systems. It was therefore determined that the likelihood for crustaceans residing in the mangrove system to become infected from White Spot Syndrome Virus would most certainly be through contamination from the Logan River and not from treated wastewater.

In addition to white spot syndrome, modelling considered the presence of human enteric viruses. With a potential minimum removal rate of 3 log by the MBR and a further 1-2 log by the wetlands, the reduction of viruses would align with what is generally observed in conventional treatment systems used in South East Queensland.

For the WWTP, the mangrove wetland, together with the adjoining section of the Logan River was assessed as an enteric pathogen barrier for the protection of recreational and other water users in and around adjacent sections of the lower Logan estuary. Modelling concluded current level of treatment / controls by the WWTP are adequate to protect Logan River water users from enteric bacteria.

#### Release of Contaminants

The absorption of heavy metals from solution occurs in plants and animals by passive diffusion across gradients created by adsorption at the surface, and by binding by constituents of the surface cells, body fluids, etc. An alternative pathway for animals is when metals are adsorbed onto or are present in food and by the collection of particulate or colloidal metal by food gathering mechanisms. Depending upon the types and concentrations of heavy metals release, impacts could range from the reduction of reproductive capacity of some species to the mortality of aquatic flora and fauna. The effect of chronic heavy metal pollution is still largely unresolved, and effects depend on the interrelationships of many physical and chemical factors. Threshold concentrations of toxicants to ensure the protection of aquatic ecosystems have been developed by the Australian and New Zealand Environment and Conservation Council (ANZECC & ARMICANZ 2000).

Water quality modelling by Water Technology (2020) identified the following with respect to the Logan River:

- Essentially all existing heavy metal concentrations were below guideline levels
- Essentially all pharmaceutical and personal care products concentrations were significant below guideline levels.
- Essential all existing endocrine disrupting compounds were below guideline levels
- The levels of herbicides and pesticides were considerably lower than guideline levels.

Further, modelling by Water Technology (2020) concluded that recycled water discharge into the mangrove will not have detectable impacts on the Logan River Estuary for the following reasons:

- The wastewater treatment plant upstream of the proposed WWTP site is older and expected to have significantly lower treatment capabilities when compared to the WWTP with MBR;
- The capacity of the proposed WWTP is significantly lower than facilities upstream; and
- The proposed WWTP recycled water will be subject to UV disinfection prior to discharge into the storage lagoon and then into the mangrove wetland, which will also further 'polish' the recycled water from the WWTP.

With the implementation of the Operation Environmental Management Plan (refer Appendix X) there are unlikely to be any significant impacts from the release of 'polished' wastewater.

#### Changes in groundwater

There are no known groundwater users within 1km of the proposed action. The referral area is within the medium and high storm tide inundation areas. The groundwater salinity of the alluvial aquifer is expected to be reflective of that in the Logan River, which is equivalent to seawater in this location.

After the mangrove wetland is established in the basin, the area will be used for disposal of recycled water which will be of acceptable quality for disposal to off-site parks and reserves. Assessment of surface water quality impacts by Water Technology (2020) found there to be negligible impact on salinity and nutrient levels in the Logan River.

\*\*continued below\*\*

## Wetland

Some infiltration of recycled water to the shallow water aquifer is expected however there is no nearby groundwater users and groundwater in the shallow alluvial aquifer is expected to naturally discharge back towards the Logan River, the risks of such are low. Further, the mangrove wetland is within the medium and high storm tide inundation areas. The groundwater salinity of the alluvial aquifer is expected to be reflective of that of the Logan River, which is equivalent to seawater in this location.

#### Changes to Hydrology and Coastal Processes

While the mangrove wetland has been designed to retain the 1.8ha TEC Coastal Swamp Oak (*Casuarina glauca*) forest of New South Wales and South East Queensland ecological community located along Serpentine Creek, and translocate



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existing saltmarsh where required, hydrological changes have the potential to impact ecosystem processes and vegetation communities.

\*\*continued below\*\*

## Impact

Changes in water velocity may alter (increase or decrease) the suitability of habitat for marine plants as well as change the composition of marine vertebrates. Marine plants may be influenced by changes in velocity resulting in the removal of sediment, changes in sediment composition and chemistry as well as changes in turbidity levels.

### Effect of the Tidal Prism on the Logan Estuary

The tidal prism is defined as the volume of water that flows through a channel cross-section during the flood tidal (low water slack to high water slack). As the volume of water which flows through the cross-section is dependent on the tidal range, the tidal prism is greater during spring tides than during neaps. Both the neap and spring tide values for the tidal prism are referred to in this reporting. The tidal prism is useful for identifying potential erosion issues associated with modifications to the estuary and contextualising freshwater inflows. Further, tidal prisms can be useful for determining the most suitable sizing of tidal inlets/outlets of the mangrove establishment.

The tidal prism calculated 500m downstream of the mangrove wetlands was derived using the numerical model for both spring and neap tides for two scenarios; one for the existing case (undeveloped, no mangrove wetlands) and one for the developed case (i.e. with mangrove wetland and recycled water discharge).

At the full operational capacity of the WWTP and mangrove wetland, Water Technology (2020) estimate the change in the tidal prism in the Logan estuary (downstream of the site) was estimated to be between 0.6 % (during neap tides) and 1.5 % (during spring tides). Furthermore, Water Technology (2020) conclude these changes in the tidal prism are particularly small and have no potential impact on bed and bank stability of coastal process with adjacent sections of the Logan River. Further detail is provided in Appendix K.

### Hydrology

Based on site-based hydraulic assessments, the tidal inlet to the mangrove wetland is proposed to be located at a minimum height of mean high water springs which is RL 0.0 to 0.005 and during a spring tidal cycle the water runs into a sediment pit first so that sediments can settle there before the water floods the remainder of the site. The level of the mangrove wetland is minimum mean high water springs and is inundated during spring tidal cycles or higher. The saltmarsh area around the mangrove wetland is located at a minimum level of HAT and has been estimated to be 1.07m AHD. The detailed site design can be viewed in Engineering Plans by KN Group. Overall, changes to hydrology are considered to maintain or benefit the Logan Estuary.

### Sea Level Rise

Storm-tide inundation in the area can be further exuberated by sea-level rise. Sea level rise will lead to flooding of low parts of the coastal zone, accelerated erosion and saline intrusion into coastal waterways and wetlands. Low-elevation coastal deltas, floodplains and estuaries will be affected. If the land is uninhabited, there is opportunity for landward migration of many coastal communities, such as mangroves and saltmarshes, as sea level rises (Department of Climate Change).

Sea level rise is expected to be 0.8m by 2100, meaning that the wetland will gradually flood more often with rising sea levels. For the referral area, the future level of mean high water springs and HAT would be 1.79m and 2.33m AHD respectively. This means that the site will be inundated at future tidal levels and higher once sea level rise of 0.8m has occurred. If sea level rises gradually, it is expected the plants can accommodate the change and move with the tidal levels. Overall, changes to hydrology are considered to maintain or benefit the Logan Estuary.

### Fluvial Flood

The referral area can be impacted by fluvial floods. The difference is that the water will enter the site via overland flow from Serpentine Creek and not via the inlet/sediment basin. Intermittent flooding may lead to short term increased sediment deposition on the site, depending on the sediment loads during a flood event. Overall, changes to hydrology are considered to maintain or benefit the Logan Estuary.

### Soil Erosion

The referral area is located at the outside bend of the Logan river that is usually prone to erosion compared to other areas of a river. Vegetation along the shoreline is comprised of sections of mangrove forest dominated by *Avicennia marina* (Grey Mangrove), and Saltmarsh dominated by *Sporobolus virginicus* (Salt Couch). The Salt Couch area has been moderately eroded with large pieces of mud and silt washed into the river and exposed at low tide. In spite of these factors, historical imagery revealed that the river bend has not moved in 62 years, and is therefore relatively stable.

\*\*continued below\*\*



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## Wetland

Nonetheless, it is important to support and maintain a vegetated riverbank to protect it against future storm events (especially with increased cyclone intensity forecasted with climate change), and to support and prevent the need for hard engineering solutions. Any development (maintenance access paths) should also be positioned as far landwards as possible to minimise potential negative impacts.

Erosion within the wetland will be partially managed by the inlet and outlet structures that control tidal velocities into the wetland. Local erosion around inlet and outlet structures will need to be managed. Some local rock protection around those structures might be required and should be carefully integrated with the naturally vegetated bank.

\*\*continued below\*\*

## Impact

An Erosion and Sediment Control Plan (ESCP) will be prepared for the proposed works by a suitably qualified professional. The ESCP should be in accordance with the International Erosion Control Associations Best Practices Erosion and Sediment Control (2008). Some roughening (preferably with materials that will decompose) of the site may be required to assist in slowing water velocity, trapping propagules and seedlings, and to provide protection for developing vegetation. For example, coir rolls and matting can be used for erosion and silt control, and will also contribute organic matter to the soil profile.

Overall, the proposed action is expected to limit bank erosion along the Logan River.

### Significant Impact Assessment

Detailed water quality assessments were undertaken by Water Technology (2002) as part of Stage 1 (due diligence), Stage 2 (Concept Design) and Stage 3 (assessment) (refer Appendix K). Overall modelling, analysis and assessments concluded that with proposed site-based management plans the WWTP will either maintain existing conditions in the Logan River, or add benefit. Benefits included offsetting (small reduction in) nutrients from the WWTP and existing Logan Estuary and reducing impacts of storm tide inundation and coastal erosion. Importantly, extensive modelling by Water Technology, which has been peer reviewed by academic experts, CSIRO and State Government technical agencies, concluded that there would be a negligible (no measurable) change in water quality from the WWTP and mangrove wetland to the Logan River at the point it adjoins the site, 5.7km upstream of Moreton Bay.

Further, to support this referral, assessments were undertaken by expert consultants to determine the potential for downstream impacts to Moreton Bay. A memo was prepared by Water Technology which concludes the project is highly unlikely to have a direct or negative impact on the estuarine wetlands in the region (refer Appendix K). Additionally, an assessment by frc environmental concluded that project is highly unlikely to have a significant impact on the marine environment (refer Appendix M).

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will impact any of the following:

#### 1. Areas of the wetland being destroyed or substantially modified

There will be no direct impacts from the proposed action to the Moreton Bay Marine Park which is located approximately 5.7 km downstream from the site and Carbrook Wetlands Conservation Park 2 which is located upstream from the site. Subsequently, areas of the wetland will not be destroyed or substantially modified as a result of the proposed action.

2. A substantial or measurable change in the hydrological regime of the wetland, for example, a substantial change in the volume, timing, duration and frequency of ground and surface water flows to and within the wetland.

The proposed WWTP will have no direct impact on the Moreton Bay Ramsar wetland.

The Carbrook Wetlands Conservation Park 2 is located upstream from the proposed WWTP and there will be no change in the hydrological regime of the wetland as a result of the action. The action will require very minimal fill material, which will be sourced from offsite.

With respect to the Moreton Bay Marine Park, the action will result in the discharge of recycled water into Logan River, 5.7 km upstream of Moreton Bay. Assessments of the possible impacts on the tidal prism of the Logan River Estuary from the development of the WWTP were found to be negligible in proximity to the site. Assessments by Water Technology (2020) concluded that it is therefore unlikely that the action would in any way impact on the hydrological regime of the wetlands 5.7km downstream of the referral area. No substantial change in the volume, timing, duration and frequency of ground and surface water flows to and within the main Moreton Bay Marine Park are forecast.

\*\*Significant Impact Assessment continued below\*\*

## Wetland

3. The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected



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The action will have no direct impact on the Ramsar wetland.

The action is located downstream of Carbrook Wetlands and will have no direct nor indirect impact on aquatic or terrestrial wetland species. Given the location of the WWTP, downstream and visually screened by existing and planted vegetation and stringent controls required under the Environmental Authority licence with respect to air, noise, light and water management and mitigation, the action is not anticipated to have any indirect impacts that would affect the habitat or lifecycle of native species dependant on the wetland. Any wetland species are considered only visitors to the referral area and thus the action will not result on significant impact on habitat for these species.

\*\*continued below\*\*

## Impact

With respect to the Moreton Bay Marine Park, the WWTP development footprint is located on land which has been subject to broadscale clearing and predominately reflects open paddock. Subsequently, it is expected that in its developed state, the proposed action is likely to enhance the habitat of migratory birds and native aquatic species by providing breeding sites and nature refuges through the created mangrove forest and saltmarsh wetland. Targeted field surveys did not record migratory birds, roosting habitat or foraging habitat on or adjacent to the site.

The frc environmental assessment (refer Appendix M) identified that given the location of the referral area, 5.7km upstream from Moreton Bay, and with stringent controls and management requirements under the Environmental Authority licence and MID approval, the action is not considered to have a significant impact on aquatic and marine species within Moreton Bay, nor habitat on which these species rely.

Further, adaptive management, reporting and auditing required under the Concept Mangrove Rehabilitation Plan and Water Quality Management Plan will ensure controls relative to protecting known values of Moreton Bay, which contribute to habitat and lifecycle of threatened and native species, are always in place.

4.A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biology, ecological integrity, social amenity or human health.

The action will have no direct impact on the Ramsar wetlands.

Based on the expected wastewater generation and the requirements to allow up to 5 years for the mangrove establishment prior to receipt of recycled water, proposed pathways are sufficient to accommodate zero discharge to the mangroves until Year 4 after which time a minor discharge could occur during the wettest conditions. Importantly, water quality objectives must be achieved under the Environmental Authority licence and will be annually monitored and reported to the State Government four years prior to wastewater being discharged into the mangrove wetlands and ultimately the Logan River and Moreton Bay.

Monitoring and verification of the recycled water quality will be routinely undertaken to ensure recycled water meets the National State Recycled Water Quality Guidelines for Class A recycled water and target nitrogen and phosphorus levels and as required under the Environmental Authority license.

The land disposal of highly treated and disinfected recycled water in the mangrove wetland within the WWTP is highly unlikely to significantly change the nearfield or far field water quality in the Logan River Estuary. Based on investigations by Water Technology (2020), any changes to the level of salinity, pollutants, or nutrients in the Logan River due to the project are considerably small or unmeasurable. Importantly, based on the impact assessment by Water Technology, it was concluded that it is highly unlikely that the physio-chemical or biological (including pathogen) attributes of the estuarine waters would worsen in the downstream reaches given the expected nutrient uptake in the mangroves and owing to considerable tidal flushing, mixing and dilution in the Logan River. Therefore, a measurable change in the water quality of the wetlands downstream of the project (such as Moreton Bay) is highly unlikely.

The project intends to adopt the WQMP including designation mitigation and management measures, monitoring parameters and trigger thresholds. With adoption of these measures, any changes to the water quality of the wetland (including changes to salinity, pollutants, and nutrients) will be minor and temporary, at most. Contingency measures have been incorporated into the WWTP so that spills of contaminants, and the introduction of pollutants, are mitigated.

For both plant breakdowns and high rainfall events there will be measures in place to prevent the uncontrolled release of wastewater as follows:

1. Equipment and hydraulic structures sized with wet weather flows accounted for – different wet weather scenarios have been allowed for at different stages;
2. Redundancy includes in all processes in the main plant flow path for all project stages
3. Membranes sized for 5xADWF for Stages 1A and 1B (first 10 years of operation approx.), which will be confirmed against pumped flows in preliminary design;
4. After approximately 10 years (at Stage 2), inlet balance tank sized to hold short duration 5 x ADWF event from Stage 2 (when the membranes are only treating 3 x ADWF).
5. Back-up generator to be provided which at a minimum would provide power to equipment in the main flow path (screens,



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membrane systems) in the event of a power outage for several hours.

\*\*continued below\*\*

### Wetland

6. SCADA monitoring of plant process performance and power supply including communications with the plant at all times. Any failures of comms would result in attendance at the plant by operations crew.

7. Regular monitoring of the plant's performance through sampling of the discharge.

8. Storage at the pumping stations feeding the plant.

9. Any discharge from the plant will go to a 10 ML storage lagoon prior to being discharged to the mangrove wetland.

\*\*continued below\*\*

### Impact

Further, the project will adopt a raft of environmental management plans prepared in accordance with national and state guidelines and policies and will be subject to State Government approval including:

- Construction Environmental Management Plan (refer Appendix W)
- Operational Environmental Management Plan (refer Appendix X)
- Water Quality Management Plan (refer Appendix K)
- Flooding and Stormwater Management Plan (refer Appendix K)
- Mangrove Rehabilitation Plan (refer Appendix O)
- WWTP Rehabilitation Plan (refer Appendix P)

Further, adaptive management, reporting and independent auditing required under the above management plans will ensure controls relative to protecting Moreton Bay are always in place.

5. An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

Given the location of the referral area, downstream of Carbrook Wetland Conservation Park 2 and 5.7km upstream of Moreton Bay Marine Park, no invasive species are predicted to colonise the area as a result of the proposed action.

Under proposed rehabilitation plans (Concept Mangrove Rehabilitation Plan and Concept WWTP Rehabilitation Plan) the project will result in a net ecological benefit through extensive rehabilitation works including weed and pest management, assistant and natural regeneration with native pre-clear regional ecosystems and the establishment of the mangrove forest wetland. These rehabilitation plans have been prepared been reviewed by Queensland Government State Agencies including Department of Agriculture and Fisheries (Department of Primary Industries, Biosecurity Queensland), Department of Natural Resources and Mines and Department of Environment and Science as part pre-lodgement documentation to ensure all rehabilitation works will:

- Not result in the spread of weeds or introduction of harmful species
- Weed control methods will not utilise herbicides
- Endemic and locally sourced plant material will be utilised on site

Further, modelling by Water Technology (2020) with respect to viruses and pathogens concluded that in the unlikely scenario where a white spot syndrome viral particle was able to reach the WWTP, due to its larger size and morphology, and capacity of the WWTP (MBR) and wetlands reduce viral numbers by an expected minimum of 32 and 1 log removals respectively (4 log combined). It was considered probable that any white spot syndrome virus that could be present would be effectively removed by these treatment systems. It was therefore determined that the likelihood for crustaceans residing in the mangrove system to become infected from white spot syndrome virus would most certainly be through contamination from the Logan River and not from treated wastewater. Additionally, the WWTP, the mangrove wetland, together with the adjoining section of the Logan River was assessed as an enteric pathogen barrier for the protection of recreational and other water users in and around adjacent sections of the lower Logan estuary. Modelling concluded current level of treatment / controls by the WWTP are adequate to protect Logan River water users from enteric bacteria.

Due to stringent water quality controls under the Environmental Authority licence, discharged recycled water must meet Australian and Queensland best practice water quality standards for parameters such as TSS, Phosphorus, Nitrogen, Dissolved Oxygen and pathogens and as such will not result in an increase in nutrients (no worsening) that could support the spread of invasive species. Therefore, it is highly unlikely that the project will result in the introduction or spread of an invasive species that is harmful to the ecological character of the Moreton Bay wetland.

#### 2.3.2 Do you consider this impact to be significant?

Yes

No



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**2.4 Is the proposed action likely to have any direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?**

Yes  No

**Species or threatened ecological community**

A comprehensive likelihood of occurrence assessment was conducted to determine the occurrence and potential impacts to MNES (Refer Appendix M). Communities and species listed below were either confirmed occurrences (recorded within the site) or determined to be likely to occur and potentially impacted by the proposed action.

Subtropical and Temperate Coastal Saltmarsh: The Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (AWE, 2013) states Queensland regional ecosystem mapping for 12.1.2, described as saltpan vegetation including grassland and herbland on marine clay plains, equates to this TEC. The site is mapped as containing areas of RE12.1.2 within the western extent bounded by Serpentine Creek and Logan River.

**Impact**

This RE was confirmed on ground as being relatively accurate to the mapped extent. This TEC however is considered to extend beyond the mapped patch with a mosaic of this TEC represented by *Sporobolus virginicus* (Salt Couch), *Juncus kraussii* (Sea Rush) and *Tecticornia australasica* (Grey Samphire) along drainage channels created by former land use (refer Section 6.2 of the Appendix M).

Ecological constraints, including the extent of saltmarsh areas were provided to Water Technology to inform the extent of the created mangrove wetland. Importantly, where impacts do occur, they are minimised to the greatest practicable extent and are concentrated to weedy and disturbed areas. To minimise impacts to marine plant communities, where possible they will be translocated on-site. Salt Couch can be successfully transplanted using sods within the site and advice has been sought from Queensland DAWF and rehabilitation experts Bulimba Creek Catchment Committee in preparation of the Concept Mangrove Rehabilitation Plan (refer Appendix O). Where Salt Couch will fall within the earthworks footprint (approx. 1.44ha) it is proposed to be translocated in 50cm x 50cm pivots as part of the mangrove wetland. The mangrove wetland will include assisted and natural regeneration efforts to support 2.52ha of saltmarsh; a net gain of 1.08ha of this community.

Potential impacts associated with changes to water quality and hydrology that may affect ecosystem process and have been assessed by Water Technology (2020), and have been minimised and mitigated through the design of the WWTP (i.e. MBR) and mangrove wetland management measures. The WWTP will be managed under a State Government-issued Environmental Authority and a raft of environmental management plans.

**Species or threatened ecological community**

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland: This ecological community occurs in coastal catchments, mostly at elevations of less than 20m above sea level that are typically found within 30km of the coast, however, distance can vary by catchment. These trees typically grow on alluvium, hydrosols, clay loam, heavy clay (greater than 50% clay), light to medium clay (35-50% clay) or loam, sandy loam, sandy clay loam and sometimes organosols (peaty soils). Flowers appear in September to October. Cones last on the trees for at least one season and contain around 450 viable seeds per gram. No pre-treatment is required for seeds to germinate, which occurs in about 5 days. Seedlings of local provenance are available from commercial nurseries. The trees are fast growing, and can be pruned and pollarded.

**Impact**

The canopy layer is dominated by *Casuarina glauca* (Swamp Oak) and in Queensland is represented by Regional Ecosystem 12.1.1 or 12.3.20. This threatened ecological community is listed as Endangered and under the EPBC Act any population is considered significant.

Three patches of *Casuarina glauca* (Swamp She-oak) are present on-site (refer Section 6.2.1.2 of Appendix M). The two smaller southern patches along Logan River are not considered part of this threatened ecological community due to species mix and composition.

The largest, adjoining Serpentine Creek is considered to be part of the threatened ecological community. Under the Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (AWE, 2018) this isolated 1.8ha patch would be considered a 'small patch' (i.e. between 0.5-2ha) of 'high quality' (i.e. less than 20% of understorey is comprised of non-native species). It is thus considered under the listing advice as 'Category C' and requires referral under the EPBC Act if there is potential for a significant impact. 'Category C' communities are good candidates for restoration aimed at meeting higher quality thresholds.

The threatened ecological community patch consists of scattered mature *C. glauca* which have been retained by historical broadscale clearing in recent years and a lack of maintenance has allowed regrowth of *C. glauca* to occurred. The mature trees retain diameters at breast height (DBH) of approximately 280mm and have a median tree height of 12m. Regrowth *Eucalyptus tereticornis* (Forest Red Gum) is also present with retained DBH approximately 150mm and median height of 14m.



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The ground layer within the patch is dominated by *Sporobolus virginicus* (Salt Couch) and *Parsonia straminea* (Monkey Rope) is present as a climbing vine. Weeds are present within the *C. glauca* patch and are dominated by *Solanum seafortianum* (Brazilian Nightshade) with *Lantana camara* (Lantana) also present. *Baccharis halimifolia* (Groundsel) is present in the transition area from within the *C. glauca* patch to the open paddock.

No evidence of EPBC listed fauna species was recorded within this patch of vegetation inferring that it is highly unlikely to provide important habitat for threatened species.

Apart from clearing, one of the biggest threats to this threatened ecological community is sea-level rise. Sea-level rise will lead to inundation of parts of the coastal zone, accelerated erosion and saline intrusion into coastal waterways and wetlands and low-elevation coastal deltas, floodplains and estuaries will be affected. If the land is uninhabited, there is an opportunity for landward migration of many coastal communities, such as mangroves and saltmarshes, as sea-levels rise. However, if there are built structures, such as roads or settlements, that prevent this migration landward, these communities are likely to be reduced by a process called 'coastal squeeze'. Even where there may be limited opportunity for migration inland, this is likely to be at the expense of other higher terrain ecosystems (Department of Climate Change 2009).

This 'coastal squeeze' is a particular threat to Coastal Swamp Oak Forest, as it may be replaced by more littoral communities migrating landward, such as saltmarsh or mangroves, while the landward areas have been converted to pasture or replaced by development. There is some evidence already for land migration of mangroves at the expense of other communities squeezed between higher land or built structures and the invading mangroves (Department of Climate Change 2009). In the Wide Bay-Burnett region there has been an observed replacement of Coastal Swamp Oak Forest by more littoral communities migrating landward (Currie, 2017).

The proposal intends to protect this vegetation by retaining the existing extent of the threatened ecological community in-situ. The wetland earthworks footprint has been designed to avoid impacts to this threatened ecological community, with minor reprofiling of natural topography not anticipated to cause significant changes to hydrological regimes and inundation timeframes that would not occur outside natural variations (i.e. storm tide events, climate change). Further, the action avoids building roads and structures near the threatened ecological community or creating fire regimes that would affect the ground layers of the threatened ecological community. No public access will occur to the site, with maintenance restricted to authorised personnel (e.g. construction constructors, Redland Water and third-party consultants to undertake monitoring and maintenance).

### Species or threatened ecological community

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland \*\*continued\*\*

### Impact

Rehabilitation over a 2ha *Casuarina glauca* area inclusive and surrounding this TEC is proposed under the Concept Mangrove Rehabilitation Plan. This includes weed removal and establishing Salt Couch ground layer to support ecosystem function. Consideration of climate change has been made when designing the mangrove wetland to minimise risk of mangrove migration with outer edges of the wetland rehabilitated with saltmarsh.

Under the Environmental Authority licence stringent controls for water quality physiochemical parameters will be imposed to ensure National and State water quality objectives are achieved. Water quality modelling by Water Technology (2020) conclude that the land-based disposal of highly treated and disinfected recycled water in to mangrove wetland is unlikely to significantly change the nearfield or far field water quality in the Logan River Estuary. Modelling indicates that water quality parameters will see a negligible change in water quality entering the mangrove wetland. Potential impacts associated with changes to water quality and hydrology that may affect ecosystem process and have been identified through TUFLOW modelling by Water Technology (2020) and minimised and mitigated through proposed management plans.

#### Concept Mangrove Rehabilitation Plan

The Concept Mangrove Rehabilitation Plan (CMRP) (refer Appendix O) has been informed by extensive and robust literature review and supported by expert opinion from reputable educational and research organisation including CSIRO, University of Queensland, Griffith University, aquatic ecologists frc environmental, water quality engineers Water Technology and rehabilitation experts B4C Bulimba Creek Catchment Committee. The CMRP has also been reviewed by Queensland Government State Agencies including Department of Agriculture and Fisheries (Department of Primary Industries, Biosecurity Queensland), Department of Natural Resources and Mines and Department of Environment and Science as part pre-lodgement documentation.

Existing and potential invasive species (weeds) will be managed under the CMRP which will involve rehabilitation as part of the 9.86ha mangrove forest and saltmarsh wetland. The CMRP has been prepared in accordance with National Standards for the Practice of Ecological Restoration in Australia (Standards Reference Group SERA, 2016) and the South East Queensland Ecological Restoration Framework prepared by Healthy Land and Water. Rehabilitation efforts will support endemic native species and use local seed collection where available and consider impacts of sea level rise and climate change in rehabilitation outcomes. The CMRP considers landscape context and other relevant species and communities, including the adjoining Subtropical and Temperate Coastal Saltmarsh TEC and potential habitat for migratory and aquatic species on completion.



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Further, the CMRP includes provisions for a seed collection program to be developed with an Australian Seed Bank partner (e.g. Greening Australia) as well establishing community engagement and conservation research of through engagement with University academics and local community groups e.g. Bulimba Creek Catchment Committee, indigenous landowners etc. The Rehabilitation Program incorporates adaptive management provisions to allow success and failures to be measured and methods adapted accordingly.

With the proposed rehabilitation measures it is anticipated that the proposed wetland will support further regeneration of species to create a net gain in this TEC and support conservation and recovery objectives. The Mangrove Rehabilitation Management Plan will be subject to State approval as part of the MID.

### Species or threatened ecological community

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland \*\*continued\*\*

### Impact

#### Significant Impact Assessment

To determine whether the proposed action is likely to have a significant impact on the TEC, an assessment against the EPBC Significant Impact Guidelines 1.1.

#### 1. Lead to a long term decrease in the size of a population.

The referral area contains a small (1.8 ha) isolated patch of the TEC identified as Category C under the conservation listing advice.

The action intends to protect the TEC by avoiding further clearing and conserving existing areas of the TEC in situ. While minor earthworks reprofiling will be required to construct the wetlands, these impacts will be minor and temporary in nature. The design has included hydrological- regimes which will support natural regeneration of the TEC.

The action is not considered to lead to the long-term decrease in the size of the population. With the proposed rehabilitation measures it is anticipated that the proposed wetland will support further regeneration of species to create a net gain in this TEC on the site.

#### 2. Reduce the area of occupation of a population

The area of the TEC is intended to be retained in-situ with indirect impacts mitigated and managed through a raft of management plans. With the proposed rehabilitation measures it is anticipated that the proposed wetland will support further regeneration of species to create a net gain in this TEC on the site.

Therefore, the action is not considered to reduce to occupancy of a population.

#### 3. Fragment an existing population into two or more populations

The existing TEC will be retained with indirect impacts mitigated and managed through a raft of management plans. While minor earthworks will occur in proximity to the TEC to create required levels for rehabilitation, these works are minor, temporary and consistent with natural resource management measures required of standard conservation.

No built infrastructure will occur within 50m of the TEC. Based on these measures, the proposed action is not considered to reduce to occupancy of a population.

#### 4. Adversely affect habitat critical to the survival of a species

The Conservation Advice states 'habitat most critical to the survival of the ecological community are those patches that are of a reasonable size and in best condition (i.e. 'Category A' or 'B'). It notes Category C communities are important where they contain habitat features or other characteristics that are important in a regional or local context. A minimum 30 m buffer zone is considered to sufficient to buffer edge effects.

No built infrastructure will occur within 50m of the TEC. Further, no evidence of threatened fauna species was recorded as utilising this TEC.

While minor earthworks will occur in proximity to the TEC to create required levels for rehabilitation, these works are minor, temporary and consistent with natural resource management measures required of standard conservation.

With the proposed rehabilitation measures it is anticipated that the proposed wetland will support further regeneration of species to create a net gain in this TEC on the site.

Therefore, the action is not considered to adversely affect habitat critical to the survival of a species.

#### 5. Disrupt the breeding cycle of a population

No evidence of threatened fauna species was recorded as utilising this TEC. Therefore, the action is not considered to disrupt the breeding cycle of a population.

#### 6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline



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The TEC this site did not contain any special or unique values nor evidence of threatened fauna species utilising the habitat. The action will retain the TEC in situ and not modify, destroy, remove, isolate or decrease the availability of habitat or extent of this TEC.

With the proposed rehabilitation measures it is anticipated that the proposed wetland will support further regeneration of species to create a net gain in this TEC on the site.

7. Result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat.

Due to historical rural land use and lack of land management this TEC has been predominately cleared with the remaining patch subject to weed invasion within the understory, particularly along the edges. The Rehabilitation Management Plan will include measures to ensure weed removal and ongoing management to reduce the risk of invasive species. With the removal of rural land use, the risk of invasive species is highly unlikely particularly post rehabilitation outcomes.

Further, stringent water quality controls require the removal of nutrients, TSS and pathogens further reducing the risk of the spread of weeds.

**\*\*Significant Impact Assessment continued below\*\***

### Species or threatened ecological community

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland **\*\*continued\*\***

### Impact

**\*\*Significant Impact Assessment continued\*\***

8. Introduce disease that may cause the species to decline.

Ongoing collaboration with nearby aquaculture industries has resulted in water quality controls, above and beyond best practice under State and National Guidelines for removal of nutrients, TSS and pathogens to reduce to risk of disease (e.g. white spot) for aquatic species.

No known disease within terrestrial fauna populations is known to occur. No feral animals were recorded on-site.

Therefore, the action is not considered to introduce disease that may cause the TEC, or species which may inhabit the TEC, to decline.

9. Interfere with the recovery of the species.

The SPRAT databased states as Recovery Plan is not required with the main threats well understood and listed in the Conservation Advice as Appendix D and include clearing and fragmentation, weeds, invasive fauna, agricultural activities and grazing, changes to hydrology including flood mitigation and drainage, inappropriate fire regimes, impacts from recreational activity and climate change.

Given the proposal will result in the cessation of agricultural activities and maintenance clearing, increased weed and pest management, rehabilitation of cleared rural land to pre-clear regional ecosystems, mitigation and management of climate change and storm tide inundation through management of tidal flows the action is consider to support the recovery objectives for the TEC with an anticipated increase in size of the TEC to occur under the rehabilitation plan (refer Appendix O).

The above assessment against the EPBC Significant Impact Guidelines 1.1 indicates the proposed action is highly unlikely to have a significant impact on the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community

### Species or threatened ecological community

Koala (*Phascolarctos cinereus*)

The Koala is found from north east Queensland to the south-east corner of South Australia. As a consequence of translocations, the Koala are found outside their historic range, for example, Kangaroo Island. The distribution of Koala is influenced by altitude, temperature and leaf moisture. The density of the Koala population in coastal regions is generally greater than inland areas. Koalas are known to naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* sp. Koala habitat can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland and emergent food trees. Preferred food and shelter trees are naturally abundant on fertile clay soils.

### Impact

Threats

Habitat loss and fragmentation, vehicle strike and predation by domestic or feral dogs are the main threats to the Koala. Extreme environmental events, such as drought, can also cause significant mortality. Analysis of 10,597 records collated from



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the Moggill Koala Hospital for the period of 1997-2017 reveals that disease, vehicle-strike and dog attack are the primary contributors to Koala mortality across the Local Government Area (LGA). Deaths from disease accounted for approximately 57% of all known mortalities, while collectively vehicle-strike and domestic dog attack accounted for approximately 40% of the remaining mortalities.

The analysis of vehicle-strike data identified a number of long-standing black spots for Koalas in the Redlands Coast, particularly along Mount Cotton Road, Duncan Road and Redland Bay Road intersections in Capalaba.

The incidence of domestic dog attack, occurring at highest density within the most urbanised parts of the Redlands Coast, has remaining proportionally, constant over time.

The mortality data is most notable for the large number of 'diseased' Koalas that have been euthanised in recent generations, the numbers of which are considered to have been the primary driver of a reduction in Koala density over the last three generations, with at least 2,292 Koalas having been removed from the populations and euthanised between 1997 and 2014, a number that exceeds that known to have been collectively killed by vehicle strike and domestic dog attack over this same time period.

Site Relevance (refer Appendix M for further details, figures and maps)

Both the PMST and Wildlife Online searches identified the potential of the species to occur within 5km of the site. A search of the Atlas of Living Australia (Atlas of Living Australia) database identified 12 records for the species within 5km of the site. These records date from 1990 to 2019, with 10 of the records made between 2012-2016. The three nearest records, to the north-east, are along Serpentine Creek Road in 2012, 2013 and 2014 as a result of vehicular strike. The only record made within the last 4 years, is approximately 3km north-east cleared pastoral land at Orchard Road, which is also the location of the temporary irrigation area. As no canopy trees occur at this location, it is believed that the GPS location is incorrect and should reflect adjoining bushland to the east.

The Koala has the potential to occur on-site given the presence of non-juvenile Koala habitat trees (NJKHTs). In accordance with the EPBC Act Referral Guidelines for the Vulnerable Koala, the Spot Assessment Technique (SAT) was applied in to search the site for the potential presence of the Koala. The SAT method is an assessment of Koala activity involving a search for any Koalas and signs of Koala usage. While no evidence of Koala was recorded, two opportunistic SAT surveys were undertaken within the referral area.

Impacts to Koala habitat are considered only to be associated with the removal of trees for construction of the WWTP and pipeline infrastructure. All trees with a DBH > 100mm within the WWTP area, and a 10 m buffer, were recorded with a hand-held GPS and all trees were searched for evidence of Koala. No evidence of Koala was recorded. Field survey confirmed the majority of the proposed WWTP area is free of native tree species and is dominated by the weed tree *Pinus elliottii* (Slash Pine) and other weed species such as *Lantana camara* (Lantana). A large patch of planted *Cinnamomum camphora* (Camphor Laurel) was present within the southern extent of the WWTP.

Koala habitat vegetation assessment was undertaken over part of the balance land in the north-east (outside the referral area), as a potential area for Koala habitat rehabilitation. This patch was confirmed as containing Slash Pine and Camphor Laurel and currently providing no Koala habitat.

While detailed assessment was not undertaken over remnant vegetation remaining balance land (outside the referral area), to be retained by the development, based on aerial imagery, site visual assessment and regional ecosystem mapping, this vegetation contains Koala food trees however is considered to be of poorer quality habitat than vegetation to the north associated with Native Dog Road Conservation Area and Serpentine Creek Conservation Area.

Importantly, due to significant disturbance on the site, surrounding roads fragmenting remaining vegetation from large areas of bushland, lack of local records and more desirable habitat for Koala within the broader landscape, the referral area is considered to be unlikely utilised by the species.

\*\*continued below\*\*

### Species or threatened ecological community

Koala (*Phascolarctos cinereus*) \*\*continued\*\*

### Impact

Koala Habitat Assessment Tool

Koala occurrence +0

The EPBC Act PMST identified the Koala as having potential to occur on-site. A search of Queensland's Wildlife Online Search Tool using a 5km radius found 243 record of the Koala within a 5km radius, although it is noted that many of these



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records are old.

A search of the Atlas of Living Australia (Atlas of Living Australia) database indicates 12 records of the species within a 5km radius of the site, with the three nearest records made along Serpentine Creek Road / Longland Road as a result of vehicle strike in 2012, 2013 and 2014. The only record made within the last 4 years, is approximately 3km north-east cleared pastoral land at Orchard Road. As no canopy trees occur at this location, it is believed that the GPS location is incorrect and should reflect adjoining bushland to the east.

Assessment by University of Queensland and Biolink show no recent records for Koala on or within proximity of the site, with low occurrence for the species within the southern Redland Bay area on a whole.

Recent field survey of the referral area did not observe any Koalas and no evidence of their use (e.g. scat, scratch), despite two opportunistic KSAT surveys and checking all GPS located trees. This suggests use of the site by the species is unlikely, and if at all, only transitory, rather than sedentary.

There is no recorded evidence of one or more Koalas within 2km of the edge of the impact area within the last 2 years. This attribute is assigned a score of 0.

#### Vegetation composition +2

Impacts to Koala habitat are considered only to be associated with the removal of trees for construction of the WWTP and pipeline infrastructure. Field survey confirmed the majority of the proposed WWTP area is free of native tree species and is dominated by the weed tree *Pinus elliotii* (Slash Pine) and other weed species such as *Lantana camara* (Lantana). A large patch of planted *Cinnamomum camphora* (Camphor Laurel) was present within the southern extent of the WWTP. This vegetation was confirmed on ground as Category X (non-remnant).

While detailed assessment was not undertaken over remnant vegetation remaining balance land (outside the referral area), to be retained by the development, based on aerial imagery, site visual assessment and regional ecosystem mapping, this vegetation contains Koala food including *Eucalyptus siderophloia* (Grey Ironbark), *Corymbia intermedia* (Pink Bloodwood) and *Corymbia trachyphloia* (Brown Bloodwood) which were recorded as part of the Tree Plot survey. However, this vegetation is considered to be of poorer quality habitat than vegetation to the north associated with Native Dog Road Conservation Area and Serpentine Creek Conservation Area. It is noted that the University of Queensland zonation analysis identify the site within the lowest habitat value category for Koala within all of Redland Bay.

Two or more Koala food trees were identified in the canopy, resulting in an attribute score of 2.

#### Habitat connectivity +0

The background property is rural and has been predominately been cleared however retains remnant and regrowth vegetation containing NJKHTS within the eastern portion of the site. This vegetation will be retained by the development however is noted to be an isolated patch, currently fragmented from bushland reserves to the north by roads and existing cleared rural properties.

Evidence of vehicle strike along Longland Road/Serpentine Creek Road (speed limit 80kmph) and Rocky Passage Road combined with an absence of records or evidence of occurrence on the referral site by Koala, further confirms this road creates a barrier to Koala and fragmentation of the site from Koala areas of Koala occupancy in the north as recorded by University of Queensland and Biolink (refer Appendix M for details).

The University of Queensland zonation analysis identified the site within the lowest habitat value category for Koala within all of Redland Bay. Further, the Biolink report concluded that the areas of Koala occupancy have not changed despite urban development and population declines. Therefore, as the referral area is currently not occupied, nor forms part of connected Koala habitat at present, it is unlikely to contribute to future Koala habitat areas; which should be focused on retaining bushland to the north where known populations occur.

As such the vegetation on the site in its current and future form (post development) is considered fragmented from the surrounding landscape.

The site does not form part of a contiguous landscape (>300ha) and this attribute his assigned a score of 0.

\*\*Koala habitat assessment tool continued below\*\*



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### Species or threatened ecological community

Koala (*Phascolarctos cinereus*) \*\*continued\*\*

### Impact

\*\*Koala habitat assessment tool continued\*\*

Key existing threats +0

Analysis of 10,597 records collated from the Moggill Koala Hospital for the period of 1997-2017 reveals that disease, vehicle-strike and dog attack are the primary contributors to Koala mortality across the Local Government Area (LGA). Deaths from disease accounted for approximately 57% of all known mortalities, while collectively vehicle-strike and domestic dog attack accounted for approximately 40% of the remaining mortalities.

The southern Redland Bay area is planned for significant urbanisation. According to the Queensland Department of Environment and Science (DES), an average of almost 300 Koalas are killed each year by motor vehicles in South East Queensland, based on wildlife hospital records in the period 1997 to early 2011. Three deaths have been recorded along Longland Road/Serpentine Creek Road. The risk of Koala mortalities from vehicle strikes in the vicinity of the referral site is considered high.

Further, according to DES, more than 100 Koalas are hospitalised each year in South East Queensland after being attacked by dogs. Around 75% of the hospitalised Koalas will die from their injuries. Dog ownership in rural residential areas is considerably high, with properties > 600 m<sup>2</sup> allowed to keep 2 dogs without or up to 4 dogs with Council approval. Several properties within the immediate vicinity of the subject site contain domestic dogs.

The risk of Koala mortalities from dog attack at the referral site is considered high.

There is evidence of frequent Koala mortality from vehicle strike and dog. This attribute has been scored 0.

Recovery value+1

The interim recovery objective for coastal areas is based upon protecting and conserving large, connected areas of Koala habitat, particularly where Koalas are genetically diverse or distinct, free of disease or have a low incidence of disease or where there is evidence of breeding. None of these attributes are considered to occur on the referral area.

The vegetation on the subject site is not considered to be important in achieving the Interim Recovery Objectives for the coastal context given its foundation on the ability to protect and conserve large connected areas of Koala habitat. Koala Context Attributes listed under Interim Recovery Objectives in Table 1 of the Koala Referral Guidelines for coastal areas are to:

1. Protect and conserve large, connected areas of Koala habitat, particularly large connected areas that support Koalas that are:

- a. of sufficient size to be genetically robust or operate as a viable sub-population, or;
- b. are free of disease or have a low incidence of disease, or;
- c. are breeding.

2. Maintain corridors and connective habitat that allow movement of Koalas between large areas of habitat.

The site does not retain opportunity to achieve the interim recovery objectives for coastal areas, which is based primarily on maintaining large areas of bushland and connectivity. The site is isolated from large tracts of bushland in the locality.

In addition, the regional Koala population is not considered to be genetically diverse from other SEQ Koala populations, and instances of sickness (refer Appendix M for details) indicate the local population is not free of disease. Records from Moggill Koala Hospital for the period of 1997-2017 confirmed disease accounted for approximately 57% of all known mortalities

The referral area is does not currently maintain corridors and connected habitat. Due to fragmentation, the referral area cannot form a large connected area of Koala habitat that is of sufficient size to support a sub-population. The recovery value of the referral area is poor and fragmented and the attribute is assigned a score of 1.

Total +3: The site does not contain critical habitat.

### Species or threatened ecological community

Koala (*Phascolarctos cinereus*) \*\*continued\*\*

### Impact



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### Significant Impact Assessment

1. Lead to a long term decrease in the size of an important population of a species.

While the referral area does contain portions of remnant vegetation comprising Koala food trees, as a result of historical broad-scale clearing the site, and surrounding area, is highly modified. This vegetation is fragmented from large tracts of bushland that would support a Koala population and due to surrounding roads it is unlikely to be utilised as refuge habitat.

No evidence of Koala occurrence was recorded on-site and no recent evidence of Koala was recorded within the area (e.g. only 1 record within the last 4 years approximately 3km from the site).

The referral area does not currently support Koalas, and no known local populations occur in the area. Populations of Koala within Redland Bay are known to occur located in northern suburbs, north predominately north of Thornlands approximately 15km north of the site.

The action is highly unlikely to lead to the long-term decrease in the size of an important population.

2. Reduce the area of occupancy of an important population.

An important population is not considered present on the referral area for the following reasons:

- No Koalas have been recently (within 4 years) recorded on-site or within close proximity to the site (i.e. within 3km).
- Koala populations in the Redland Bay area do not traverse south as far as the site and are predominately located in areas over 15km north of the site. Biolink analysis identified despite urban development and mortality from dog attacks, vehicle strike and disease leading to a delinking population, the area of occupancy over three generational periods has not changed.

- The referral site contains lower quality habitat and is fragmented from conservation areas or large tracts of vegetation

- Koala records in the broader Redlands area include specimens carrying disease.

The overall decrease in a small area of disturbed, low quality habitat not considered to reduce the area of occupancy of an important population.

3. Fragment an existing important population into two or more populations.

An important population is not considered to occupy southern Redland Bay with known populations located within the northern bay area, approximately 15km and beyond, of the site. Further, given disturbance of vegetation and no evidence of Koala use an important population is not considered to utilise the site.

The overall decrease in a small area of disturbed and fragmented, low quality habitat will not fragment connectivity or an important population.

4. Adversely affect habitat critical to the survival of a species.

The proposed action does not result in net loss of NJKHTs.

Further, under the proposal an approximately 1.5ha area patch of exotic vegetation will be removed and rehabilitated with Koala feed trees. This area adjoins existing regrowth and remnant vegetation which contains suitable habitat for the species and will be retained post development. However, it is noted that this vegetation is degraded from historical broad scale clearing and isolated from significant patches of bushland habitat. The vegetation on-site is not considered to be unique or of special value.

Given the relatively disturbed nature of the site, topography of the land being predominately influenced by tidal undulation, fragmentation from large areas of conservation land (to the north) and surrounding rural land uses, the site is not considered of importance to the interim recovery objectives for the Koala. The site is not considered to adversely affect habitat critical to the survival of the species.

5. Disrupt the breeding cycle of an important population.

Site surveys did not identify any evidence of Koala (e.g. breeding or transient occurrence). Further, no recent sightings for Koala have occurred within the last 5 years within 2km of the area. As such, the site is unlikely to support Koalas even as transient individuals and does not provide known habitat for an important population.

Known populations occupy the northern areas of Redland Bay. Conservation reserves to the north are considered to maintain current connectivity values for potential dispersal. Therefore, it is considered unlikely that the breeding cycle of an important population will be disrupted by the proposed action.

### Species or threatened ecological community

Koala (*Phascolarctos cinereus*) \*\*continued\*\*

### Impact

\*\*Significant Impact Assessment continued\*\*

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to



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decline.

The habitat on this site did not contain any special or unique values and is predominately to be retained by the development.

Twenty-one NJKHT will be removed as a result of the development however 2.84ha of koala habitat RE12.3.5/12.3.6 will be rehabilitated and 100 Koala habitat trees will be planted along the pipeline/services easement between Longland Road and the WWTP. Thus their removal is highly unlikely to have a significant impact on the availability of habitat throughout the broader landscape, given the vast quantity and availability of Koala habitat to the north. Individuals are not considered to utilise the site, even as transient and do not form part of an important population. As such, the proposal is highly unlikely to lead to species decline.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

Due to historical broad scale clearing and irregular management, invasive plant species are present on-site and will be suppressed under the rehabilitation efforts for the ongoing approval of the proposed development. Under management plan requirements, the proposal will augment invasive species impacts already present in the area.

8. Introduce disease that may cause the species to decline.

Most of South East Queensland's Koala populations already have a high prevalence of Chlamydia infection and Koala Retrovirus (KoRV), and sick Koalas have been recorded in the vicinity of the referral area. Records from Moggill Koala Hospital for the period of 1997-2017 confirmed disease accounted for approximately 57% of all known mortalities

As such, the project is considered unlikely to cause pressure on the local Koala population to the point where these diseases manifest and the project is extremely unlikely to introduce or spread disease or pathogens into Koala habitat areas.

9. Interfere substantially with the recovery of the species.

Analysis suggests the action is unlikely to interfere substantially with the recovery of Koala, primarily due to the relatively disturbed nature of the site, a lack of records of the Koala utilising the site and optimal habitat retained in conservation reserve to the north.

The above assessment against the EPBC Significant Impact Guidelines 1.1 indicates the proposed action is highly unlikely to have a significant impact on the Koala, and in summary:

- The site does not support an important population of Koalas and the action is highly unlikely to result in a significant impact on the species; and

- Habitat within the referral area was assessed using the Koala Habitat Assessment Tool as per the criteria in the Koala Referral Guidelines and was found to have a score of 3 out of 10. Therefore, under the Koala Referral Guideline, the site does not contain Critical Habitat for the Koala.

Under the Koala Referral Guidelines, the action does not need to be referred for Koala for impacts on habitat. Further, an assessment against the significant impact guidelines identifies that the action is highly unlikely to result in a significant on the species.

## Species or threatened ecological community

Grey-headed Flying-fox (*Pteropus policephalus*)

Distribution and Habitat

The Grey-headed Flying-fox occurs between Rockhampton in Queensland to Melbourne in Victoria. The species will usually selectively forage where food is available and as such, its patterns of occurrence and relative abundance vary between seasons and years. There are no separate or distinct populations due to the constant genetic exchange and movement between camps throughout its geographic range.

Threats

The primary threat to the Grey-headed Flying-fox is shooting and culling to protect commercial fruit farms. In addition, habitat loss and fragmentation creates competition for food sources and the loss of roosting camps is also considered to be a threat.

## Impact

Desktop & Field Survey Results

Flying-fox roost camps have been recorded to the north of the site and on nearby islands. The closest roost is located approximately 5.7km north of the site, at Jundee Street Wetlands, however has not been recorded by the species since 2012. Opportunistic and targeted surveys did not locate roosting sites in the application area or within the immediate vicinity of the site. No Grey-headed Flying Fox individuals were recorded during field surveys and a search of the Atlas of Living Australia database identified only four records within a 5km radius of the site and older than 25 years; 3 made in 1994 and one made in



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1985. Due to the limited availability of suitable foraging habitat on-site, particularly in context to Native Dog Road Conservation and Serpentine Creek Conservation Area to the north, the species is considered highly unlikely to utilise the site.

It is noted that the Department consider foraging habitat for the Grey-headed Flying-fox is analogous with habitat for the Koala and that is why it the species was targeted as part of this assessment. Given no recent evidence for the species, it is considered unlikely to occur. Adopting the precautionary principle to best practice environmental assessment and an assessment against the EPBC Act Significant Impact Guidelines 1.1 has been undertaken as for Grey-headed Flying-fox.

#### Avoid, minimise and mitigate

While Grey-headed Flying-fox is unlikely to occur on site, suitable habitat for the species will be retained within bushland adjacent the referral area. Potential impacts to fauna during vegetation clearing, construction and operation will be minimised and managed under the Vegetation Clearing and Fauna Management Plan (refer Appendix N).

#### Significant Impact Assessment

Under the EPBC Act Grey-headed Flying-fox populations are listed as Vulnerable and under the Queensland Nature Conservation Act 1992 the species is listed as least concern. The referral guideline for management actions in grey-headed and spectacled flying-fox camps summarise the decision process in considering the likelihood of a significant impact on the Grey-headed Flying-fox or Spectacled Flying-fox schematically. The Guidelines are specifically for the assessment of impacts on Flying-fox camps. Given no roosting sites are located on-site or in the near vicinity, it is highly unlikely that the action will involve impacts on the Grey-headed Flying-fox according to the Guidelines. However, the Guidelines also state that, 'It does not apply to the following actions... Actions which may impact on the foraging habitat of EPBC Act-listed flying-fox species. Proponents of actions of this kind should refer to the Significant Impact Guidelines 1.1.'

To determine whether the proposed action is likely to have a significant impact on the Grey-headed Flying-fox, an assessment against the EPBC Significant Impact Guidelines 1.1 is provided below.

#### Significant Impact Assessment

1. Lead to a long term decrease in the size of an important population of a species.

No Grey-headed Flying-fox individuals nor roost camps were recorded on-site during field survey. Further, no known roost camps are located within close proximity to the site.

SEQ has a permanent and abundant population of Grey-headed Flying-fox and available habitat is spread throughout the region given the high prevalence of eucalypts. While native vegetation on-site may be considered potential foraging habitat for the species, due to the poor level of habitat quality, cleared surrounding lands, abundance of exotic tree species and absence of evidence of the species utilising the site even as a transient visitor, the site is not considered to support an important population of the species. The proposed action is highly unlikely to lead to a long term decrease in the size of any local Grey-headed Flying-fox populations.

### Species or threatened ecological community

Grey-headed Flying-fox (*Pteropus poliocephalus*) \*\*continued\*\*

### Impact

\*\*Significant Impact Assessment continued\*\*

2. Reduce the area of occupancy of an important population.

No individuals or roost camps were recorded on or in the immediate vicinity of the referral area. The proposed action is not considered to have a significant impact on any population of the species. A roosting camp is located over 5.7km north of the site, at Jundee Street Wetlands. Further, the relative quality of referral area habitat is not considered likely to attract foraging as the presence of exotic tree species would be a deterrent, particularly given the abundance of suitable habitat within conservation reserve to the north. While the proposed action will remove a small number of flowering Eucalypts, given the abundant availability of eucalypts in the surrounding landscape and the greater SEQ region, the proposed action is highly unlikely to have a significant impact on the area of occupancy of the species.

3. Fragment an existing important population into two or more populations.

The SPRAT species profile outlines that while there are spatially structured colonies of Grey-headed Flying-fox, there are no separate or distinct populations due to the constant genetic exchange and movement between camps throughout the species' geographic range. In addition, given the high mobility of the species, the proposed action is highly unlikely to fragment a population into two or more populations.



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4. Adversely affect habitat critical to the survival of a species.

While the proposed action results in the removal of trees which may provide potential foraging habitat, this habitat is highly disturbed and from contemporary rural land uses. Further, this habitat is not considered to be unique or of special value. The SEQ landscape provides abundant eucalypt and similar genera which are available for foraging. The habitat on referral area is not considered to be critical to the survival of the Grey-headed Flying-fox.

5. Disrupt the breeding cycle of an important population.

The site surveys did not identify any evidence of breeding Grey-headed Flying-fox. Mating normally occurs during autumn, and females generally give birth in October, where they carry their young to feeding sites for four to five weeks after giving birth. As no roosting camps were observed on or near the referral area, the proposed action is highly unlikely to disrupt the breeding cycle of an important population.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

The habitat on site did not contain any special or unique values. Its removal is unlikely to have a significant impact on the availability of habitat in the landscape, given the vast quantity and availability of eucalypts in the broader locality. As such, the proposal is considered highly unlikely to lead to species decline.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

Invasive plant species are present on-site and will be suppressed under the rehabilitation efforts for the ongoing approval of the proposed action. Under management plan requirements, the proposal will augment invasive species impacts already present in the WTPP area.

8. Introduce disease that may cause the species to decline.

The project is unlikely to introduce disease into the area.

9. Interfere substantially with the recovery of the species.

Recovery of the species has specifically targeted the broad scale culling of the species. In addition, conservation efforts have led to the protection of known roosting sites and important habitat. The site has not been identified as an important habitat or roost site and the action is unlikely to interfere with the recovery of the species.

The above assessment against the EPBC Significant Impact Guidelines 1.1 indicates the proposed action is highly unlikely to have a significant impact on the Grey-headed Flying-fox.

## Species or threatened ecological community

### Water Mouse (*Xeromys myoides*)

The Water Mouse is listed as Vulnerable under the EPBC Act.

### Distribution and Habitat

The Water Mouse typically occurs in coastal saltmarsh, mangroves and adjacent freshwater wetland habitats in Australia and in coastal wetland areas of Papua New Guinea. In Australia, the species distribution encompasses coastal areas of central and south-east Queensland from Proserpine south to the Queensland/New South Wales border. The species is also known from the mainland and nearshore islands of the Northern Territory. The species known to occur in several marine habitats ranging from sedgeland, saline grassland, marine couch grassland and tidally flooded landward mangroves to feed and nest. The Water Mouse utilises exposed mangrove substrates and intertidal saltmarsh habitats for foraging, following the outgoing tide and foraging until advancing water covers these habitats.

## Impact

### Threats

The Water Mouse is mostly threatened by habitat loss, fragmentation and degradation. This has resulted from urban development, sand mining, land reclamation, swamp drainage, feral animals, recreational vehicles, discharge of polluted waters and chemical pollution (runoff from agricultural and urban lands, exposure of acid sulphate soils and off-shore pollution events). These degrading processes reduce potential feeding resources and nesting opportunities, promote weed invasion and increase predation by feral animals (foxes, pigs and cats).

### Desktop & Field Survey Results

Potential habitat is located along the Logan River outside of the site as the species' habitat is limited to the upper littoral zone. No mounds or evidence of Water Mouse was recorded despite targeted searches. A search of the Atlas of Living Australia database did not identify any records within 5km of the site and there are no known local records. Given no recent



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evidence for the species, it is considered unlikely to occur.

Adopting the precautionary principle to best practice environmental assessment, an assessment against the EPBC Act Significant Impact Guidelines 1.1 has been undertaken as for Water Mouse.

#### Significant Impact Assessment

1. Lead to a long term decrease in the size of an important population of a species.

The National Recovery Advice lists important populations for Water Mouse in Queensland as including high density populations of *X. myoides* occurring within the Great Sandy Strait (including Tin Can Bay), Pumicestone Passage and southern Moreton Bay (including the western shores of North and South Stradbroke Islands).

Despite targeted searches, Water Mouse individuals or nests were not recorded within the referral area. Nor were any records noted for the species within 5km of the site on the Atlas of Living Australia. Based on the results, the referral area is not considered to support an important population.

The action will result in the protection of existing suitable habitat and creation of mangrove habitat for the species. Overall, the action is considered to provide a net ecological benefit for Water Mouse.

2. Reduce the area of occupancy of an important population.

Despite targeted searches no Water Mouse individuals or nests were recorded within the referral area. Given lack of records in the area, the site is not considered to support an important population.

The action will result in the protection of existing suitable habitat and creation of mangrove habitat for the species. Overall, the action is considered to provide a net ecological benefit for Water Mouse.

The action will not reduce the area of occupancy of an important population.

3. Fragment an existing important population into two or more populations.

Given lack of records in the area, the site is not considered to support an important population.

Further, the action will result in the creation of suitable habitat for the species and thus will not fragment an existing population into two or more populations.

4. Adversely affect habitat critical to the survival of a species.

The action will result in minor and temporary impacts to mangroves for the creation of the inlet and outlet structure. No evidence of Water Mouse was recorded within the referral area and thus these impacts will not adversely affect known habitat, nor critical habitat for the species.

Further, the proposed action will result in the protection of existing suitable habitat and creation of mangrove habitat for the species. Overall, the action is considered to provide a net ecological benefit for Water Mouse.

5. Disrupt the breeding cycle of an important population.

No evidence of Water Mouse or breeding sites was recorded on site or known to occur within proximity to the site.

While the action will result in minor and temporary impacts to mangroves for the creation of the inlet and outlet structure, as breeding is not considered to occur on site, these works will not disrupt the breeding cycle of an important population.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

The action will result in the protection of existing suitable habitat and creation of mangrove habitat for the species. Overall, the action is considered to provide a net ecological benefit for Water Mouse. As such, the proposal is considered highly unlikely to lead to species decline.

#### Species or threatened ecological community

Water Mouse (*Xeromys myoides*) \*\*continued\*\*

#### Impact

\*\*Significant Impact Assessment continued\*\*

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

Invasive plant species are present on-site and will be suppressed under the rehabilitation efforts for the ongoing approval of the proposed action. Under management plan requirements, the proposal will largely halt invasive flora species impacts already present in the referral area. No known feral pests (e.g. foxes, dogs, cats) which would pose a risk to Water Mouse were observed on-site during fauna surveys.

8. Introduce disease that may cause the species to decline.



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Due to high water quality standards for the control of pathogens, the project is highly unlikely to introduce disease into the area.

9. Interfere substantially with the recovery of the species.

The National Recovery Plan for the Water Mouse (*Xeromys myoides*) states the overall objective of the recovery plan is to improve the conservation status of the Water Mouse and its habitat through habitat protection, reducing threats to species' survival, research and increasing public participation in recovery activities

While no known habitat for the species exists on the referral area, the action will result in the creation of suitable habitat for the species.

The above assessment against the EPBC Significant Impact Guidelines 1.1 indicates the proposed action is highly unlikely to have a significant impact on the Water Mouse

### Species or threatened ecological community

Australian Painted Snipe (*Rostratula australis*)

The Australian Painted Snipe is listed as Vulnerable and Marine under the EPBC Act.

Distribution and Habitat

The Australian Painted Snipe has been recorded at wetlands in all states of Australia. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The Australian Painted Snipe has also been recorded nesting in and near swamps, canegrass swamps, flooded areas including samphire, grazing land, among cumbungi, sedges, grasses, salt water couch (*Paspalum*), saltbush (*Halosarcia*) and grass, also in ground cover of water-buttons and grasses, at the base of tussocks and under low saltbush.

### Impact

Threats

The primary factor in the decline of the Australian Painted Snipe has probably been a loss and alteration of wetland habitat. As a wetland inhabitant, the Australian Painted Snipe is also presumed to be vulnerable to other processes that reduce the potential for flooding, such as prolonged drought. The replacement of endemic wetland vegetation by invasive, noxious weeds could render habitats less suitable or unsuitable for the snipe as well as threats of predation by feral animals (foxes, pigs and cats).

Desktop & Field Survey Results

The species has a scattered distribution throughout many parts of Australia. A search of the Atlas of Living Australia database identified two records approximately 5km upstream of the site along Logan River (refer Figure 18). Both records were made in 1991 in November and December, respectively. No recent or local records are known. Despite targeted surveys the species, nor evidence of breeding (e.g. nests) were recorded on site.

Adopting the precautionary principle to best practice environmental assessment, an assessment against the EPBC Act Significant Impact Guidelines 1.1 has been undertaken as Australian Painted Snipe.

Significant Impact Assessment

1. Lead to a long term decrease in the size of a population.

There is no known important population in the Redland Bay Area. No evidence of the species or breeding (e.g. nests) were recorded within suitable habitat on site. Nor has any evidence of the species been recorded in the area. The action is not considered to lead to the long-term decrease in the size of the population. With the proposed rehabilitation measures it is anticipated that the proposed wetland will create suitable habitat for the species.

2. Reduce the area of occupancy of a population.

Suitable habitat for the species will be retained by the proposed action. Further, with proposed rehabilitation measures it is anticipated that the proposed wetland will create suitable habitat for the species. Therefore, the action is not considered to reduce the area of occupancy of a population.

3. Fragment an existing population into two or more populations.

There is no known important population in the Redland Bay Area. No evidence of the species or breeding (e.g. nests) were recorded within suitable habitat on site. Nor has any evidence of the species been recorded in the area. Therefore, the action is not considered to reduce to occupancy of a population.

4. Adversely affect habitat critical to the survival of a species.

Suitable habitat for the species will be retained by the proposed action. Further, with proposed rehabilitation measures it is



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anticipated that the proposed wetland will create suitable habitat for the species. Therefore, the action is not considered to adversely affect habitat critical to the survival of a species.

5. Disrupt the breeding cycle of a population.

Breeding habitat was not recorded on or proximal to the site. Therefore, the action is not considered to disrupt the breeding cycle of a population.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Suitable habitat for the species will be retained by the proposed action. Further, with proposed rehabilitation measures it is anticipated that the created wetland will deliver suitable habitat for the species.

7. Result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat.

The rehabilitation plan includes measures to ensure weed removal and ongoing management to reduce the risk of invasive species. With the removal of rural activities, the risk/threat of invasive species becoming established is unlikely particularly post rehabilitation outcomes. Further, stringent water quality controls require the removal of nutrients, TSS and pathogens further reducing the risk of the spread of weeds.

8. Introduce disease that may cause the species to decline.

Ongoing collaboration with nearby aquaculture industries has resulted in water quality controls, above and beyond best practice under State and National Guidelines for removal of nutrients, TSS and pathogens to reduce to risk of disease for resources of this threatened species. No known feral pests (e.g. foxes, dogs, cats) which would pose risk to Australian Painted-snipe occur on site.

9. Interfere with the recovery of the species.

The primary factor in the decline of the Australian Painted Snipe is likely the loss and alteration of wetland habitat. Suitable habitat for the species will be retained by the development. Further, with proposed rehabilitation measures it is anticipated that the proposed wetland will create suitable habitat for the species and thus will positively influence with the recovery objectives.

The above assessment indicates the proposed action is highly unlikely to have a significant impact on this species.

### Species or threatened ecological community

#### Threatened Shore Birds

##### *Calidris ferruginea* (Curlew Sandpiper)

Curlew Sandpiper is listed as Endangered under the EPBC Act. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. A search of the Atlas of Living Australia database did not identify any records within 5km of the site and there are no known local records.

### Impact

##### *Limosa lapponica baueri* (Bar-tailed Godwit)

Bar-tailed Godwit is listed as Vulnerable under the EPBC Act and NCA. The Bar-Tailed Godwit (western Alaskan) nests on the ground in open tundra, usually on dry elevated sites and often between clumps of grass. The nest is usually a depression lined with bits of vegetation and lichens. The species occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. A search of the Atlas of Living Australia database identified one record approximately 4km north-west of the site within Serpentine Creek Conservation Area

##### *Numenius madagascariensis* (Eastern Curlew)

Eastern Curlew is listed as Critically Endangered, Marine and Migratory under the EPBC Act and Endangered under the NCA. This species is endemic to the East Asia-Australian Flyway and breeds in Asia after which migratory during the austral summer. In Australia, Eastern Curlew feeds during the non-tide phase of the tide cycle on open intertidal mudflats or sandflats with relatively soft sediments with or without seagrass. These are usually located within 50m of the low-water mark, with the birds preferring areas with softer sediments they can more easily probe into and capture prey. A search of the Atlas of Living Australia database identified two records, approximately 4km north-west within Carbrook Wetlands made in 1991 and approximately 4km south-east along the Logan River made in 2019. The site does not contain suitable habitat for this species and it is considered unlikely to occur.



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#### Desktop and Field Survey

The Eastern Curlew and Bar-tailed Godwit are known to occur approximately 2km north east of the site along Moreton Bay mudflats and coastal saltpan. Wetland bird and roost site target surveys were undertaken by BAAM during the summer months March 2015 – March 2018 for the Shoreline residential development (EPBC 2016/7776). The survey extent included the area adjoining the referral area. These surveys consisted of eight low-tide and four high tide-surveys along the coastline and were conducted in accordance with the industry guidelines for avoiding, assessing and mitigating impacts on EPBC listed migratory shorebirds species published by the DoEE (2015). While Eastern Curlew was the target species, BMM recorded evidence of three other listed migratory shorebirds: *Limosa lapponica baueri* (Bar-tailed Godwit), *Numenius phaeopus* (Whimbrel) and *Tringa nebularia* (Common Greenshank).

The results of BAAM's four (4) high-tide surveys (2016) concluded that no migratory shorebirds use habitats along this area of Moreton Bay for roosting. This was also supported by no recorded roosting sites in the area, with the closest roosting area recorded as Port Halloran, approximately 9km north of the area. Recent fauna surveys by SHG confirmed that the referral area does not support roosting habitat.

#### Avoid, minimise and mitigate

No direct impacts will occur to wetland bird habitat along Moreton Bay with indirect impacts associated with changes in water quality, minimised and mitigated through stringent controls and management plans.

#### Significant Impact Assessment

Given significantly limited habitat features available on the referral site for these species, and known habitat within Moreton Bay and Carbrook Wetlands, at present wetlands species are considered unlikely to occur, and if so, only as transient visitors. Given proposed mitigation and management measures and stringent water quality controls during construction and operation, downstream impacts to Moreton Bay and foraging habitat are not anticipated.

Subsequently, the actions is unlikely to have a significant impact on the these species for the following reasons:

- Unlikely to lead to a long-term decrease in the size of a population or important population,
- Unlikely to reduce the area of occupancy of a species,
- Unlikely to fragment an existing population or important population into two or more populations,
- Unlikely to adversely affect habitat critical to the survival of the species,
- Unlikely to disrupt the breeding cycle of a population,
- Unlikely to modify, destroy, remove, isolate or crease the availability of habitat to the extent that a species is likely to decline,
- Unlikely to result in invasive species that are harmful to a critically endangered, endangered or vulnerable species,
- Unlikely to introduce disease that may cause the species to decline, and
- Unlikely to interfere with the recovery of a species.

Overall, the creation of an area approximately 12ha in size of terrestrial and tidal wetlands will create additional habitats for migratory birds, particularly wetland species, within the Moreton Bay catchment.

#### 2.4.2 Do you consider this impact to be significant?

Yes  No

#### 2.5 Is the proposed action likely to have any direct or indirect impact on the members of any listed migratory species or their habitat?

Yes  No

#### Migratory species

##### Rhipidura rufifrons (Rufous Fantail)

In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns.

Suitable habitat for the species was recorded within the south-east adjoining the Logan River. A search of the Atlas of Living Australia identified five records for the species within a 5km radius of the site which date from 1984-2017 (refer Appendix M).

#### Impact

Three of these records are associated with Carbrook Wetlands to the north; the fourth located to the north-east along Serpentine Creek Road and the fifth located to the north-west at the Carbrook Golf Course.



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The species was recorded on site as a fly-over. No nests were recorded on the site. Given the abundance of higher quality habitat associated with Moreton Bay Ramsar and Carbrook Wetlands, the species is considered unlikely to frequent or rely on the referral area for breeding or feeding.

#### Potential Impact

**Avoid, minimise and mitigate discussion:** No terrestrial migratory species are considered to frequent the site for breeding or feeding. Suitable habitat for Rufous Fantail will be retained within the balance land.

**Significant impact discussion:** Important habitat for migratory species is defined as habitat used occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or habitat that is of critical importance as a particular life stage, and/or habitat utilised by a migratory species which is at the limit of the species range, and/or habitat within an area where the species is declining.

The site and surrounding land have been historically disturbed and cleared as part of rural land uses, and does not contain any important habitat features (i.e. rock outcrops, rainforest) nor is it considered to represent an ecologically significant area of habitat. Additionally, the site and/or the adjoining properties are not known to support an ecologically significant proportion of the Rufous Fantail or other terrestrial migratory species' populations.

No terrestrial migratory species are considered to frequent the site for breeding or feeding. Suitable habitat for the Rufous Fantail and other terrestrial migratory bird species will be retained within the referral area and on surrounding lands.

As such, the action is not considered to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for the Rufous Fantail or other terrestrial migratory species.

Invasive plant species are present on-site and will be suppressed under the rehabilitation efforts committed to in the MID application to the State Government. Under management plan requirements, the proposal will abate invasive species impacts already present in the area.

The site is not considered to support an ecologically significant proportion of the population of the Rufous Fantail or other terrestrial migratory species. Indirect impacts to foraging species numbers including increased risk of flight from human intrusion and light and noise impacts during construction will be controlled, mitigated and managed under management plans proposed to be adopted as part of this project.

As such, the proposed action is not considered to cause a serious disruption to the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the Rufous Fantail or other terrestrial migratory species' populations.

### Migratory species

#### Wetland Species

Consideration of the Australian Government's Referral Guideline for 14 birds listed as migratory species under the EPBC Act (Sept 2015) and the EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species for migratory shorebirds was made as part of this assessment.

The likelihood of assessment identified the potential for five migratory wetland bird species to occur on site; three of which are also listed threatened species (Curlew Sandpiper, Bar-tailed Godwit and Eastern Curlew). The two remaining species are *Calidris acuminata* (Sharp-tailed Sandpiper) and *Tringa nebularia* (Common Greenshank).

### Impact

#### Avoid, Minimise and Mitigate

Under the definition in the Wildlife Conservation Plan for Migratory Shorebirds (Australian Government, 2015) the site does not contain 'internationally important' nor 'nationally important habitat' for shorebirds because the area does not support at least 0.1 per cent of the flyway population for a single species, 2000 migratory shorebirds or 15 migratory species.

While migratory species are not considered to rely on or frequent the site at present, the creation of mangrove wetlands is anticipated to increase habitat and resources for migratory species. Subsequently, consideration of the National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds (Commonwealth of Australia, 2020) has been made in the design of proposed infrastructure to ensure potential future impacts to migratory species are not created. The Guidelines outline the process to be followed where there is potential for artificial light to affect wildlife. As no additional lighting will be created outside the WWTP and access road, no potential impacts are anticipated to marine turtles nor to marine seabirds due to the action located inland from Moreton Bay. Appendix H of the Guidelines was used in this assessment of potential impacts of artificial light on migratory shorebirds.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

Important habitat for migratory species is defined as habitat used occasionally or periodically within a region that supports



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an ecologically significant proportion of the population of the species, and/or habitat that is of critical importance as a particular life stage, and/or habitat utilised by a migratory species which is at the limit of the species range, and/or habitat within an area where the species is declining.

The site and surrounding land have been historically disturbed and cleared as part of rural and pastoral land uses, and does not contain any important habitat features (i.e. rock outcrops, rainforest) nor is it considered to represent an ecologically significant area of habitat. Additionally, the site and/or the adjoining properties are not known to support an ecologically significant proportion of any of the species' populations.

There will be no direct impacts to Moreton Bay and known foraging or potential roosting habitats for migratory birds. Indirect impacts associated with changes in water quality, minimised and mitigated through stringent controls and management plans.

As such, the action is not considered to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.

2.Result in an invasive species that is harmful to migratory species becoming established in an area of important habitat for the migratory species

The Rehabilitation Management Plan includes measures to ensure weed removal and ongoing management to reduce the risk of invasive species (refer Appendix N). With the removal of rural land use, the risk of invasive species is highly unlikely particularly post rehabilitation outcomes. Further, ongoing collaboration with nearby aquaculture industries has resulted in water quality controls, above and beyond best practice under State and National Guidelines for Recycled Water Quality for removal of nutrients, TSS and pathogens to reduce to risk of disease for resources of this threatened species.

3.Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

The site is not considered to support an ecologically significant proportion of the population of any listed migratory species.

There will be no direct impacts to Moreton Bay and known foraging or potential roosting habitats for migratory birds, indirect impacts associated with changes in water quality, will be minimised and mitigated through stringent controls under the Environmental Authority license and MID approved management plans.

As such, the action is not considered to cause a serious disruption to the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Refer Appendix M for further details.

**2.5.2 Do you consider this impact to be significant?**

Yes  No

**2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?**

Yes  No

**2.7 Is the proposed action likely to be taken on or near Commonwealth land?**

Yes  No

**2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?**

Yes  No

**2.9 Is the proposed action likely to have any direct or indirect impact on a water resource from coal seam gas or large coal mining development?**

Yes  No

**2.10 Is the proposed action a nuclear action?**

Yes  No

**2.11 Is the proposed action to be taken by a Commonwealth agency?**

Yes  No



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**2.12 Is the proposed action to be undertaken in a Commonwealth Heritage place overseas?**

Yes       No

**2.13 Is the proposed action likely to have any direct or indirect impact on any part of the environment in the Commonwealth marine area?**

Yes       No



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## Section 3

### Description of the project area

#### 3.1 Describe the flora and fauna relevant to the project area

Contextually, the site is located in southern Redland Bay and is bounded by Longland Road to the north, Rocky Passage Road to the east, Logan River to the south and Serpentine Creek to the west. The site is located approximately 5.7km upstream of Moreton Bay. Surrounding land uses comprise of a mix of rural and aquaculture industries. The development footprint is located on land which has been subject to broadscale clearing and predominately reflects open paddock and mapped as Category X (non-remnant) vegetation.

The balance land on the background land parcels (outside the referral area) contains areas of comparatively higher ecological value. These areas comprise regrowth and remnant bushland to the east and provide suitable habitat for terrestrial fauna species. Patches of *Casuarina glauca* were recorded along the banks of the Logan River and Serpentine Creek which can provide diverse habitat for a wide range of wetland, grassland and woodland fauna species. A 1.8ha patch along Serpentine Creek meets the definition of the EPBC Act TEC *Casuarina Glauca* (Coastal Swamp Oak). Mangroves and saltmarsh dominate tidally influenced areas in the west and along the banks of Logan River and Serpentine Creek and provide habitat for fish and aquatic species, and suitable foraging habitat for migratory birds. Several of low order watercourses traverse the site.

The pipeline infrastructure which connects the WWTP to the Shoreline residential development (EPBC 2016/7776) is located within State controlled road reserve and is mapped as Category X (non-remnant) vegetation.

Recorded Flora (refer Appendix M)

The majority of the impact site reflects cleared open paddocks as a result of rural use. The field surveys recorded 115 flora species across the site, of which 70 species are considered native and 45 species area considered introduced to the area.

The extensive field surveys did not observe/record MNES species.

Recorded Fauna (refer Appendix M)

The following observations were made based on the field surveys:

- Eighteen (18) fauna species were observed on-site or as fly over species (refer Appendix M).

The fauna species consisted of 13 birds, 3 amphibians, 1 reptile and 1 mammal. The majority of the birds recorded were as flyover species.

- oOne species, *Rhipidura rufifrons* (Rufous Fantail), listed as Migratory and Marine under the EPBC Act, was recorded as a flyover species. Although no roosts were recorded on-site, suitable habitat is located within mangroves along the banks of the Logan River.

- oOne species, *Haliaeetus leucogaster* (White Bellied Sea-eagle) listed as Marine under the EPBC Act, was recorded as a flyover species. This species is highly territorial. No roosts were recorded on-site, indicating that the site is not utilised by the species.

- With the exception of the above, all species observed are common and typically found within the local area. Due to significant historical disturbances on-site, and the absence of unique habitat features (i.e. rock outcrops, ridgelines) the site does not support specific habitat requirements for the majority of listed threatened species.

- Two opportunistic SAT surveys for Koala were conducted across the site, and no evidence of Koala (i.e. scats or scratches) was recorded. Searches targeted suitable habitat for the species and were undertaken within the impact area and immediate surrounds. It is noted that suitable habitat for Koala will be retained within the balance land.

- Fisheries Act 1994 mapped waterways on-site were assessed for their provision of habitat for aquatic fauna.

- oBoth Serpentine Creek and the red Fisheries mapped waterway are influenced by Logan River and confirmed to provide habitat features for aquatic fauna. Macrophytes were observed within the feature, and frog calls believed to be that of the *Litoria fallax* (Eastern Sedge Frog) were audible within the southern tributary at the time of the assessment.

- oThe northern green mapped Fisheries waterway was heavily dominated by weeds and is considered to be inaccurate mapped for fish passage. No frogs calls were audible from amphibian playback surveys.

- oAn unmapped central drainage feature, containing a series of spring fed dams connects to the tidal dam system and will be retained by the development.

- Spotlight surveys over 3 nights only recorded common fauna species (note additional surveys are underway and will be provided in an addendum report).

- Essential habitat mapping for Koala, Tusked Frog and Powerful Owl occurs on-site due to associated mapped regional ecosystems. No evidence of these species was recorded. Due to significant modification of the land from historical broadscale clearing for cropping and fragmentation from off-site areas of conservation, these species are considered unlikely to occur.

Refer to Appendix M, MNEs and MSES Ecological Assessment Report (SGH2020) for further detail.

#### 3.2 Describe the hydrology relevant to the project area (including water flows)

The site is located adjacent to an outer bend of the Logan River, about 5.7km upstream from the mouth of the river. Currently the site is intermittently inundated by tides of the order of mean high water springs via Serpentine Creek and other small waterways. Once developed, incoming tides will inundate the created mangrove area via a unidirectional inlet at the east of the site and drain out via a unidirectional outlet to Serpentine Creek to the west of the site. The Site will experience



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regular inundation during all tidal cycles. A drainage feature running south from Longland Road has been modified into a linear dam. The northern extent of the dam is freshwater up to the point where it has been bunded for a vehicle crossing. The southern extent of this dam is influenced by a constructed drain which connects to the Logan River.

The site is mapped as containing state environmental mapping also shows the following:

- Areas in the western and north western peripheries of the WWTP site are mapped as estuarine wetlands; and
- Areas mapped as non-riverine (palustrine) wetlands.

Wetlands in the western and north western portions of the site are mapped as High Ecological Significance (HES) and are also largely estuarine. For the areas of the HES wetland coinciding with the site boundaries, we note the following:

- The majority of the areas mapped as HES wetlands will not be modified by the development. Design considerations have aimed at largely retaining existing HES wetland areas;
- The proposed created mangrove wetland construction within this region is likely to impact the south-western corner of the site due to proposed site modifications, which are essential to:
  - oLower land elevations to facilitate mangrove rehabilitation elsewhere on-site; and
  - oTo construct a tidal outlet for the proposed mangrove wetland.
- Site surveys conducted in 2019 indicated that the south-western corner of the site where the modifications are proposed is largely salt couch dominated (refer Appendix M) and essentially these areas will be replaced with mangrove forest; and
- Based on the site surveys by SHG, the location of the tidal outlet will be in a degraded part of the eastern bank of Serpentine Creek where mangroves are sparse or not present at all.

The design of recycled water discharges into the proposed created mangrove wetland is based on the inherent tidal action in the Logan River and Serpentine Creek. The tidal inlet gates of the mangrove area will allow the tidal waters in the Logan to inundate the wetland before releasing water into the Logan River via Serpentine Creek through tidal outlet gates during the subsequent ebb tide. The tidal outlet will be located upstream of the confluence of Serpentine Creek and the Logan River. The plant will not impact HES values in Serpentine Creek for the following reasons:

- The tidal relationship of the discharge from the mangrove area will allow for release only during an ebb tide in Serpentine Creek and the Logan River quickly removing such waters from the system;
- The highly treated and disinfected recycled water release to the mangrove wetlands from the plant will not affect water quality in Serpentine Creek or the Logan River (See Estuarine Impact Assessments in the Southern Redland Bay WWTP – Mangrove Design and Receiving Environmental Assessments for the Infrastructure Designation Process Report by Water Technology 2020); and
- Due to the expected quality of the recycled water release in to the mangrove wetlands and the nature of the release (ebb tide) from the mangroves into Serpentine Creek, no impact on water quality in Serpentine Creek is expected.

The nature of the release (ebb tide) will affect the flow regime in the Serpentine Creek, which may cause some localised erosion along the banks near the discharge. Design of the proposed culverts has carefully considered hydraulic implications to the creek and mitigation methods have been proposed.

Refer to Appendix L.

### 3.3 Describe the soil and vegetation characteristics relevant to the project area

The following observations are made based on desktop and detailed field surveys:

-The development footprint has been purposefully located on land predominately cleared of native canopy vegetation as a result of the historical rural use for agricultural dating back to 1982.

-A dwelling and ancillary infrastructure are established within the northern extent of Lot 3 along with planted landscape trees including *Cinnamomum camphora* (Camphor Laurel), *Mangifera indica* (Mango) and *Delonix regia* (Poinciana). *Pinus elliottii* (Slash Pine) also dominates this area along with dense infestation of *Lantana camara* (Lantana).

-The majority of the proposed WWTP and mangrove wetland areas contain cleared open paddocks. The south-west portion of the site is tidally influenced and this area, particularly where old crop rills remain, is dominated by *Sporobolus virginicus* (Salt Couch) with patches of *Tecticornia australasica* (Grey Samphire).

-Patches of *Casuarina glauca*, mangroves and other marine plants are located along the banks of Logan River and Serpentine Creek.

The results of flora and fauna surveys are summarised in the sections below with key ecological features and values are shown on the field survey results plan (refer Appendix M).

#### WWTP and ancillary infrastructure

The proposed WWTP is located on a previously cleared western facing slope on Lot 3 on RP223470. The area is predominately devoid of native tree species and is dominated by the weed tree *Pinus elliottii* (Slash Pine) along with other weed species including *Lantana camara* (Lantana).

Plan 15 in Appendix M shows the tree plot survey of the WWTP. Plan 15 shows that the existing access road from Longland Road to the dwelling area is surrounded by Slash Pine.

A small number of scattered native trees are located within the WWTP earthworks footprint. These include *Acacia*



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disparima (Hickory Wattle), *Allocasuarina littoralis* (Black Sheoak) and *Banksia integrifolia* (Coastal Banksia). None of these species are koala habitat trees.

Koala habitat trees such as *Eucalyptus siderophloia* (Grey Ironbark), *Corymbia intermedia* (Pink Bloodwood) and *Corymbia trachyphloia* (Brown Bloodwood) were recorded around the existing dwelling, the powerline easement adjoining Lot 2 on RP223470 and from Longland Road to the existing dwelling. The tree plot survey was used to inform the impact extent to retain native vegetation to the greatest practicable extent.

The area south-west of the WWTP is mapped as regrowth vegetation comprised of composite endangered RE12.11.27/12.11.23/12.11.26 (60/30/10) and least concern composite RE12.3.5/12.3.6 (80/20). The vegetation in this area is dominated by exotic species such as *Cinnamomum camphora* (Camphor Laurel), *Mangifera indica* (Mango) and *Delonix regia* (Poinciana). There are also several mature *Araucaria bidwillii* (Bunya Pine), the largest of which retains a DBH of 950mm. The shrub layer was dominated by *Lantana camara* (Lantana). The ground layer varied from absent to dominated by exotic grass species *Setaria sphacelata* (South African Pigeon Grass), *Pteridium esculentum* (Bracken Fern) and *Ageratum houstonianum* (Blue Billygoat Weed) among other non-native species. The flora species within this area do not represent the mapped regional ecosystems but instead reflect a modified, exotic vegetation cover. A detailed PMAV report has been prepared to request a correction of the mapped regrowth to Category X (non-remnant) (refer Appendix M). It is noted that MSES mapping reliant on regulated vegetation mapping should also be amended based on the results of field survey and the absence of habitat (e.g. wildlife / essential habitat) for protected fauna species.

#### Soils investigation summary (refer Appendix R)

The subsurface conditions encountered generally comprised upper clayey sand topsoil to depths of between 0.1m-0.3m underlain by alluvial soils. The alluvial soils generally comprised high plasticity, estimated soft to firm sandy clay to depths between 0.7m and 1.2m and then estimated loose clayey sand to the termination depth of 2m.

An acid sulfate soils assessment was completed and concluded that whilst a management plan was not required, a neutralising agent such as ag-lime should be applied during site works to achieve desired pH levels.

### 3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area

The WWTP is on land that abuts the Logan River, and the river mouth is approximately 5.7km downstream from the proposed action.

Further afield is the Moreton Bay Ramsar wetland (refer Appendix M). Serpentine Creek forms the western boundary of the proposed action.

### 3.5 Describe the status of native vegetation relevant to the project area

Queensland vegetation mapping (i.e. Regulated Vegetation Management Map) identifies the site is predominately mapped as Category X (non-remnant vegetation) with polygons of Category B (remnant) and Category C (high value regrowth). The Supporting Vegetation Management Map shows the following regional ecosystems are mapped on-site:

Category B is comprised of:

- Endangered RE12.11.27 and
- Least Concern RE12.1.2 and RE12.1.3

Category C is comprised of:

- Endangered RE12.11.27 / 12.11.23 / 12.11.26 (60/30/10) and
- Least Concern RE12.3.5 / 12.3.6 (80/20).

Least Concern RE12.1.2 and RE12.3 is mapped along Serpentine Creek. Least Concern RE12.3.5 / 12.3.6 and Endangered RE12.11.27 is mapped along Logan River. Non-remnant and regrowth vegetation is mapped over the balance of the site. The regrowth vegetation is mapped as Endangered RE12.11.27, Endangered RE12.11.27 / 12.11.23 / 12.11.26 (60/30/10), Least Concern RE12.3.5 / 12.3.6 (80/20).

Regional Ecosystem Short Descriptions (source: <https://apps.des.qld.gov.au/regional-ecosystems/>)

12.3.5:Melaleuca quinquenervia open forest on coastal alluvium

12.3.6:Melaleuca quinquenervia +/- *Eucalyptus tereticornis*, *Lophostemon suaveolens*, *Corymbia intermedia* open forest on coastal alluvial plains

12.11.27:*Eucalyptus racemosa* subsp. *racemosa* and/or *E. seeana* and *Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics

12.11.23:*Eucalyptus pilularis* open forest on coastal metamorphics and interbedded volcanics

12.11.26:*Eucalyptus baileyana* and/or *E. planchoniana* woodland to open forest on metamorphics +/- interbedded volcanics

12.1.2:Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains

12.1.3:Mangrove shrubland to low closed forest on marine clay plains and estuaries



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The REs mapped on-site are also associated with essential habitat for Powerful Owl (*Ninox strenua*), Koala (*Phascolarctos cinereus*) and Tusked Frog (*Adelotus brevis*).

As detailed in Appendix M, the Queensland vegetation mapping is partly inaccurate and an amendment is sought to update the mapping based on ground-truthed data. These changes are detailed extensively in the Property Map of Assessable Vegetation (PMAV) report (Appendix F within the Ecological Assessment Report (Appendix M)).

### 3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area

The north-eastern portion of the site is elevated, while much of the western portion of the site is low lying land and supports some estuarine wetlands (including saltmarsh / samphire) with weed dominated areas. There are some steeper areas of the site, generally to the east of the existing driveway from Longland Road. LiDAR mapping (as shown on the Existing Site Plan) indicates there are some drainage features in the eastern part of the site (in Lot 3 on RP223470) and parallel to Longland Road. There is an existing freshwater dam located to the west of the driveway from Longland Road and several other depressions, including what appear to be some tidally influenced depressions in the southern part of Lot 3.

### 3.7 Describe the current condition of the environment relevant to the project area

The WWTP area (Area 1) is discussed in section 3.3.

Area 2 reflects the balance of the site which was surveyed to identify environmental values and constraints to inform the design of the mangrove wetland, inlet, outlet and access roads. Plan 16 in Appendix M maps the extent of marine plants within the investigation area. Marine plant field zones are discussed below.

Area 2a-Mangroves along Logan River and Serpentine Creek: Mangrove was the dominant vegetation along the banks of the Logan River and Serpentine Creek. The dominant mangrove species was *Avicennia marina* (Grey Mangrove) with some *Aegiceras coniculatum* (River Mangrove) and *Bruguiera gymnorhiza* (Orange Mangrove) also recorded. Mangroves were present beyond the site boundary on Logan River bank. The exception to this, is a portion of the Logan River at Lot 254 on S31102, where there is ongoing erosion of the bank. The bank of the Logan River to the south of the power easement at Lot 3 on RP223470 is rocky and steep and there are fewer mangrove and other marine plants present. A disused boat launch area was present on the bank of Logan River in the south east of the site; a steel ramp was still in place. The area contained *Avicennia marina* (Grey Mangrove) regrowth. A small patch of Eucalypt trees was also recorded associated with RE12.11.27

Area 2b-Open paddock area dominated by Salt Couch: Across the open paddock there was limited canopy or native species. Lower lying areas predominately in the west of the site contain marine plants other than mangroves. The vegetation is dominated by *Sporobolus virginicus* (Salt Couch) with patches of *Tecticornia australasica* (Grey Samphire). This area is consistent with the definition of the EPBC Act listed TEC 'Subtropical and Temperate Coastal Saltmarsh'.

Areas to the east on Lot 3/RP223470, where tidally influenced, contained marine plants including mangroves *Avicennia marina* (Grey Mangrove) and *Aegiceras coniculatum* (River Mangrove).

Area 2c-Open paddock area dominated by weeds and drainage lines with scattered marine plants. An intermediate area was identified which contains tracks and small drainage lines remnant of cropping rills that are under intermittent tidal influence. The vegetation along these depressions consisted of marine plants, predominantly *Sporobolus virginicus* (Salt Couch) and *Juncus kraussii* (Sea Rush). Portions of the intermediate area not directly along the tracks and drainage lines are dominated with the weed *Baccharis halimifolia* (Groundsel). Historical imagery shows the extent of the tracks which has created these lines of marine plants.

The higher open ground beyond any tidal influence is dominated by weed species *Baccharis halimifolia* (Groundsel) and *Cinnamomum camphora* (Camphor Laurel).

Area 2d-Casuarina glauca polygons: Three patches of *Casuarina glauca* (Swamp She-oak) are present within the open paddock area. The largest of which in Lot 1 on SL3427 adjoining Serpentine Creek is considered to be part of the EPBC Act listed TEC. The smaller southern patches are not considered part of this TEC due to species mix and composition.

Area 2e-Open paddock area dominated by weeds (no marine plants) (balance land): The balance of the site is dominated by open grassed paddocks which have been subject to historical clearing and regular maintenance. Field surveys did not detect or assess this area as holding important or unique ecological values/features.

Area 3-Watercourse and drainage features

Area 3a-Northern mapped waterway: A waterway that may provide fish passage is mapped over the northern portion of the site (Qld mapping). The western portion of this feature is dominated by Slash Pine with some Camphor Laurel. Several small dams were observed and mapped along the waterway. Aquatic species were not observed during field surveys along this mapped waterway and consequently the mapping of this waterway for barrier works/fish passage is considered incorrect. Plan 17 in Appendix M shows the ground-truthed extent of this drainage feature which has been severed by a created bund for the existing driveway. No fish passage exists between the existing dam and the northern drainage line.

Area 3b- Southern mapped waterway (drain): A waterway connecting to the Logan River in the south-west corner of the site reflects a modified drainage channel connecting the on-site linear wetland and Logan River. The feature is under tidal influence for approximately 250m upstream where a small (<0.5m) step up in elevation marks the end of tidal water. *Avicennia marina* (Grey Mangrove) and *Aegiceras coniculatum* (River Mangrove) are present in the tidal portion of the waterway. A section of *Typha orientalis* (Broad-leaved Cumbungi) is growing in the transition area between the salt and fresh water. This wetland is comprised of 3 linear constructed dam/channels on the eastern edge of the cleared paddock area.



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**3.8 Describe any Commonwealth Heritage places or other places recognised as having heritage values relevant to the project**

The north-eastern portion of the site is elevated, while much of the western portion of the site is low lying land and supports some estuarine wetlands (including saltmarsh / samphire) with weed dominated areas. There are some steeper areas of the site, generally to the east of the existing driveway from Longland Road. LiDAR mapping (as shown on the Existing Site Plan) indicates there are some drainage features in the eastern part of the site (in Lot 3 on RP223470) and parallel to Longland Road. There is an existing freshwater dam located to the west of the driveway from Longland Road and several other depressions, including what appear to be some tidally influenced depressions in the southern part of Lot 3.

**3.9 Describe any Indigenous heritage values relevant to the project area**

The proposed action is identified within the native claim area described under the native title claimant application (QUD331/20017; QC2017/007).

The Shoreline Project Cultural Heritage Management Plan is an agreement between Lendlease Communities (Shoreline) Pty Ltd and the Native Title Stakeholders over the 'Agreement Area' that encompasses land within the Shoreline residential development and the proposed action. This agreement is an approved management plan under Part 7 of the Aboriginal Cultural Heritage Act 2003.

The roles and responsibilities of the proponent is to take all reasonable and practicable measures to avoid harm to Aboriginal Heritage Values as a result of the project where reasonable and practice to allow Aboriginal Heritage Values to remain and be managed in situ. There is no impact on cultural heritage resulting from the proposed high impact activity provided that the increased risk of damage and destruction to cultural heritage from site disturbance is managed in accordance with the Shoreline Project Cultural Heritage Management Plan (Appendix Q). The management plan identifies mitigation measures to protect cultural heritage, in the event that an artefact is identified on-site. As per the agreement, a representative of the clan will be present on-site during construction.

**3.10 Describe the tenure of the action area (e.g. freehold, leasehold) relevant to the project area**

Freehold, State-owned road reserve and banks of the Logan River.

**3.11 Describe any existing or any proposed uses relevant to the project area**

The project area is comprised of three primary components:

- 1-Linear (pipeline) infrastructure along the existing linear infrastructure corridor (Longland Road and Serpentine Creek Road). The existing transport use will continue post-development.
- 2-WWTP including the mangrove area which occupies historically disturbed rural land. This part of the proposed action will result in a permanent change to the land use and will deliver improved/superior ecological functioning compared to the existing use.
- 3-The banks of the Logan River where assisted natural regeneration work is proposed (refer Appendix O). There will be no change to the existing use in this area.



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## Section 4

### Measures to avoid or reduce impacts

#### 4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action

The proposed action has considered the ecological values and features of the land and will enact the following avoidance and mitigation measures:

##### Bushfire Management Plan (BMP)

The BMP has been prepared for the WWTP in consultation with Saunders Havill Group with the intent to retain native vegetation (large trees) within the bushfire management zone. Refer Appendix S.

##### Biting Insects Management Plan (BIMP)

The BIMP was developed to inform planning, design, construction and operational phases of the project. Refer Appendix T.

##### Vegetation Clearing and Fauna Management Plan (VCFMP)

The purpose of the VCFMP identifies measures to mitigate the potential impacts of construction activity on terrestrial and riparian vegetation, marine plants and native fauna. The VCFMP prescribes how the contractor must undertake vegetation clearing including management and mitigation measures, roles and responsibilities and reporting requirements. The VCFMP includes provisions for a Fauna Spotter Catcher holding Queensland Government issued permits to oversee the works and dictate the direction of clearing to allow fauna to safely move on from work areas. Refer Appendix N.

##### Koala Management Plan (KMP)

The KMP prescribes step by step procedures for the management of Koala prior to, during and post-vegetation clearing and construction activities to reduce potential impacts on all fauna, specifically Koala. Fauna management specifications and principles incorporated into the KMP apply generally to all native animals and focus on incorporating measures to minimise disturbance and avoid conflicts. Compliance with the KMP is compulsory and incorporates the use of expert consultants, including a registered and Queensland Government approved Fauna Spotter Catcher. The KMP was prepared in accordance with:

- Nature Conservation (Koala) Conservation Plan 2017;

- Koala Sensitive Design Guideline: A guide to Koala-sensitive design measure for planning and development activities.

- Code of Practice for Welfare of Animals effected by Land Clearing and Other Habitat Impacts and Wildlife Spotter/Catchers (Draft) as prepared by the Wildlife Warriors and Voiceless (The Code).

The MID process will assess the KMP, and will form part of the approved documents under the MID. Refer Appendix II.

##### Concept Mangrove Rehabilitation Plan (CMRP)

A CMRP was prepared by SHG for the improvement works that will create 9.86ha mangrove wetland. The CMRP is intended to provide a clear methodology for the propagation and establishment of the mangrove wetland and salt marsh areas, and ongoing maintenance, monitoring and reporting requirements throughout the life of the project. The wetland is intended to create and establish productive tidal fish habitats and was prepared in accordance with the following:

1. Queensland's 'Fish Habitat Guidelines FHG 002: Restoration of Fish Habitats': The FHG002 provides guidance on the restoration (i.e. returning the site to an agreed pre-existing condition) of degraded marine plant sites in Queensland.

2. Ecological Mangrove Rehabilitation / Restoration (EMR) Protocol: The EMR is a 6-step process that has been used to guide several successful mangrove projects worldwide, and has been adopted in the planning and design of this project to ensure that the procedures and methodologies adopted are technically sound and tailored to this project.

3. South East Queensland Ecological Restoration Framework (SEQERF): This proposal is to create and establish productive tidal fish habitats and a key aspect of habitat establishment is that structure and function are provided within the site, improving site stability, and improved habitat for fauna (fish) and flora. Refer to Appendix O.

##### Concept WWTP / Storage Lagoon Rehabilitation Plan (WWTP RP)

The Concept WWTP RP, has been prepared by for areas adjoining the freshwater lagoon and WWTP with consideration of earthworks required to construct the infrastructure and requirements under the BMP. Refer to Appendix P.

##### Construction Environmental Management Plan (CEMP)

This CEMP summarises the measures to avoid, minimise and manage the environmental and social impacts associated with the WWTP. Refer to Appendix W.

##### Operation Environmental Management Plan (OEMP)

The OEMP is intended to be a working management document, to be used in the operation of the WWTP, to achieve defined objectives in minimising environmental harm, which includes a contingency and emergency response plan. Refer Appendix X.

##### Water Quality Management Plan (WQMP) and Water Quality Monitoring

A water quality management and monitoring plan forms part of Water Technology's investigations completed to date. Refer to Appendix K.

The MID process will assess the BMP, BIMP, VCFMP, KMP, CMRP, Concept WWTP RP, CEMP, OEMP, and WQMP and, the plans will form part of the approved documents under the MID.

#### 4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved

The project has been designed to not only minimise and mitigate environmental impacts from the construction and



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operation of the proposed WWPT but has been designed to deliver a net ecological benefit for the region through the creation of a 9.85ha mangrove forest and saltmarsh wetland. In addition to producing Class A recycled water for the reuse in open space and nurseries, the secondary component of the project, the mangrove wetland, will have ancillary benefits such as carbon sequestration, an increase in habitat for terrestrial and aquatic flora and fauna species, additional flood storage, a net increase in wetlands which play an important role in ecosystem processes and biodiversity values for threatened and migratory species.

Positive environmental outcomes achieved by the proposed action include:

- A regional wastewater infrastructure to service 13, 000 EP in the South East Queensland Regional Footprint;
- A WWTP that delivers best practice water quality management through a MBR system producing recycled water to Class A (National and State recycled water quality guidelines) and including contingencies in the event of extreme wet weather or plant failure to avoid the uncontrolled release of wastewater into the receiving environment;
- A recycled water strategy which prioritises reuse of recycled water for irrigation of sports fields, open space, parks and at local businesses, over direct disposal;
- Minimising the area of disturbance (development footprint) to:
  - oMinimise the clearing of Koala food trees and retain in-tact Koala habitat
  - oRetain the 1.8ha *Casuarina glauca* Coastal Swamp Oak TEC and protect this community through rehabilitation
  - oMinimise the clearing of marine plants and translocating these (where possible) as part of rehabilitation efforts to achieve a net gain in marine plants and create habitat for a variety of local and migratory fauna species.
- Designing the wetland to alter hydrodynamics to reduce the risk of bank erosion and storm tide impacts;
- Extensive weed management to remove weeds of National Environmental Significance within the impact area including Lantana;
- Allowing the mangroves to establish (Year 4) prior to the release of recycled water to allow adaptive management and minimise risk in the event on rehabilitation failures;
- Installing a culvert inlet and outlet which provide fish passage into and out of the mangrove wetland to increase fish habitat;
- Installing sympathetic lighting strategies, vegetation screening and sound attenuation to minimise potential impacts on localised fauna and migratory birds;
- Installing fauna exclusion fencing around the WWTP to deter fauna from entering dangerous areas and roads with wildlife signage;
- Implementing a raft of environmental management plans prepared in accordance with best practice standards and guidelines, including a:
  - oVegetation Clearing and Fauna Management Plan including provisions for a fauna spotter catcher and Koala Spotter holding Queensland Government permits to oversee the works
  - oRehabilitation Plans prepared in accordance with the South East Queensland Ecological Restoration Frameworks and Ecological Mangrove Protocol
  - oConstruction Environment Management Plan
  - oOperational Environment Management Plan
  - oStormwater and Flooding Management Plan
  - oWater Quality Management Plan
  - oBushfire Management Plan
  - oBiting Insects Management Plan
- Developing a project in consultation with Indigenous owners, State and Local Government, technical agencies, academics and leading experts, community groups and local businesses.

The project has been designed to avoid impacts to MNES and MSES to the greatest practicable extent. With the implementation of mitigation measures, potential adverse impacts to flora and fauna habitats are considered to be low, and the project is unlikely to result in a significant impact on MNES or MSES. Overall, the project is anticipated to deliver ecosystem benefits through the creation of the 9.85ha mangrove and saltmarsh wetland on rural land delivering a net gain in wetlands, marine plants and potential habitat for threatened and migratory species; and to mitigate the impacts of climate change, storm tide inundation and erosion at the site.



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## Section 5

### Conclusion on the likelihood of significant impacts

#### 5.1 You indicated the below ticked items to be of significant impact and therefore you consider the action to be a controlled action

- World Heritage properties
- National Heritage places
- Wetlands of international importance (declared Ramsar wetlands)
- Listed threatened species or any threatened ecological community
- Listed migratory species
- Marine environment outside Commonwealth marine areas
- Protection of the environment from actions involving Commonwealth land
- Great Barrier Reef Marine Park
- A water resource, in relation to coal seam gas development and large coal mining development
- Protection of the environment from nuclear actions
- Protection of the environment from Commonwealth actions
- Commonwealth Heritage places overseas
- Commonwealth marine areas

#### 5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action

Extensive environmental assessments have been undertaken by, and in collaboration with, leading experts, academic, key stakeholders and Government agencies to inform the design of the WWTP. Assessments have been conducted over a three-year period from due diligence in 2018 to conceptual design in 2019 and final design in 2020. During this time regular engagement with technical experts, the community and Commonwealth, State and Local government agencies has been maintained at key design junctions.

The WWTP and mangrove wetland has been developed to be an international example of best practice recycled water management. The WWTP will be an advanced MBR system; a proven treatment process that will remove nutrients and pathogens to a level that is as low, or lower than, most existing plants in South East Queensland. The MBR will remove at least 99.9% of pathogens prior to discharge. Recycled water from the WWTP will be treated to equal to or better than that required under the Australian and Queensland Recycled Water Guidelines (Class A) and suitable to irrigate parks and sports fields. Subsequently, recycled water quality will be treated to levels safe for human contact and release to the environment. An Environmentally Authority (ERA 63(3)) granted under the Environment Protection Act 1994 (Qld) will be tied to the point of discharge from the WWTP to ensure treatment complies with these standards. Importantly, under the ERA licence the WWTP must include contingencies to prevent the uncontrolled release of wastewater in the event of plant failures and wet weather. The construction and operation of a WWTP in Queensland undergoes a high degree of scrutiny and regulated, and subsequently WWTPs are monitored for compliance with the licence conditions. Based on the research, assessments, design and commitment to protect and improve ecological features, the WWTP will not have a significant adverse impact on MNES.

The secondary component of the wastewater treatment plant is the creation of 9.85ha of mangrove forest and saltmarsh wetland on degraded open paddock subject to intermittent flooding. The mangrove wetland will not only further polish recycled water, prior to release into the receiving environment, but additional benefits of the wetland include carbon sequestration and mitigation of the impacts of climate change including bank erosion and storm tide impacts. The proof of concept was designed in collaboration with leading experts at University of Queensland and Griffith University, and independently peer reviewed by GHD. Most importantly, the 9.85ha mangrove forest and saltmarsh wetland will result in a net ecological benefit at the site, supporting terrestrial and aquatic biodiversity of the region and provide suitable habitat for threatened and migratory species. The project will retain, rehabilitate and enhance EPBC Act TECs: Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales (endangered) and Coastal Temperate Saltmarsh (vulnerable).

As the project is for sub-regional community infrastructure it has been endorsed by to be assessed by the Queensland Treasurer and Minister for Infrastructure and Planning under a Ministerial Infrastructure Designation. The MID application, endorsement and assessment processes are thorough and equivalent to an EIS level of assessment where the proposal, applicable state interests, key issues, required technical material and proposed consultation strategy are all addressed under the ID. The MID provides for all approvals required under the Queensland's Planning Act 2016. To support the MID an Environmental Assessment Report (EAR) (similar to an EIS) prepared in accordance with the Minister's Guidelines and Rules must be prepared. The EAR must demonstrate that it is in the State's Interests for the project to proceed, and address the relevant Queensland State Planning Policy (2017) criteria.

Environmental State Interests include Biodiversity, Coastal Environment and Water Quality. Under State Interest - Biodiversity the project must demonstrate it has been designed to avoid, minimise and mitigate impacts on MNES and MSES. The Biodiversity interest requires viable Koala populations and habitat in SEQ to be protected and ecological process to be enhanced to avoid fragmentation; interests which are applicable to MNES. As part of the EAR the MNES and MSES Ecological Assessment (refer Appendix M) was prepared which addresses pre-lodgement advice from State technical agencies including the DES, DAFF, DNRME and Biosecurity Queensland. Under the MID process, State technical agencies will be involved in the assessment of the EAR inclusive of the MNES and MSES Ecological Assessment, as they are part of



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the MID team.

Lastly, the assessment against the Significant Impact Guidelines identified that the project will not have a significant adverse impact on MNES and the creation of 9.85ha mangrove forest and saltmarsh will result in a net ecological benefit.



Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

## Section 6

### Environmental record of the person proposing to take the action

#### 6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Explain in further detail

Lendlease has an excellent record of environmental management and sustainability at State, national and international levels.

It has worked closely with community as well as local and state authorities to ensure site responsive outcomes. Examples of this include returned effluent treatment and reuse systems, seed collection and propagation programmes with both Landcare and Greening Australia, undertaking HIA Green Smart programmes across a number of projects, provision of site based management plans across all communities, generation of site based urban design outcomes (in consultation with the local authorities), water recycling programmes at a number of communities, waterway and corridor management plans ensuring no impact into downstream wetlands and builder's water recycling programmes. Additional to this, Lendlease undertakes community education and interaction programmes across all of its communities in creating a high level of social capital.

#### 6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application

Nil.

#### 6.3 If it is a corporation undertaking the action will the action be taken in accordance with the corporation's environmental policy and framework?

Yes  No

#### 6.3.1 If the person taking the action is a corporation, provide details of the corporation's environmental policy and planning framework

Lendlease's vision to create the best places is underpinned by its commitment to sustainability as a core operating principle. Lendlease aspires to be a sustainable organisation which goes beyond minimising harm to the natural environment. To achieve this aspiration, they will not only employ strategies to prevent pollution but also explore every opportunity to leave a positive environmental impact.

Lendlease have an integrated Environment, Health & Safety (EHS) management system called Orbit, which is supported by the Lendlease Global Minimum Requirements. Together, these set out the process of how we will set objectives relating to environmental management and provide the minimum standards of management. Lendlease commit to complying with legislation, regulation, codes of practice, industry standards, contractual relationships and other requirements that we subscribe to. We will monitor, measure and report our performance in accordance with our EHS framework and ISO14001 requirements. To exhibit leadership, we will continually improve our environmental performance through the ongoing review and setting of objectives within our EHS framework.

We will also seek out opportunities to partner and engage with leading organisations, industry associations and our supply chain to drive better environmental outcomes for a sustainable future.

In support of this Environment Policy we will:

- Reduce our contribution to climate change and build resilience into the places we create and in the communities where we have a presence;
- Seek to prevent and minimise pollution associated with any of our operations
- Protect biodiversity and ecosystems through the ongoing assessment and management of our activities;
- Value water as a natural resource and conserve its use;
- Recognise resource scarcity through responsible procurement, use and management of materials; and
- Advocate and pursue a holistic approach to the design, delivery and operation of high performance green buildings, infrastructure and sustainable precincts that exceeds best practice through innovation.

#### 6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Yes  No

#### 6.4.1 EPBC Act No and/or Name of Proposal

2019/8587 Mt Gilead Stage 2 Residential Development, NSW

2019/8552 Chapman Street Residential Development, NSW

2019/8436 Subdivision of Lot 12 on SP243847 Elliot Springs Estate, Townsville, Qld



Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

2018/8359 Pine Valley Residential Development, Morayfield, Qld  
2017/7875 Woogaroo Heights master planned residential development, Springfield, Qld  
2016/7849 Adelaide Festival Plaza Precinct Upgrade, SA  
2016/7830 Residential development, Lot 61 off Appin Road, Mt Gilead, NSW  
2015/7599 Mt Gilead residential development, NSW  
2015/7561 Alkimos city centre and central development, WA  
2015/7534 Construction of a western access road, Julago, Qld  
2014/7400 Bingara Gorge staged residential development, NSW  
2013/7057 Spring Mountain mixed use master planned community development, Springfield, Qld  
2013/6828 Woodlands Residential development (Villages 4 and 6, Waterford, Qld  
2013/6818 Fernbrooke Ridge residential estate development - Balance Land, Redbank Plains, Qld  
2013/6791 Yarrabilba residential development and associated infrastructure. Qld  
2011/5902 Residential development Lot 1004 Alkimos WA  
2011/5826 Gawler East Residential Development Project, SA  
2010/5381 Calderwood Urban Development, NSW  
2007/3574 Development and Construction of Rocky Springs Masterplanned Community, Qld  
2005/1936 Upgrade of Taylors Road West, Vic  
2005/1935 Caroline Springs Residential Development (middle sector), Vic  
2004/1925 Subdivision of Precincts 3 and 12, St Patricks Estate, NSW  
2004/1921 Caroline Springs residential development (northern sector), Vic  
2004/1907 Development of Stage 7 of the North Shore Coastal Village, Qld  
2001/520 North Lakes Development, Qld



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## Section 7

### Information sources

#### Reference source

Review of Federal guidelines and policies  
Matters of National Environmental Significance – Significant Impact Guidelines 1, Environment Protection and Biodiversity Conservation Act 1999 (Australian Government, 2013).  
EPBC Act Referral Guidelines for the vulnerable Koala (Combined populations of Queensland, New South Wales and the Australian Capital Territory (Australian Government, 2014).  
Referral Guidelines for 14 Birds Listed as Migratory Species under the EPBC Act (Australian Government, 2015).  
Draft National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebird Species (Australian Government, 2019).  
Australian Guidelines for Water Recycling: managing Health and Environmental Risk (Phase 1). (2006). National Water Quality Management Strategy. Natural Resource Management Ministerial Council, Environment Protection and Heritage Council.  
Conservation Advice for Subtropical and Temperate Coastal Saltmarsh (AWE, 2013)

#### Reliability

Federal Government data and source and therefore considered reliable.

#### Uncertainties

None

#### Reference source

Review of Federal and State guidelines and policies  
Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (AWE, 2018)  
Guide to Determining Terrestrial Habitat Quality (Queensland Government, 2020).  
Restoration of Fish Habitats: Marine Areas (FGH002) (Queensland Government, 1998)  
Fish Habitat Management Operational Policy FHMOP 001 -Management and Protection of Marine Plants and Other Tidal Fish Habitats (Queensland Government, 2007).  
Methodology for survey and mapping regional ecosystems and vegetation communities in Queensland, (Queensland Government, 2019)  
Mangrove Nurseries: Construction, Propagation and Planting: Fisheries Guidelines. Fish Habitat Guideline FHG 004. State of Queensland, Department of Primary Industries.

#### Reliability

Federal and State Government data and source and therefore considered reliable.

#### Uncertainties

None

#### Reference source

Review of State guidelines and policies  
Water Quality Guidelines for Recycled Water Schemes. (2008). Queensland Water Supply Regulator, Water Supply and Sewerage Services, Department of Energy and Water Supply.  
Koala Sensitive Design Guideline (2020) Department of Environment and Science.  
Guideline: State Code 25: Development in South East Queensland Koala Habitat Areas (2020) Department of Environment and Science.  
Accepted development requirements for constructing or raising waterway barrier works (2018). Fisheries Queensland.  
Accepted development requirements for operational work that is the removal, destruction or damage or marine plants (2017). Fisheries Queensland.  
Queensland State Planning Policy (2017)  
Queensland Government - Guidelines for the process for environmental assessment and consultation for making or amending a Ministerial designation.

#### Reliability

State Government data and source and therefore considered reliable.



Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

**Uncertainties**

None

**Reference source**

Desktop analysis also included review of existing reporting, supporting approvals for the surrounding area, including: Biodiversity Assessment and Management. (2014). Shoreline Ecological Assessment – Redland Bay, prepared for Fox and Bell, by BAAM Ecological Consultants, dated 2014.

Biodiversity Assessment and Management. (2017). Response to EPBC Request for preliminary documentation (EPBC 2016/7776), prepared for Shoreline Redlands by BAAM Ecological Consultants, dated 20 Jun 2017

Biodiversity Assessment and Management. (2020). Eastern Curlew Impact Management Plan, prepared for Shoreline Redlands, by BAAM Ecological Consultants, dated 28 Jan 2020.

Biodiversity Assessment and Management. (2004). Draft Action Plan to Reduce Koala Hits from Vehicles.

Biodiversity Assessment and Management. (2012). Koala Habitat Review and Mapping – Redland City Mainland Areas.

Biolink. (2019). Redlands Coast Koala Population and Habitat Assessment.

**Reliability**

Reports and studies developed to inform compliance with Commonwealth, Queensland and local government approval processes. These studies have been undertaken by professional consultants who are qualified ecologists with practical experience in surveying and monitoring the local environment. Methods followed during field surveys were in accordance with relevant guidelines published by State and Commonwealth departments. References that have been cited in preparation of this referral and supporting documentation (include databases and documents) have been produced and maintained by State and Commonwealth departments, and as such are considered highly reliable.

**Uncertainties**

The field surveys are based on conditions encountered and information reviewed at the date of preparation of the report. The opinions, conclusions and any recommendations in the field survey reports are based on information obtained from specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Investigations undertaken in respect of these reports are constrained by the site conditions, such as access restrictions and vegetation. Thus, not all relevant site features and conditions may have been identified. Site conditions may change after the date of preparation of these reports.

**Reference source**

Desktop analysis also included review of existing reporting, supporting approvals for the surrounding area, including: Dr Romane Cristescu, K. H.-C. (2018). Redland Coast Koala Population Assessment Project. University of the Sunshine Coast, Detection Dogs for Conservation.

Hosking, D. C. (2018). Priority areas in the Redlands for Koala Conservation: Building a Model of Spatial Prioritisation using Zonation. University of Queensland.

**Reliability**

Reports and studies developed to inform compliance with Commonwealth, Queensland and local government approval processes. These studies have been undertaken by professional consultants who are qualified ecologists with practical experience in surveying and monitoring the local environment. Methods followed during field surveys were in accordance with relevant guidelines published by State and Commonwealth departments. References that have been cited in preparation of this referral and supporting documentation (include databases and documents) have been produced and maintained by State and Commonwealth departments, and as such are considered highly reliable.

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#### Reference source

Technical reporting prepared for the wastewater treatment plant including:

##### Project Design and Due Diligence

- Southern Redland Bay WWTP Options Analysis (Stantec, 2020)
- Southern Redland Bay WWTP - Concept Design Report (Stantec 2020)
- Shoreline Mangrove Offset Program Due Diligence (Letter dated 12 September 2019), prepared by Dr. M. F. Adame, Research Fellow, Australian Rivers Institute, Griffith University.
- Academic assessment of Shoreline Mangrove Offset Program Due Diligence (Letter dated 12 September 2019), prepared by A. Grinham, Senior Research Fellow, University of Queensland.
- Shoreline Mangrove Offset Due Diligence Assessment – Preliminary Assessment of Ecological Constraints. frc environmental. (2019, Aug 8)

#### Reliability

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#### Reference source

##### Assessment and Management Plans

- Acid Sulfate Soils Investigation. Douglas Partners. 2019.
- Aquatic Ecological Constraints: Longland Road Redland Bay. frc environmental. 2020.
- Bushfire Management Plan - Southern Redland Bay Wastewater Treatment Project. Land and Environment Consultants (2020).
- Concept Mangrove Rehabilitation Plan. Saunders Havill Group. 2020.
- Construction Environmental Management Plan. Stantec 2020.
- Environmental Assessment Report. Saunders Havill Group. 2020.
- EPBC Significant Impact Assessment for Moreton Bay Wetland (Memorandum). Water Technology (2020).
- Hydrodynamic Modelling for Culvert Sizing Report. Water Technology (2020).
- Koala Management Plan. Saunders Havill Group. 2020.
- MNES and MSES Ecological Assessment. Saunders Havill Group. 2020

#### Reliability

Reports, studies and management plans developed to inform compliance with Commonwealth, Queensland and local government approval processes. These have been undertaken by professional consultants who are qualified with practical experience in surveying and monitoring the local environment. Methods followed during field surveys were in accordance with relevant guidelines published by State and Commonwealth departments. References that have been cited in preparation of this referral and supporting documentation (include databases and documents) have been produced and maintained by State and Commonwealth departments, and as such are considered highly reliable.

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#### Reference source

##### Assessment and Management Plans

- Operation Environmental Management Plan. Stantec. 2020.
- Site Based Management Plan. Stantec 2020
- Southern Redland Bay Wastewater Treatment Project - Biting Insect Management, frc environmental (2020).
- Southern Redland Bay WWTP – Coastal Processes Assessment (Memorandum). Water Technology (2020).
- Southern Redland Bay WWTP - Mangrove Design and Receiving Environmental Assessments. Water Technology (2020)
- Southern Redland Bay WWTP – Noise Impact Assessment. ATP Consulting Engineers 2020.
- Southern Redland Bay WWTP - Odour Impact Assessment. Stantec 2020.
- Southern Redland Bay WWTP - Options Assessment. Stantec 2020.
- Southern Redland Bay WWTP - Recycled Water Strategy. Stantec 2020.
- Traffic Impact Assessment. SLR Consulting 2020
- Visual Impact Assessment. Saunders Havill Group. 2020.
- WWTP and Freshwater Storage Lagoon Rehabilitation Plan. Saunders Havill Group. 2020.

#### Reliability

Reports, studies and management plans developed to inform compliance with Commonwealth, Queensland and local government approval processes. These have been undertaken by professional consultants who are qualified with practical experience in surveying and monitoring the local environment. Methods followed during field surveys were in accordance with relevant guidelines published by State and Commonwealth departments. References that have been cited in preparation of this referral and supporting documentation (include databases and documents) have been produced and maintained by State and Commonwealth departments, and as such are considered highly reliable.

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## Section 8

### Proposed alternatives

Do you have any feasible alternatives to taking the proposed action?

Yes



No



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**Section 9**

**Person proposing the action**

9.1.1 Is the person proposing the action a member of an organisation?  
 Yes       No

**Organisation**

Organisation name	LENLEASE COMMUNITIES (SHORELINE) PTY LIMITED
Business name	
ABN	14623367377
ACN	
Business address	300 Barangaroo Ave, Level 14, Tower Three, International Towers Sydney, Exchange Place, Barangaroo, 2000, NSW, Australia
Postal address	
Main Phone number	0409 825 427
Fax	
Primary email address	joel.salmon@lendlease.com
Secondary email address	

9.1.2 I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:  
 Small business  
 Not applicable

9.1.2.2 I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations \*  
 Yes       No

**9.1.3 Contact**

First name	Joel
Last name	Salmon
Job title	Senior Development Manager
Phone	
Mobile	0409 825 427
Fax	
Email	joel.salmon@lendlease.com
Primary address	GPO Box 2777, Brisbane, 4001, Qld, Australia
Address	

**Declaration: Person proposing the action**

I, Joel Salmon, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf or for the benefit of any other person or entity.

Signature:  Date: 26 NOV 2020

I, **NOT APPLICABLE - THE PROPONENT DOES NOT DESIGNATE ANOTHER PARTY**, the person proposing the action, consent to the designation of \_\_\_\_\_ as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature:.....Date: .....





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### Referring party (person preparing the information)

9.3.1 Is the referring party (person preparing the information) a member of an organisation?

Yes  No

#### Organisation

Organisation name	Saunders Havill Group Pty Ltd
Business name	SAUNDERS HAVILL GROUP
ABN	24144972949
ACN	
Business address	9 Thompson St, Bowen Hills, 4006, QLD, Australia
Postal address	
Main Phone number	(07) 3251 9455
Fax	
Primary email address	mail@saundershavill.com
Secondary email address	

#### 9.3.2 Contact

First name	Jordan
Last name	Bachmann
Job title	Senior Environmental Planner
Phone	(07) 3251 9451
Mobile	
Fax	
Email	jordanbachmann@saundershavill.com
Primary address	9 Thompson St, Bowen Hills, 4006, QLD, Australia
Address	

#### Declaration: Referring party (person preparing the information)

I, JORDAN BACHMANN, declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence.

*Jordan Bachmann*

- 26 Nov 2020



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Appendix A		
Attachment		
Document Type		File Name
action_area_images	Published as 8868 E 01-02.2 Proposed Action A	8868 E 01 Proposed Action A.pdf
action_area_images	Published as 8868 E 01-02.2 Proposed Action A	8868 E 02.1 and 2.2 Proposed Action A.pdf
action_area_images	Published as 8868 E 01-02.2 Proposed Action A	8868 E 02 Proposed Action A.pdf
govt_approval_conditions	Published as 11-12 Appendix K-L	11 Appendix K - Receiving Water Environmental Assessments_opt.pdf
govt_approval_conditions	Published as 11-12 Appendix K-L	12 Appendix L - Hydrodynamic Modelling for Culvert Sizing.pdf
govt_approval_conditions		13 Appendix M.1 - Ecological Assessment Report_opt.pdf
govt_approval_conditions		13 Appendix M.2 - Ecological Assessment Report_opt.pdf
govt_approval_conditions		13 Appendix M.3 - Ecological Assessment Report_opt.pdf
govt_approval_conditions	Published as 13 Appendix M.4-M.5 - Eco Assess Report	13 Appendix M.4 - Ecological Assessment Report_opt.pdf
govt_approval_conditions	Published as 13 Appendix M.4-M.5 - Eco Assess Report	13 Appendix M.5 - Ecological Assessment Report_opt.pdf
govt_approval_conditions		14 Appendix N - Preliminary VCFMP.pdf
govt_approval_conditions	Published as 15 and 10 Appendix O and J	15 Appendix O - Concept Mangrove Rehabilitation Plan.pdf
govt_approval_conditions	Published as 15 and 10 Appendix O and J	10 Appendix J - WWTP Process Flow Chart.pdf
public_consultation_reports	Published redacted version	00 Environmental Assessment Report.pdf
public_consultation_reports	Published as 01-03 Appendix A-C	01 Appendix A - MID Process Overview and Flowchart.pdf
public_consultation_reports	Published as 01-03 Appendix A-C	02 Appendix B - Proposal Plans Site Plans.pdf
public_consultation_reports	Published as 01-03 Appendix A-C	03 Appendix C - ROL Proposal Plan.pdf
public_consultation_reports	Published as 04-06 Appendix D-F	04 Appendix D - Engineering Plans.pdf
public_consultation_reports	Published as 04-06 Appendix D-F	05 Appendix E - Existing Site Plan.pdf
public_consultation_reports	Published as 04-06 Appendix D-F	06 Appendix F - Options Assessment Report_opt.pdf
public_consultation_reports	Published as 07-09 Appendix G-I	07 Appendix G - Concept Design Report_opt.pdf
public_consultation_reports	Published as 07-09 Appendix G-I	08 Appendix H - Engineering Services Report.pdf
public_consultation_reports	Published as 07-09 Appendix G-I	09 Appendix I - Recycled Water Management Plan.pdf
supporting_tech_reports		17 Appendix Q - CHMP.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	18 Appendix R - Acid Sulfate Soils Investigation.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	19 Appendix S - Bushfire Management Plan.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	20 Appendix T - Biting Insects Management Plan.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	21 Appendix U - Transport and Traffic Impact Assessment.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	22 Appendix V - Visual Impact Mapping.pdf
supporting_tech_reports	Published redacted version	23 Appendix W - CEMP.pdf
supporting_tech_reports	Published redacted version	24 Appendix X - OEMP.pdf
supporting_tech_reports	Published as 18-22 and 25 Appendix R-V and Y	25 Appendix Y - Preliminary SBMP Wetlands.pdf
supporting_tech_reports	Published redacted version	26 Appendix Z - Pre-consultation Report.pdf
supporting_tech_reports	Published redacted version	27 Appendix AA - Consultation Strategy.pdf
flora_fauna_investigation	Published as 28-29 Appendix BB-CC	28 Appendix BB - Survey Sketch Plan.pdf
flora_fauna_investigation	Published as 28-29 Appendix BB-CC	29 Appendix CC - Lumion Perspective Images.pdf
flora_fauna_investigation	Published as 30-32 and 34 Appendix DD-FF and HH	30 Appendix DD - MSES Mapping.pdf
flora_fauna_investigation	Published as 30-32 and 34 Appendix DD-FF and HH	31 Appendix EE - RCC PD Online Property Summary.pdf
flora_fauna_investigation	Published as 30-32 and 34 Appendix DD-FF and HH	32 Appendix FF - Adjoining and Directly Affected Landowners.pdf
flora_fauna_investigation	Published redacted version	33 Appendix GG - Property Searches.pdf
flora_fauna_investigation	Published as 30-32 and 34 Appendix DD-FF and HH	34 Appendix HH - DA Mapping - State.pdf
flora_fauna_investigation	Published as 16-17 and 35 Appendix P-Q and II	35 Appendix II - Koala Management Plan.pdf
hydro_investigation_files	Published as 16-17 and 35 Appendix P-Q and II	16 Appendix P - Concept WWTP Rehabilitation Plan.pdf
hydro_investigation_files	Published as 16-17 and 35 Appendix P-Q and II	17 Appendix Q - CHMP Cover Only.pdf
hydro_investigation_files		24 Appendix X - OEMP redacted.pdf
hydro_investigation_files		33 Appendix GG - Property Searches- redacted.pdf
hydro_investigation_files		00 Environmental Assessment Report-redacted.pdf
hydro_investigation_files		26 Appendix Z - Pre-consultation Report-redacted.pdf
hydro_investigation_files		27 Appendix AA - Consultation Strategy- redacted.pdf



Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

<b>Appendix B</b>
<b>Coordinates</b>
Area 1
-27.68434053679,153.29559608969
-27.68642020207,153.29614306726
-27.686426031193,153.29614415429
-27.686431936785,153.29614437611
-27.686437817527,153.29614372894
-27.686443572523,153.29614222387
-27.686515868433,153.29611761653
-27.686526322328,153.29611405834
-27.686563409212,153.29610143507
-27.686585124008,153.29609404399
-27.687041312777,153.296213761
-27.687392975892,153.29508525524
-27.688301300128,153.29573390525
-27.689616795471,153.29520757212
-27.689170294509,153.29352227059
-27.689326729647,153.29318626788
-27.690091931894,153.29342398015
-27.691204510924,153.2937696123
-27.691315421883,153.29364102669
-27.691925952391,153.29293319556
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