Environmental Impact Statement

Thrumster Wastewater Scheme

Port Macquarie-Hastings Council

29 July 2024

→ **The Power of Commitment**

Project name		Cowarra WSS EIS and Thrumster WWS EIS					
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Registered Environmental Assessment Practitioner EIS Declaration

EIS Declaration (SSI)		
Project name		
Application number: SSI		
Address of the land in respect of which the development application is made: 433 Fernbank Road, Fernbank Creek		
Proponent details		
Applicant name: Port Macquarie-Hastings Council		
Applicant address: 17 Burrawan Street Port Macquarie, NSW 2444		
Details of person by this EIS was prepared		
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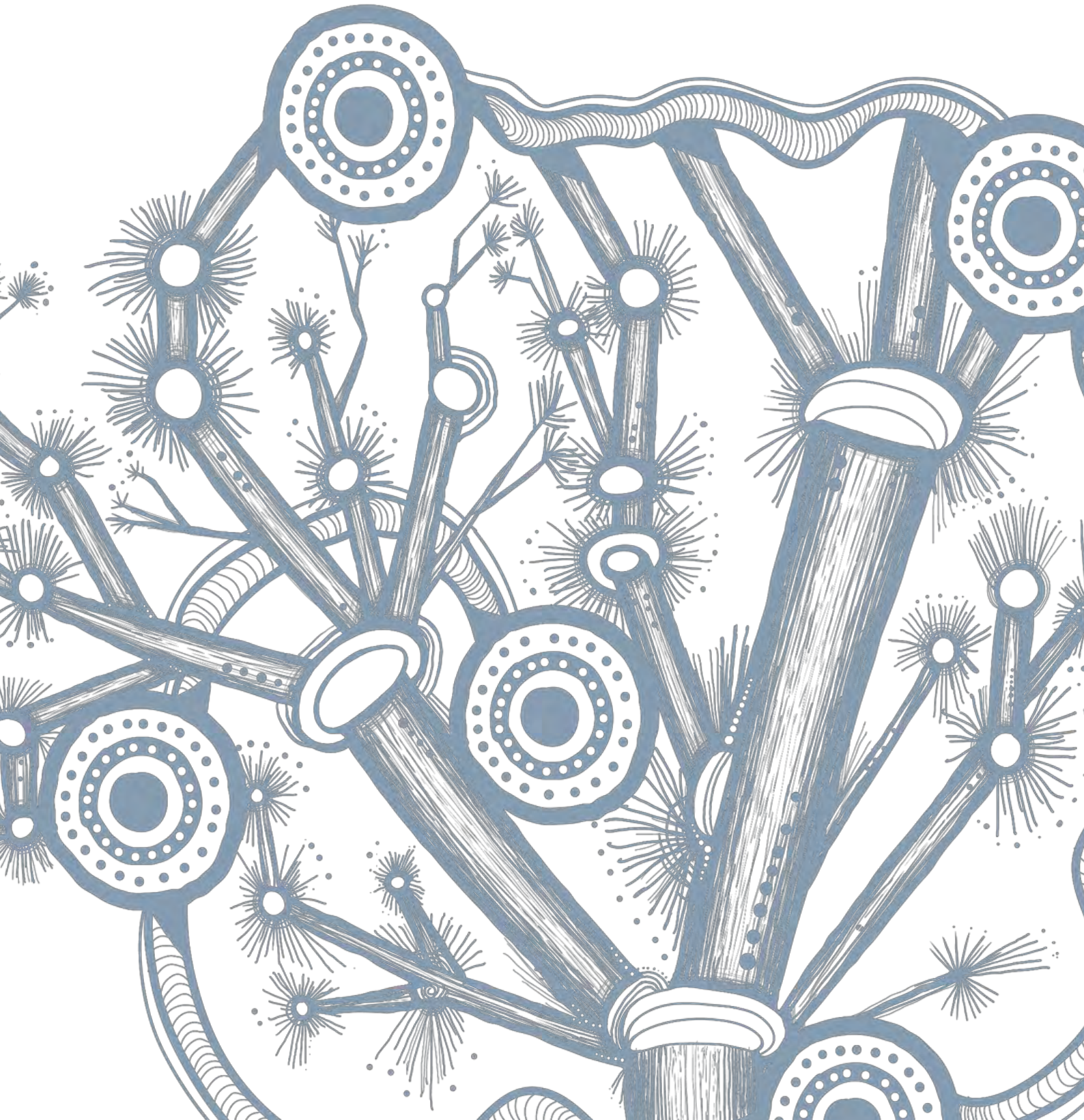
Declaration by registered environmental assessment practitioner		
Name: David Gamble		
Registration number: Certification number: 1666 Specialist Certification number: IA11091 REAP Registration number: R80043		
Organisation registered with: GHD Pty Ltd		
Declaration	The undersigned declares that this EIS: – has been prepared in accordance with Schedule 2 and Part 10 of the Environmental Planning and Assessment Regulation 2021; – contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates; – does not contain information that is false or misleading; – addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project; – identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments; – has been prepared having regard to the Department's *State Significant Infrastructure Guidelines – Preparing an Environmental Impact Statement*; – contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development; – contains a consolidated description of the project in a single chapter of the EIS; – contains an accurate summary of the findings of any community engagement; and – contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.	
Signature		
Date: 29/07/2024		

Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



Terms and abbreviations

Term/Abbreviations	Definition
ACHA	Aboriginal Cultural Heritage Assessment
ACHCR	Aboriginal cultural heritage consultation requirements
ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AIS	Air insulated switchgear
AR5	Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report
AS	Australian Standard
BAM	Biodiversity Assessment Method
BAM-C	BAM calculator
BC Act	*Biodiversity Conservation Act 2015* (NSW)
BDAR	Biodiversity Development Assessment Report
BFMC	Bush Fire Management Committee
BoM	Bureau of Meteorology
BOS	Biodiversity Offset Scheme
CEEC	Critically Endangered Ecological Community
SSI	State Significant Infrastructure
Cmth	Commonwealth
DCCEEW (Comm)	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DCCEEW (NSW)	Department of Climate Change, Energy, the Environment and Water (New South Wales)
DPE	Department of Planning and Environment
DPHI	Department of Planning, Housing and Infrastructure
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning Industry and Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPI	Environmental planning instrument
EPL	Environment Protection Licence
FDI	Fire Danger Index
FM Act	*Fisheries Management Act 1994* (NSW)
FSRU	Floating Storage and Regasification Unit
GDE	Groundwater Dependent Ecosystems

Term/Abbreviations	Definition
GIS	Geographic information system
HDD	Horizontal Directional Drilling
Heritage Act	*Heritage Act 1977* (NSW)
IAP2	International Association of Public Participation
IBRA	Interim Biogeographic Regionalisation of Australia
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IPCC	Intergovernmental Panel on Climate Change
JSA	Job Safety Analysis
LEP	Local Environment Plan
LGA	Local Government Area
mm	Millimetres
MNES	Matters of National Environmental Significance
MW	Megawatts
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
PAD	Potential archaeological deposits
PCT	Plant community type
Planning and Systems SEPP	State Environmental Planning Policy (Planning Systems) 2021
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
RAPs	Registered Aboriginal Parties
Resilience and Hazards SEPP	State Environmental Planning Policy (Resilience and Hazards) 2021
RCP	Representative Concentration Pathway
RFS	Rural Fire Service
Roads Act	*Roads Act 1993* (NSW)
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
TfNSW	Transport for NSW
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
WM Act	*Water Management Act 2000* (NSW)
WM Regulation	Water Management (General) Regulation 2018 (NSW)

Executive Summary

This environmental impact statement (EIS) addresses the Secretary's environmental assessment requirements (SEARs) issued by the Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure (DPHI)).

Port Macquarie-Hastings Council (Council) is proposing to develop the Thrumster Wastewater Scheme which includes a new wastewater treatment plant (WWTP), associated pipelines and infrastructure to service Thrumster, Sancrox, Fernbank Creek and catchment diversions from the Port Macquarie Wastewater Scheme (the project), identified as key areas for future growth in the region. The project is located on the Mid North Coast of NSW. The project and its regional context is shown in Figure 1-1.

The project has been declared as State Significant Infrastructure (SSI) and is a priority project for Council to ensure communities have access to necessary resources in a safe and reliable manner. The project is seeking the Minister's approval to construct and operate the wastewater scheme.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.4.1 and the assumptions and qualifications contained throughout this report.

Background

Council operates and maintains the Port Macquarie Hastings local government area (LGA) wastewater infrastructure. Forecasting has predicted that the population within the LGA will grow rapidly, increasing pressure on the existing wastewater infrastructure and utilities.

The project is one of two infrastructure schemes that Council has identified to assist with the anticipated population growth projection in the Port Macquarie-Hastings LGA. The other complimentary scheme is the Cowarra Water Supply Scheme, subject to a separate SSI application being developed concurrently as related development.

Key elements of the project include:

– New WWTP, including a recycled water plant within Lot 14, DP 1139180 on 433 Fernbank Creek Road, about six kilometres west of Port Macquarie CBD.
– Return treated effluent pipeline to Kooloonbung Creek.
– Main access road to the WWTP and a flood-proof, all-weather access road.
– New sewer pump stations, sewer rising mains, recycled water mains and a potable water connection.
– Upgrade works at identified existing sewer pump stations (SPSs) to reduce the current load on the existing system.
– Improvements to site access, optic fibre connection and electricity supply.

The project

Wastewater treatment plant

The WWTP would be located on Lot 14 DP1139180 at 433 Fernbank Creek Road approximately six kilometres west of the Port Macquarie CBD. The Thrumster sewerage scheme includes a WWTP to provide treatment capacity for 40,000 EP and a design average dry weather flow (ADWF) of 9.2 ML/day. The WWTP provides capacity for treatment of flows up to 4 x ADWF or 36.8 ML/day.

The proposed treatment process includes a continuous bioreactor with submerged membrane separation or membrane bioreactor (MBR) providing mechanical and biological nutrient reduction in wastewater. Biosolids dewatered onsite and transported for further treatment at the existing Cairncross organics recycling facility. A recycled water plant incorporating UV and chlorine disinfection systems is included in design to provide treatment for up to 4.7 ML/day for non-potable reuse.

Effluent treated within MBR process will be pumped via return effluent pipeline to discharge with Port Macquarie WWTP effluent via existing discharge structure to Kooloonbung Creek.

Linear infrastructure and network connections

The project's linear infrastructure will include the discharge main pipeline to Kooloonbung Creek for treated effluent, sewer rising mains, recycled water mains, potable water main and power and telecommunications. This infrastructure will be approximately 33.5 kilometres long located within the Port Macquarie LGA as shown on Figure 3-1.

As part of the project, three new sewer pump stations (SPS) and upgrades to five existing pumping stations within the sewerage system would be required.

Other components

In addition to the above, the project would include improvements to site access, power supply, utilities and ancillary infrastructure and communication connection.

Construction program

It is anticipated that construction would commence in 2026 and take approximately two years to complete.

Construction workforce

It is anticipated that a work force of approximately 60-100 full time equivalent (FTE) employees would be required during the construction phase of the project.

Operational workforce

Once fully operational it is anticipated that three to four FTE employees would be required to manage the onsite operations at the WWTP.

Estimated development cost

The estimated development cost (EDC), previously known as the capital investment value (CIV) for the project is $134 million (excluding GST, contingency and escalation costs). This is based on a Concept Design Cost Estimation Report (Beca HunterH20, 2024) prepared in accordance with *PS 24-002 Changes to how development costs are calculated for planning purposes* and the *Standard Form of Estimated Development Cost Report (State significant projects)*.

Project justification and alternatives considered

Justification

Port Macquarie is one of the fastest growing regional cities in NSW with an additional 9,100 new homes required to meet the anticipated growth projections outlined in the North Coast Regional Plan 2041 (NSW DPE 2022d). Population forecasting has predicted that the population within the LGA will grow to 115,302 residents by 2046 increasing demand on the existing wastewater infrastructure and utilities.

The project is considered to be justified because it:

– Responds to a critical, recognised need and is consistent with several state and regional government plans, policy and guidelines concerning water security.
– Improves the reliability, redundancy and resilience of wastewater infrastructure across the Port Macquarie-Hastings LGA.
– Provides short and long-term benefits to the wider Port Macquarie-Hastings LGA.
– Would not result in significant, adverse environmental, social or economic impacts.
– Is consistent with the principles of ecologically sustainable development, the objects of the EP&A Act and is considered to be in the public interest.

Alternatives considered

Alternatives considered for the project are summarised below:

– Do-nothing option

  The do-nothing option would result in continued pressure on the existing Port Macquarie WWTP, which is already operating at or beyond its design capacity during periods of heavy rainfall. The Do nothing alternative will not service new growth areas in Port Macquarie.

– New wastewater scheme

  Four options were considered for the provision of a new wastewater scheme including:

  - Option 1 – Separate treatment facilities (Port Macquarie WWTP and Thrumster WWTP)
  - Option 2 – Centralised treatment at Port Macquarie WWTP
  - Option3 – Centralised treatment at new Thrumster WWTP
  - Option 4 – Separate treatment facilities at Port Macquarie and Lake Road WWTP

  Option 1 involving a new WWTP at Thrumster and ongoing operation of the Port Macquarie WWTP was selected as the preferred option.

– WWTP site location

  After consideration of the initial six sites, then the additional four blue sky options, the GIS multicriteria showed that the sand plan site (proposed WWTP site) as most suitable. The existing Port Macquarie WWTP and adjacent site were mapped as potentially favourable however, the location in close proximity to high density of sensitive receivers, operational and constructability constraints, potential environmental impacts and additional time implications were present for these options. Following a number of MCA and associated workshops, Council re-affirmed its strategy to continue to provide wastewater treatment at the existing Port Macquarie WWTP to be augmented by the new WWTP at the Sand Plains site.

– Effluent discharge

  Three options were initially shortlisted for further consideration for the discharge location:

  - Option 1 – Discharge to Partridge Creek via a polishing wetland
  - Option 2 – Discharge to the Hastings River via a deep-water diffuser outfall
  - Option 3 – Discharge to Kooloonbung Creek via a shoreline outlet

During the review of these options and discussion with stakeholders, two additional options were added:

- Option 4 – Discharge to the mouth of the Hastings River via a deep-water diffuser outfall on an ebb tide
- Option 5 – Discharge to the ocean via deep sea outfall from the North shore

Discharge to Kooloonbung Creek was selected as the preferred effluent discharge location to provide a single consolidated release with existing discharges from the Port Macquarie WWTP.

– Treatment process

Three treatment options were considered for the WWTP:

- Intermittent reactor with pressurised membrane filtration
- Continuous reactor with clarifiers and pressurised membrane filtration
- Continuous reactor with submerged membrane filtration (MBR) (preferred option)

Planning approval process

Pursuant to section 5.12(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) the project is declared State significant infrastructure (SSI) under clause 10 of schedule 4 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP).This EIS has been prepared to support the application for project approval which is to be determined by Minister for Planning and Public Spaces under section 5.14 of the EP&A Act.

This EIS has been prepared in accordance with Section 5.7 of the EP&A Act, Part 8 of the *Environmental Planning and Assessment Regulation 2021* and in response to the Secretary's Environmental Assessment Requirements issued by the DPHI on 28 April 2023.

All applicable NSW and Commonwealth legislation has been considered during the preparation of this EIS.

The process for environmental assessment and approval of SSI is set out as follows:

– Application for approval of the Minister for Planning (the Minister) to carry out development
– Development of Planning Secretary's Environmental Assessment Requirements (SEARs)
– Preparation of an Environmental Impact Statement (EIS)
– Public exhibition of the EIS
– Response to submission(s) received during public exhibition of the EIS
– Preparation of Planning Secretary's Assessment Report
– Determination regarding the development by the Minister

Community and stakeholder engagement

Council has undertaken investigations and consultation regarding the project since 2004 which included engagement with a range of stakeholders. While that proposal was not progressed at the time, it did provide a good level of local and regional knowledge around potential issues and that they could be addressed or mitigated, allowing the proposal to proceed.

More recent consultation has been undertaken in 2022 till current. To date, engagement with key stakeholders and the community has included:

– Development of a stakeholder register including all relevant community groups, agencies, residents, and businesses.
– Creation of a project webpage (Thrumster Wastewater Scheme) on the Council web site for stakeholders to refer to for general project information.
– Consultation with Port Macquarie Race Club regarding the potential location of mains within/near their property.
– Inception meetings and engagement of relevant internal stakeholders in Council.

- Engagement with DPIE, DPI and NSW EPA to provide an overview of the project and identify designated personnel for liaison associated with the project.
- Engagement (several meetings) with Oyster Farmers and North-side progress association, Friends of Kooloonbung Creek Nature Park, Hastings Birdwatchers regarding wastewater treatment plant discharge locations and potential impacts on the Hastings River estuary.
- Engagement with EPA, DPI, DPIE and DCCEEW regarding water quality modelling, environmental and ecological assessment, and discharge assessment.
- Engagement of NSW Health and DPIE through workshops regarding reuse of recycled water from the plant.
- Engagement of Rural Fire Service through workshops regarding Bushfire Hazard Assessment and defining the required Asset protection Zone.
- Liaison with the Local Aboriginal Land Councils (LALCs) was undertaken by Community Inclusion Team Leader and Major Projects Lead to share project information.
- Development of an Expression of Interest process for the potential reuse of effluent and biosolids on agricultural land located in Thrumster, Fernbank Creek, and Greater Sancrox areas.
- An industry briefing for potential local industries, contractors and suppliers for the project and fostering circular economy.
- Project information was sent out with rates notices.
- Engagement of the neighbouring landowners through information and consultation sessions regarding selection of the plant location, treatment technology, and discharge location and identification of potential concerns and addressing those concerns.

The following external stakeholders have been consulted:

- Adjacent landowners
- General community
- Oyster Farmers and North-side progress association
- DPHI
- DCCEEW
- DPIE
- EPA
- Port Macquarie Racecourse
- Essential Energy
- LALCs
- NBN Co.
- NSW Health
- NSW Maritime
- Transport for NSW
- NSW RFS
- NSW SES
- NSW DPI

Future consultation would continue during public exhibition of the EIS. This community engagement would be led by DPHI and include:

- Publishing the EIS online via the Major Projects Planning Portal.
- Notifying the public exhibition in accordance with the requirements in the EP&A Act and the EP&A Regulation.
- In some cases, arranging for a community information session to explain the assessment and submission process and to listen to community views on the project.

Key issues

The following key issues identified within the SEARs have been addressed below.

Water quality

A Water Resources and Flooding Assessment has been prepared for the project. Relevant features of the existing environment, include:

– The main water bodies in proximity to the project include the Hastings River, Partridge Creek and Fernbank Creek. The WWTP and recycled water facility footprints as well as portions of the associated sewerage and recycled water pipelines are situated in flood prone land.
– There are areas of high potential aquatic groundwater dependent ecosystems (GDEs) within five kilometres of the project as well as areas of low, moderate and high potential terrestrial GDEs, based on regional assessments, and there are three registered groundwater bores within a 1.5 kilometres radius of the WWTP and recycled water facility footprints.
– The WWTP and recycled water facility footprint and pipelines are underlain by Coastal deposits (dune facies), Alluvial floodplain, and Alluvial backswamp surface geology and lie within the Korogoro and Christmas Creek soil landscapes. Soils are typically not prone to erosion due to the low relief and waterlogging. The proposed pipelines pass through a number of different geological environments and soil landscapes. Some low – high probability acid sulfate soils are encountered throughout the WWTP and recycled water facility footprint as well as segments of the pipeline. The pipeline routes also pass through dispersible, sodic and moderately reactive soils.
– The sewer and recycled water mains intersect the southern reach of Partridge Creek. Overall, this creek is in moderate – good condition based on the NSW River Styles and River Condition Index assessment criteria. The pipelines also cross several first-order and second-order waterways.
– The WWTP and recycled water facility footprints intersect the northern and southern reach of Partridge Creek. Overall, the northern and southern reaches of Partridge Creek are in moderate – good condition based on the NSW River Styles and River Condition Index assessment criteria. The pipelines do not intersect any major creeks but cross a number of first-order and second-order waterways.

Potential water related risks have been considered in developing the proposal, resulting in the inclusion of the following water management measures in-built to the project:

– Chemicals and associated storages required for operation of the WWTP and recycled water facility would be bunded and contained/roofed as per Australian Standards to maintain separation from stormwater.
– Design of a WWTP to treat incoming effluent at up to 4 x ADWF or 36.8 ML/day such that it is suitable for disposal to the environment, as well as sizing the plant to allow for higher inflows to be temporarily stored in 25 ML storm pond to minimise the likelihood of emergency discharges.
– A bulk chemical system control strategy has been developed within the design for management of chemicals within the WWTP processes to minimise potential environmental impacts.
– Clean water runoff would be diverted around the WWTP and recycled water facility footprint to prevent water logging, and a site drainage network would be constructed to suitably convey collected water around the site and discharge to the receiving environment. Emergency overflows from the lined storm pond would be controlled and directed to a swale to Partridge Creek to mitigate scour of the downstream area.
– Flood Planning Levels identified in the Port Macquarie-Hastings Council *Flood Policy* (2018) will be adopted to set proposed pad levels for the WWTP provide a flood evacuation route via the alternative access to the WWTP. The two-tiered pad design will provide opportunity locate commercial and industrial facilities above the 1% AEP flood level including climate change and 0.5 metre freeboard critical infrastructure will be located on the second tier of the pad which is located above the Probable Maximum Flood as defined by the 2006 flood study. Additionally, pipe infrastructure would be located below ground and will be suitably designed to manage impacts during flood conditions.
– Access roads were designed at suitable elevations to improve the flood resilience of access to and from the site.
– A Flood Management Plan (FMP) to be developed as part of the SWMP or CEMP to manage flooding during construction and a Flood Emergence Response Plan will be developed to manage flood risk during operation of the site.

– Pipe infrastructure would be located below ground and trenched or, where required as result of services/crossings/environmentally sensitive areas, would be horizontal-directional-drilled (HDD) to reduce the risk of scour and other geomorphological impacts for waterway crossings.
– Discharges into waterways are into existing effluent receiving areas and the incremental increase associated with population increase is not anticipated to result in geomorphological impacts to the receiving waterways.
– The proposed WWTP and recycled water facility will be located around local groundwater levels, so groundwater interception may potentially occur during the construction process of the WWTP. However, the storm pond will be suitably lined with HDPE liner to prevent seepage to or from groundwater during operation.

The impacts associated with discharges of effluent to receiving waters has been assessed by Intrawater in Technical Report 1B – Operational Water Quality assessment through the application of a project specific Water Quality Response Model (WQRM). The model results indicate that the impacts on water quality in Kooloonbung Creek are comparatively limited in nature relative to the background and baseline scenarios that simulate the current and forecast impacts from the releases from the Port Macquarie WWTP. The modelling indicates that although detrimental impacts are predicted against the future background scenario for parameters such as nutrients and salinity, the Thrumster WWTP releases may potentially return the creek back to conditions that are representative of its current baseline state in 2023/24. The results also indicate the potential for improvements in Chlorophyll *a* and Enterococci, however the potential for localised cumulative increases in algal biomass may form a potential risk due to the higher nutrient loading.

Within the Hastings River estuary, the effects of future land use and climate change are predicted under the background scenario. While the model results present impacts that include the potential for increases in nutrients, algal and pathogen content within the lower estuary, limited impacts are predicted by the introduction of the Thrumster WWTP releases. Localised increases in nitrogen and phosphorus concentrations are predicted in the vicinity of the confluence with Kooloonbung Creek but present a low risk of impact in terms of additional algal growth or increases in pathogens.

Mitigation measures have been recommended for the project, including CEMP, OEMP and FMP. On the basis of the in-built measures and with the implementation of the identified additional mitigation measures, the project is not anticipated to result in unacceptable impacts on receiving environments in relation to water.

Aboriginal heritage

An Aboriginal Cultural Heritage Assessment (ACHA) was undertaken for the project. The ACHAR included a review of previous archaeological assessments undertaken within the local and regional area, review of database information, Registered Aboriginal Party involvement and field investigations. The project area is located within the boundaries of the Birpai LALC, the traditional lands of the Birpai People and Birpai Nation. It is likely that the project area may have been visited and traversed for the purposes of hunting and gathering marine and estuarine resources for food and other uses. Movement within the landscape would likely have been associated with the seasonal availability of targeted species.

An extensive search of the AHIMS database was undertaken. Four Aboriginal cultural heritage sites were recorded within the project area, and one along the border of the project area (30-3-0205, 30-3-0121, 30-3-0321, 30-3-0390, 30-3-0405). Field surveys and assessment identified that the artefacts associated with 30-3-0405 appear to have been collected during a previous test excavation, therefore, no impact to this item. Site 30-3-0121 has been determined to have been previously disturbed and therefore no additional impacts to the site would occur. The establishment of exclusion zones for sites 30-3-0205 and 30-3-0321 would ensure no direct impacts to these sites.

ID# 30-3-0390 is Thrumster PAD 1 and is assessed to have low to moderate scientific significance. The design proposed for the WWTP and ancillary infrastructure would intercept a portion of the PAD area. A test excavation program would be undertaken prior construction in accordance with the Testing Methodology.

Non-Aboriginal heritage

A Historic Heritage Assessment was prepared for the project. The Historic Heritage Assessment included a review of heritage databases and field surveys over multiple days.

The known period of Aboriginal occupation is 5,000-6,000 years, with the Birpai people accessing a wide range of habitats including the coastal band of rocky shores, beaches and sand dunes, estuaries, wetlands, rivers and forests. The first published observations of the region by Europeans comes from the journal of surveyor General John Oxley, whose exploration party traversed the Hastings River Valley from 1818. The first settlement in the area was in 1821 located about two kilometres from the project area.

The site inspection did not identify any listed heritage items within the project area. The project area transects the former RNE listed Port Macquarie Rifle Range, however there would be no direct impacts to any listed heritage item. The nearest listed heritage item outside the project area is the 'Lake Innes House ruins and environs', which has potential to be indirectly impacted by the project.

Overall, the project would have a negligible to low direct, visual and cumulative impact on historical heritage values within the project area. There would be no impacts to World, National, Commonwealth, State or locally listed heritage as a result of the construction or operation of project. Mitigation measures are required for indirect impacts and unexpected finds.

Social

A Social Impact Assessment (SIA) was prepared for the project. The project is located within the Port Macquarie-Hastings LGA and is one of the fastest growing regional centres in NSW. It is well serviced by road, rail and air, which plays an important role in regional connectivity between Sydney and the Gold Coast. The Port Macquarie-Hastings region is characterised by a coastal environment and hinterland area, with a variety of urban, suburban and rural areas.

The SIA found that the key social benefits of the project were primarily related to the provision of wastewater infrastructure and utilities to the community which may improve overall health and wellbeing of Port Macquarie residents, both existing and future. The project is also expected to indirectly support the region's population and economic growth, as the project will deliver critical and enabling infrastructure. The project is also expected to support community values associated with environmental protection and conservation, and promotion of healthy waterways.

Key social impacts identified in the SIA during operation include amenity changes including visual changes and potential odours from operation of the project and the release of treated effluent to Kooloonbung Creek which may result in a perceived reduction to local amenity and recreational use of the waterway.

During construction, potential social impacts include the potential for reduced amenity, including noise, vibration, dust, and visual impacts in some areas which are located close to construction activities and haulage routes. Additionally, the project may result in temporary disruptions and inconveniences for some nearby residents, schools, aged care facilities, community facilities, businesses and users of recreation areas due to changes in access and connectivity including detours.

Mitigation measures have been identified in response to potential social impacts, and to enhance social benefits.

Biodiversity - aquatic

An aquatic ecology assessment has been prepared for the project. The study area includes Key Fish Habitat (KFH), freshwater, brackish and estuarine stream habitat, wetland habitat and riparian vegetation. Extensive areas of mapped Coastal Wetlands under the SEPP (Resilience and Hazards 2021) occur throughout the Thrumster and Port Macquarie region, including within the study area.

Construction works have been designed to avoid direct impacts on KFH via locating required infrastructure outside these areas where possible and utilizing horizontal directional drilling methods to minimise disturbance where pipelines need to cross creeks and waterways between the plant and discharge point. Direct impacts on KFH due to construction of the project have a total estimated area of 71 m^2, which may require offsetting. The remaining indirect impacts may include up to 10,558 m^2 of KFH. The construction works are not expected to directly disturb or harm any estuarine macrophytes such as mangroves or saltmarsh.

Potential operational impacts of the project are primarily related to the discharge of effluent into Kooloonbung Creek. Modelling that incorporates predicted sea level rise indicates that the long-term influence of this effluent will be up to 200 metres upstream and 1,600 metres downstream with nutrient concentration only moderately above ambient levels under this scenario. Although highly modified with current effluent discharges in its existing state, there remains some potential for increased risk of eutrophication in these reaches of Kooloonbung Creek. This will continue to reduce infaunal diversity amongst intertidal and subtidal sediments, which this assessment indicates is currently evident from existing effluent discharge in Kooloonbung Creek. Increased risk of similar impacts may also occur in Partridge and/or Fernbank Creek is considered to be substantially less as any discharges are expected to be confined to flood events.

Operationally, the discharge of effluent into Kooloonbung Creek has potential to indirectly impact on a further (to that during construction) 25,340 m^2 of KFH within the study area. There is also further potential for indirect impacts on KFH from overflow into Partridge and Fernbank Creek.

Given the assimilation capacity of mangroves and saltmarsh plants and the minimal impacts on water quality, the magnitude of impact on the health of these ecological communities is predicted to be minimal and typically confined to edge effects around the creek banks.

To mitigate and minimise the potential risks that this project may pose to aquatic habitat, flora and fauna and the potential for impacts to adjacent habitat from reduced water quality in both construction and operation of the project, a series of recommendations and management/monitoring plans have been provided. It is recommended that these be adopted into the project CEMP for both construction and operation of the project.

Biodiversity – terrestrial

A biodiversity development assessment report (BDAR) has been prepared for the project. This assessment has been undertaken in accordance with the Biodiversity Assessment Method (BAM). The assessment identified areas of the following Plant Community Types (PCT) within the project area:

– Northern Hinterland Blackbutt-Forest Oak Wet Forest (low and moderate condition)
– Northern Foothills Blackbutt Grassy Forest (low and moderate to good)
– Coastal Sands Apple-Blackbutt Forest (low and moderate condition)
– Northern Lower Floodplain Eleocharis Wetland (good condition)
– Northern Paperbark-Swamp Mahogany Saw-sedge Forest (moderate condition)

The total area within the Subject Land that is vegetated is 22.61 ha. Of this, a total of 3.43 ha was assessed as having a Vegetation Integrity Score >15, representing a considerable utilisation of low Vegetation Integrity areas by the project.

Threatened flora and fauna were recorded within or nearby to the project area during the field investigation undertaken, or assumed present in accordance with the BAM including:

– Small Pale Grass-lily (*Caesia parviflora var. minor*) (species credit)
– Wallum Froglet (*Crinia tinnula*) (species credit)
– Leafless Tongue Orchid (*Cryptostylis hutneriana*) (species credit)
– Spider Orchid (*Dendrobium melaleucaphilum*) (species credit)
– Black-necked Stork (*Ephippiorhynchus asiaticus*) (ecosystem credit)
– White-bellied Sea-eagle (*Haliaeetus leucogaster*) (ecosystem credit)
– Swift Parrot (*Lathamus discolor*) (species credit)
– Green-thighed Frog (*Litoria brevipalmata*) (species credit)
– Slender Marsdenia (*Marsdenia longiloba*) (species credit)
– Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (ecosystem credit)
– Little Bent-winged Bat (*Miniopterus australis*) (ecosystem credit)
– Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (ecosystem credit)
– Southern Myotis (*Myotis macropus*) (species credit)
– Giant Dragonfly (*Petalura gigantea*) (species credit)

– Squirrel Glider (*Petaurus norfolcensis*) (species credit)
– Koala (*Phascolarctos cinereus*) (species credit)
– Eastern Grass Owl (*Tyto longimembris*) (ecosystem credit)
– Eastern Cave Bat (*Vespadelus troughtoni*) (species credit)

Opportunities to avoid and minimise impacts to biodiversity and their supporting habitats was considered throughout the development of this project. Measures to mitigate potential indirect impacts to biodiversity values have been identified.

The project has been assessed in consideration of Serious and Irreversible Impacts to Swift Parrot and Giant Dragonfly as outlined in Section 10.2 of the Biodiversity Assessment Method.

The project is unlikely to have a significant residual impact on any EPBC Act listed fauna or flora species or communities. Residual impacts to native vegetation will require retirement of 105 ecosystem credits and 895 species credits in accordance with the Biodiversity Offsets Scheme.

Traffic and transport

A Traffic and Transport Assessment has been prepared for the project. The main roads which surround the project are State roads of the Pacific Highway and Oxley Highway and local roads of Fernbank Creek Road, Hastings River Drive and numerous local residential roads for the pipeline network. All roads are operating within capacity at Level of Service (LOS) under existing conditions.

Construction of the project is expected to require an average workforce of approximately 60-110 FTE. Based on a review of traffic and transport facilities in proximity to the project site, and an analysis of project trip generation and trip distribution for the construction of the WWTP and associated construction sites, it is expected that the project would have a negligible impact on the adjoining road and transport network.

Mitigation measures would be implemented prior to construction and during construction to minimise impacts on traffic and transport networks and minimise environmental impacts associated with the movement of vehicles during construction, including the development of a TMP. This is particularly key for management of potential safety risks associated with the intersection of Hastings River Drive and Fernbank Road and is expected to include construction zone speed reductions, use of signage and traffic controllers to support turning of large vehicles.

During operation of the WWTP, only minor increases in traffic are expected. It is anticipated that three to four FTE employees would be required to manage the onsite operations at the WWTP. The impacts of the WWTP operational traffic on the adjoining road network are expected to be negligible.

Air quality

An air quality impact assessment has been prepared for the project. The existing environment relevant to air quality was characterised based on the following:

– Topography: The WWTP footprint will be located on the low-lying lands of the Hastings River floodplain in an area dominated by grassland vegetation, with very minor variation in ground surface levels.
– Sensitive receptors: The WWTP has a small number of nearby sensitive receptors, the nearest of which is located approximately 460 metres from the WWTP footprint. The associated pipelines will run through more densely populated areas through the residential areas of Thrumster and Port Macquarie.
– Climate and meteorology: Annually, winds are predominantly from the west and the north, or more broadly from the west to southwest and northeastern quadrant.
– Background air quality: Annual average concentrations of both $PM_{2.5}$ and PM_{10} were both elevated in 2019 and 2020 due to bushfires in the locality. Data from the more recent years (2021-2023) show better air quality and may be due to higher than average rainfall and minimal major bushfire events. No other significant sources of odour were identified in close proximity to the proposed WWTP.

A qualitative assessment was undertaken to estimate the impacts of dust emissions for the construction stage in accordance with the *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management, 2024). The construction works will be completed across the WWTP and the associated pipelines including the recycled water pipeline, sewer rising main, and return effluent pipeline. Assessment took into account the dust emission magnitude and the receptor sensitivity for demolition, earthworks, construction and trackout. Emissions from demolition, earthworks, construction and trackout were identified as low risk for all dust soiling and human health impacts, and medium risk for ecological impacts for construction of the WWTP. Emissions from earthworks and construction were identified as low risk for the construction of the pipelines, and trackout was identified as medium risk. General management and mitigation measures have been proposed for construction to further reduce risk of dust emissions. Additional mitigation measures have been proposed for construction in areas within 20 metres of the nearest sensitive receptors.

Assessment of odour impacts was undertaken based on a review of the operational activities, review of the recommended separation distances, estimation of odour emissions based on review of similar operating plants, and prediction of impacts at the nearest sensitive receptors using dispersion modelling. Three scenarios were modelled with varying use of the odour control unit (OCU). Predicted concentrations complied with the criteria at all receptors for all modelled scenarios, with increased use of the OCU leading to reduced odour impacts at the receptors. Based on this, the risk of odour impacts at nearby sensitive receptors is considered to be low. Management and mitigation measures have been proposed for general operation of the project to further reduce risk of odour emissions.

Soils and contamination

A Preliminary Site Investigation (PSI) report has been prepared for the project. Based on the results of the desktop assessment, the overall likelihood for significant chemical contamination to be present along the proposed project is considered low. There is a high probability of encountering ASS during construction along Segments 1, 2, 3, 4 and beginnings of Segment 5. There is also low Naturally Occurring Asbestos (NOA) potential located in portions of Segment 2, 6 and 7.

It is considered that the risks from disturbance of contaminated soils within the project can be managed during the proposed works, and the site can be made suitable for the intended use, by implementation of proposed management measures.

Waste and chemicals

A waste and chemicals assessment report has been prepared for the project.

During construction of the project, the primary waste streams are expected to be generated from site preparation, construction of the project and operation of the site offices. Waste would be temporarily stored in the compound areas before on-site reuse or before being collected for off-site treatment or disposal.

The operation of the project would require chemical substances to be used for wastewater treatment. A dedicated bunded area for the storage tank and dosing pumps and road bund for bulk delivery tanker parking has been proposed in the design to prevent any spills from entering into the stormwater. Regular training of personnel and proper labelling should be followed throughout the operation to ensure the safe handling of chemicals. An emergency response plan would be developed prior to the operation.

Key waste streams that are expected during operation include dewatered sludge and clean in place (CIP) waste, and general waste from operation and maintenance. Appropriately licensed waste recycling and disposal facilities have been identified to accept general waste, construction waste, recyclables and organics waste including dewatered sludge.

On the basis of the in-built measures and with the implementation of the identified additional mitigation measures, the project is not anticipated to result in unacceptable impacts on receiving environments in relation to waste and chemicals.

Noise and vibration

A Noise and Vibration Impact Assessment (NVIA) has been prepared for the project. Noise and vibration impacts were assessed in accordance with the methods outlined in the NSW Noise Policy for Industry (EPA 2017), NSW Road Noise Policy (EPA 2011), and the Interim Construction Noise Guideline (NSW DECC 2009). Criteria was determined based on noise monitoring undertaken at different locations across the project site.

Noise from WWTP and pipeline construction was predicted to exceed noise management levels (NML) at nearby sensitive receivers. It was predicted some sensitive receivers could potentially experience highly intrusive and moderately intrusive noise levels. Some may even be highly noise affected for short periods of time as the pipeline is progressively installed in close proximity to sensitive receivers.

The relative increases in road traffic associated with the construction of the WWTP and pipeline were predicted to increase noise levels by more than 2 dBA along Fernbank Creek Road south of Hastings River Drive, Hastings River Drive west of Fernbank Creek Road, Hastings River Drive east of Winery Drive and Winery Drive south of Hastings River Drive and further assessment was required.

Further analysis indicated that daytime road traffic noise levels at nearby sensitive receivers along Fernbank Creek Road south of Hastings River Drive and Hastings River Drive east of Winery Drive were predicted to exceed the controlling criterion of 55 dBA $L_{Aeq, (1\ hour)}$ and 60 dBA $L_{Aeq, (15\ hour),}$ respectively.

Vibration from the construction of the WWTP identified no existing sensitive receivers within the structural damage safe working distances. However, the potential future residential location (not yet constructed) at 555 Fernbank Creek Road Fernbank creek (DA 773/13) may experience vibration levels above the DIN 4150 structural damage safe working distances during the flood proof all weather access road construction activities. During pipeline trenching construction, residential and non-residential receivers that are nearby may potentially experience vibration levels above the DIN 4150 structural damage safe working distances.

At the WWTP work location, sensitive receivers were identified to potentially experience vibration levels above the British Standard and *Assessing Vibration: a technical guideline* (AVTG) (2006). AVTG daytime human comfort criteria during the access road construction activities. During trenching construction activities, residential and non-residential receivers that are nearby may potentially experience vibration levels above the British Standard and AVTG daytime human comfort criteria.

Noise modelling predictions indicated no adverse impacts during the operation of the project at surrounding sensitive receivers. The relative increases in road traffic noise levels associated with the operation of the WWTP are predicted to be less than 0.5 dBA. These changes are compliant with the guidance contained in the RNP (EPA 2011).

No operational vibration impacts are anticipated given the distance between the nearest sensitive receivers to the WWTP and the pipelines will be buried underground.

Mitigation measures construction and operational noise and vibration impacts are identified in the assessment to minimise potential impacts.

Landscape character

A Landscape Character and Visual Impact Assessment report has been prepared for the project. The WWTP would be located within an existing wetland area, which would affect the landscape character of this environment however, views towards the WWTP would be predominantly screened from the public view by existing dense native bushland.

During construction of the network infrastructure minor potential impacts were identified. These would be temporary. Mitigation and management measures would be implemented to minimise these impacts.

Cumulative impacts during construction are expected to be minor. The installation of the pipelines, electrical and communication conduits would be undertaken progressively and therefore impacts in each section being installed would be short term. Any potential cumulative impacts will be reduced through the application of individual project-specific environmental management plans.

The impacts on the landscape character and visual amenity of the project have been assessed as negligible for construction and mainly negligible during operation, with moderate impacts expected in close proximity to the WWTP.

Hazard and risk

A preliminary risk screening was undertaken in accordance with *State Environment Planning Policy (Resilience and Hazards) 2021* (SEPP (Resilience and Hazards)). The results of the dangerous goods and transport screening indicate that the project does not exceed any of the SEPP (Resilience and Hazards) thresholds for construction but does exceed the thresholds for storage of chlorine, alum and sodium hydroxide during operation. A Level 2 Preliminary Hazard Analysis (PHA) has been prepared. A Level 2 PHA uses a semi-quantitative approach to demonstrate that the activity does not pose a significant risk.

Separate assessments of the air quality, and noise and vibration impact of the project have been completed as part of the EIS, as the development is 'potentially offensive'. The results show that over the lifecycle of the project, the project is not expected to release a significant quantity of pollutant emissions and is not considered to be an 'offensive industry'.

The PHA assessed the hazard of a release of toxic gas (chlorine). The assessment showed that whilst the consequences of a chlorine release extend beyond the WWTP boundary, the likelihood of a release is low, and the risk of off-site impacts complies to HIPAP 4 risk criteria.

The PHA demonstrates that the project could be designed, constructed, and operated in a manner that will minimise hazardous impact to the public. It is proposed that the following controls be implemented that incorporate practices that will prevent risk scenarios occurring through:

– A design of the WWTP to relevant Australian Standards for chlorine storage and usage.
– Ensuring regular maintenance schedules are developed.
– Implementation of standard operating procedures for chlorine drum handling.
– Inclusion of a scrubber in the design of Thrumster WWTP.
– Coordination with emergency services for off-site management if a loss of containment event was to occur.

Aviation

An Aviation Impact Assessment (AIA) has been prepared for the project. This assesses the potential aviation impacts, provides aviation safety advice with respect to relevant requirements of air safety regulations and procedures, and informs and documents consultation with relevant aviation agencies. Based on the assessment, the project:

– Will not affect the minimum sector altitude (MSA) of Port Macquarie Airport.
– Will not infringe on instrument flight rules (IFR) circling areas of Port Macquarie Airport.
– Will temporarily infringe obstacle limitation surface (OLS) surface of Port Macquarie Airport – Crane / Franna operation for the pipeline work.
– Will not infringe any of the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) procedures at Port Macquarie Airport.
– Will not impact Grid lowest safe altitude (LSALT) and air routes LSALT.
– Is within the Class G airspace (non-controlled airspace), and not located in any Prohibited and Danger areas.
– Is within the restricted area R588C, but lower than the vertical limits.
– Will not impact any aviation facilities.
– Will not impact any aviation radars.

Key recommendations have been identified in this assessment including with consultation.

Bushfire

A bushfire risk assessment has been prepared for the project. This assessment identifies and assesses the risk from bushfire to assets within the project footprint and provides mitigation measures that would be applied during construction and operation of the project, in accordance with *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (PBP) (NSW RFS, 2019).

PBP notes that for Class 5 to 8 and Class 10 buildings (the proposed development being a mix of these) the National Construction Code does not provide any bushfire performance requirements for these building classes. APZ width requirements depend on the BAL applied in building design and construction. An acceptable degree of WWTP bushfire resilience can be achieved by establishing a BAL 12.5-determined APZ.

Based on the assessment, the bushfire risk of the proposed WWTP are Low and can reasonably be considered tolerable.

The assessment details the methods to avoid and reduce bushfire risks, as well as mitigation measures to address residual impacts. The assessment also assesses potential bushfire ignition risks associated with construction works and WWTP operation.

Health impact

A health impact assessment has been prepared for the project. This assessment has looked at the potential for impacts to community health due to the project. It is noted that having such a facility provides a significant benefit to society as long as it is appropriately designed and operated.

Potential impacts to community health for this project have been considered in regard to water quality, air quality, changes in noise and vibration, soil contamination, safety (including safe handling of chemicals, flooding, bushfire) and traffic.

The primary/major benefit of this facility is that it will provide appropriate management of wastewater in an area that is currently not provided with such services. This area is being opened up for residential development and so will need wastewater services. As discussed, providing appropriate management of wastewater is a benefit to society.

The impact assessment has concluded that:

– Changes in water quality are unlikely to impact on community health during operation or construction with the inclusion of relevant mitigation measures.
– Dust emissions during construction are likely to be negligible and odours during operations are also expected to be negligible.
– Changes in noise and vibration are unlikely to impact on community health during operations.
– Risks from contamination of soil are expected to be negligible during both construction and operation as there are limited sources of contamination within the project area. The potential for acid sulfate soils or naturally occurring asbestos to be present will need to be managed appropriately during construction.
– Handling of dangerous goods, bushfire and flooding have been assessed and determined to be negligible when managed in accordance with government requirements.
– Potential impacts on the health of the community due to changes in traffic during construction have been assessed and been found to be minor. Any changes in traffic during construction are likely to be short-term/temporary. Based on the available data and information, potential impacts on the health of the community due to changes in traffic during operation have been assessed and been found to be negligible.

Mitigation measures are proposed to manage potential impacts.

Cumulative

There are a number of proposed major projects in the vicinity of the project. The majority of projects would not interact with the project and would therefore not generate cumulative impacts. Cumulative impacts have been considered by specialist studies supporting this EIS.

Management measures

A number of mitigation and management measures have been proposed to ensure the project does not have a significant impact on the environment. The project would have an overarching environmental management strategy and associated issue-specific environmental management subplans that would be developed and implemented to avoid, mitigate, and manage the potential environmental impacts associated with the construction and operation of the project.

Public exhibition

The EIS would be publicly exhibited by DPHI. Interested persons and organisations can review the EIS and make a written submission on any aspect of the project during this time. Advertisements would be placed in newspapers to advise of the public exhibition and where the EIS can be viewed.

Copies of the EIS would be available for viewing, with locations to be determined and notified by DPHI. The EIS will be available to view on the internet at:

– DPHI website: https://www.planningportal.nsw.gov.au/major-projects

Submissions to the project during the exhibition period should be made direct to DPHI via email, post, or via the DPHI website mentioned previously.

Conclusion

The project comprises the construction and operation of a new WWTP and associated pipelines and infrastructure within the Port Macquarie-Hastings LGA and is required to respond to the future population growth expected in the LGA.

The project has avoided and minimised environmental impacts as far as practicable, through adoption of appropriate technologies and management strategies.

In addition, a number of mitigation and management measures have been proposed based on the maximum parameters assessed in the EIS. These measures would be adopted during detailed design; and construction and operation through the preparation and implementation of a CEMP as appropriate.

Contents

1. Introduction 1
   - 1.1 Overview 1
   - 1.2 Project objectives 4
   - 1.3 The proponent 4
   - 1.4 Purpose of this report 4
   - 1.5 Related development 5
   - 1.6 Summary of planning and statutory requirements 5
   - 1.7 Structure of this EIS 6
2. Strategic context 8
   - 2.1 Project need 8
   - 2.2 Consistency with government plans, policies, and guidelines 8
   - 2.3 Key features of project surrounds 12
   - 2.4 Aligning with other major projects 13
   - 2.5 Offset agreements 14
   - 2.6 Alternatives 14
   - 2.7 Preferred option 26
3. Project description 28
   - 3.1 Overview 28
   - 3.2 Design 38
   - 3.3 Construction 51
   - 3.4 Operation 62
   - 3.5 Decommissioning 64
4. Statutory context 65
   - 4.1 Introduction 65
   - 4.2 Assessment and approval pathway 65
   - 4.3 Statutory requirements for the project 65
5. Community and stakeholder consultation 68
   - 5.1 Introduction 68
   - 5.2 Consultation undertaken for the EIS 69
   - 5.3 Engagement tools and activities 71
   - 5.4 Engagement to date 71
   - 5.5 Future engagement 76
6. Approach to impact assessment 80
   - 6.1 Overview 80
   - 6.2 Assessment approach 80
   - 6.3 Impact assessment method 81
   - 6.4 How the impact assessment results are detailed 82
7. Water quality and hydrology 84
   - 7.1 Assessment approach 84
   - 7.2 Methodology 84

7.3 Existing environment 88
7.4 Construction impacts 102
7.5 Operational impacts 105
7.6 Mitigation and management measures 117
8. Aboriginal heritage 120
8.1 Assessment approach 120
8.2 Existing environment 121
8.3 Potential impacts 124
8.4 Mitigation and management measures 126
9. Non-Aboriginal heritage 129
9.1 Assessment approach 129
9.2 Existing environment 130
9.3 Potential impacts 132
9.4 Mitigation and management measures 133
10. Social 134
10.2 Existing environment 137
10.3 Social infrastructure 139
10.4 Potential impacts and benefits 141
10.5 Mitigation and management measures 150
11. Terrestrial biodiversity 153
11.1 Assessment approach 153
11.2 Existing environment 156
11.3 Potential impacts – construction 161
11.4 Potential impacts – operation 171
11.5 Mitigation and management measures 171
12. Aquatic ecology 178
12.1 Assessment approach 178
12.2 Existing Environment 180
12.3 Potential impacts 184
12.4 Mitigation and management measures 193
13. Traffic and transport 197
13.1 Assessment approach 197
13.2 Existing environment 198
13.3 Potential impacts – construction 202
13.4 Potential impacts – operation 210
13.5 Mitigation and management measures 210
14. Air quality 214
14.1 Assessment approach 214
14.2 Existing environment 216
14.3 Potential impacts – construction 220
14.4 Potential impacts – operation 222
14.5 Mitigation and management measures 226

15. Soils and contamination 227
15.2 Existing environment 235
15.3 Potential impacts – construction 243
15.4 Potential impacts – operation 245
15.5 Mitigation and management measures 245
16. Waste and chemicals management 247
16.1 Assessment approach 247
16.2 Existing environment 248
16.3 Potential impacts – construction 248
16.4 Potential impacts – operation 252
16.5 Mitigation and management measures 255
17. Noise and vibration 258
17.1 Assessment approach 258
17.2 Existing environment 262
17.3 Potential impacts – construction 265
17.4 Potential impacts – operation 271
17.5 Mitigation measures 273
18. Land use and property 277
18.1 Assessment approach 277
18.2 Existing environment 278
18.3 Potential impacts - Construction 282
18.4 Potential impacts - Operation 295
18.5 Mitigation and management measures 295
19. Hazard and risk 297
19.1 Assessment approach 297
19.2 Existing environment 301
19.3 Potential impacts – construction 303
19.4 Potential impacts – operation 308
19.5 Potential impacts - aviation 315
19.6 Mitigation and management measures 317
20. Coastal erosion 320
20.1 Assessment approach 320
20.2 Existing environment 321
20.3 Potential impacts – construction 325
20.4 Potential impacts – operation 325
20.5 Management measures 325
21. Landscape character and visual amenity 326
21.2 Existing environment 329
21.3 Potential impacts – construction 337
21.4 Potential impacts – operation 339
21.5 Mitigation and management measures 340
22. Climate change 341
22.1 Legislation and policy context 341
22.2 Methodology 341

22.3 Existing environment 342
23. Greenhouse gas and ecologically sustainable development 347
23.1 Assessment approach 347
23.3 Impact assessment 350
23.4 Mitigation and management measures 354
24. Cumulative impacts 357
24.1 Assessment approach 357
24.2 Existing environment 357
24.3 Mitigation and management measures 360
25. Environmental management 361
25.1 Overview 361
25.2 Environmental management strategy 361
25.3 Issue-specific environmental management subplans 361
25.4 Work method statements/protocols 362
25.5 Mitigation measures 363
26. Project justification and conclusion 364
26.1 Justification for the project 364
26.2 Project uncertainties and approach to design refinements 370
26.3 Conclusion 371
27. References 373

Table index

Table 1-1 Structure and content of the EIS 6
Table 2-1 WWTP site location options – non-cost criteria option evaluation 17
Table 3-1 Project summary 30
Table 3-2 Project footprint 33
Table 3-3 Thrumster WWTP process overview 38
Table 3-4 Adopted effluent quality design criteria 41
Table 3-5 Log reduction credits for dual reticulation 41
Table 3-6 Sewage Pumping stations 48
Table 3-7 Indicative construction program for Thrumster WWTP 51
Table 3-8 Site compounds and SPS works 52
Table 3-9 Pipeline component and associated construction method(s) 55
Table 3-10 Open trenching occurring in verges 55
Table 3-11 Proposed materials 60
Table 3-12 Indicative construction equipment 61
Table 4-1 Summary of statutory requirements 65
Table 5-1 key stakeholder groups 69
Table 5-2 Engagement tools 71
Table 5-3 Summary of engagement activities 74
Table 6-1 Addressed issues 82
Table 7-1 Assumed treated wastewater quality for the Thrumster WWTP discharge 86
Table 7-2 Flood levels at the proposed WWTP and access roads site from various sources 88

Table 7-3	Summary of monitoring data. Sites are in order upstream to downstream.	95
Table 7-5	Thrumster WWTP Concept Design Report (90% stage) flood design requirements	102
Table 7-6	Dilution requirements for Kooloonbung Creek discharges for toxicants	113
Table 7-7	Soil and contamination impact mitigation and management measures	117
Table 8-1	ACHA Aboriginal Consultation stages	121
Table 8-2	AHIMS sites located within proximity to the project and on the project border	122
Table 8-3	Location of the Aboriginal cultural heritage sites on the border of the project area	124
Table 8-4	Aboriginal heritage impact management measures	126
Table 9-1	Non-Aboriginal heritage database searches	130
Table 9-2	Archaeological potential of identified historic phases	131
Table 9-3	Non-Aboriginal management and mitigation measures	133
Table 10-1	Social locality	135
Table 10-2	Defining likelihood levels of social impacts	136
Table 10-3	Dimensions of social impact magnitude	136
Table 10-4	Defining magnitude levels for social impact	136
Table 10-5	Social impact significance matrix	136
Table 10-6	Key demographic indicators, potentially affected communities	137
Table 10-7	Social infrastructure and services	139
Table 10-8	Social impact summary table - construction	141
Table 10-9	Social impact summary table - operation	146
Table 10-10	Social management measures mitigation measures	151
Table 11-1	Landscape Features	156
Table 11-2	Native vegetation	157
Table 11-3	TEC within the project area	157
Table 11-4	Candidate species credit species present within the Project area	158
Table 11-5	Summary of residual direct impacts	162
Table 11-6	Assessment of the project against the MNES and the EPBC Act	163
Table 11-7	Assessment of prescribed impacts	165
Table 11-8	Assessment of indirect impacts	167
Table 11-9	Biodiversity impact management measures	171
Table 12-1	Survey site locations (Data coordinate system GDA2020 MGA Zone 56)	179
Table 12-2	Aquatic habitat	180
Table 12-3	Identification of potential aquatic impacts during construction	185
Table 12-4	Approximate direct and indirect impacts to Type 1 and 3 KFH as a result of construction works	188
Table 12-5	Identification of potential aquatic impacts during operation	190
Table 12-6	Aquatic impact management measures	194
Table 13-1	Identified roads impacted by the project	198
Table 13-2	Traffic generation and traffic distribution impacts – construction	203
Table 13-3	Satellite compound construction vehicle capacity	204
Table 13-4	Alternative pedestrian facilities during trenching	208
Table 13-5	Potential public transport facilities impacted	208
Table 13-6	Mitigation and management measures – traffic and transport	210
Table 14-1	Air quality impact assessment criteria	215
Table 14-2	Odour assessment criteria	216
Table 14-3	Key climate and meteorological conditions	217

Table 14-4	Summary of available background air quality data recorded by the Port Macquarie AQMS	220
Table 14-5	Facilities reporting to the NPI	220
Table 14-6	Risk matrix for dust impacts during construction	222
Table 14-7	Air quality impact mitigation and management measures	226
Table 15-1	Contaminated land record of notices (within 3 kilometres radius of the project)	238
Table 15-2	POEO licence register (within 3 kilometre radius of the project)	239
Table 15-3	Waste management facilities (within 3 kilometre radius of the project)	239
Table 15-4	Potential contamination sources	239
Table 15-5	Soil and contamination impact mitigation and management measures	245
Table 16-1	Key waste stream and classification - construction	248
Table 16-2	Potential impacts associated with waste generation - construction	249
Table 16-3	Management approach for construction waste	250
Table 16-4	Potential impacts associated with chemical management – construction	251
Table 16-5	Key waste streams and quantities and classification - operation	252
Table 16-6	Potential impacts associated with waste generation - operation	253
Table 16-7	Management approach for operational waste	253
Table 16-8	Operation chemicals storage	254
Table 16-9	Potential impacts associated with chemical management - operation	255
Table 16-10	Waste and chemical impact management measures	256
Table 17-1	NMLs for residential sensitive receptors	259
Table 17-2	Project specific NMLs	260
Table 17-3	Acceptable vibration dose values for intermittent vibration	261
Table 17-4	Guideline values for short term vibration on structures – DIN 4150-3	261
Table 17-5	Construction stages	265
Table 17-6	Change in road traffic noise levels due to construction traffic - Fernbank Creek Road south of Hastings River Drive	266
Table 17-7	Change in road traffic noise levels due to construction traffic - Hastings River Drive east of Fernbank Creek Road	266
Table 17-8	Change in road traffic levels due to construction traffic - Hastings River Drive west of Fernbank Creek Road	266
Table 17-9	Change in road traffic noise levels due to construction traffic - Hastings River Drive east of Winery Drive	267
Table 17-10	Change in road traffic noise levels due to construction traffic - Winery Drive north of Hastings River Drive	267
Table 17-11	Change in road traffic noise levels due to construction traffic - Winery Drive south of Hastings River Drive	267
Table 17-12	Change in road traffic levels due to construction traffic - Winery Drive north of Fernbank Creek Road	267
Table 17-13	Change in road traffic noise levels due to construction traffic - Wanbuyn Drive south of Fernbank Creek Road	268
Table 17-14	Construction noise traffic impacts at affected sensitive receptors	268
Table 17-15	Predicted construction vibration levels	269
Table 17-16	Vibration buffer distances - structural damage	269
Table 17-17	Vibration buffer distances - human comfort and person, residential Receptors	270
Table 17-18	Vibration buffer distances - human comfort and perception, non-residential Receptors	270
Table 17-19	Change in road traffic noise levels due to operational traffic – Fernbank Creek Road	272

Table 17-20	Change in road traffic noise levels due to operational traffic – Hastings River Drive east of Fernbank Creek Road	272
Table 17-21	Noise and vibration impact management measures	273
Table 18-1	Land use zones within the project footprint	279
Table 18-2	Land use within the LGA and project area	281
Table 18-3	Land use conflict risk ranking matrix	285
Table 18-4	Land use conflict risk assessment	286
Table 18-5	land use and property management measures	295
Table 19-1	Hazard identification list - construction	304
Table 19-2	Construction phase bushfire ignition risk assessment	305
Table 19-3	Summary of potential human health impacts – construction	306
Table 19-4	Hazard identification list – operation	308
Table 19-5	Operation phase bushfire ignition risk assessment	310
Table 19-6	Summary of potential human health impacts – operation	311
Table 19-7	Potential aviation impacts	315
Table 19-8	Hazard and risk impact management measures	317
Table 20-1	Sensitivity ratings for sediment compartments	321
Table 20-2	20250 long term erosion estimates due to sea-level rise	323
Table 20-3	2100 long term erosion estimates due to sea-level rise	323
Table 20-4	Long term shoreline recession due to sediment loss and sea level rise	324
Table 21-1	Impact rating matrix	327
Table 21-2	Landscape character zones	329
Table 21-3	Key viewpoints	333
Table 21-4	Potential impacts to LCZs - construction	337
Table 21-5	Visual impact assessment summary	339
Table 21-6	Potential viewpoint impacts - operation	340
Table 21-7	Landscape character and visual impact management measures	340
Table 22-1	Minimum asset design life criteria	342
Table 22-2	Projections used in CRA	342
Table 22-3	Meteorological conditions and projected trends	343
Table 22-4	Summary of climate risks confirmed for the project in the CRA	344
Table 22-5	‘High’ climate risk potential impacts	344
Table 23-1	Greenhouse gases and 100-year global warming potentials	350
Table 23-2	Sources of emissions - construction	352
Table 23-3	Summary of annual emissions – operation	354
Table 23-4	Greenhouse gas emissions mitigation and management measures	355
Table 24-1	Screening criteria	357
Table 24-2	Projects with the potential for cumulative impacts	358
Table 24-3	Potential cumulative impacts for relevant future projects	358
Table 24-4	Cumulative impact management measures	360
Table 25-1	Example content of issue-specific environmental management subplans	362
Table 26-1	Objects of the EP&A Act	365

Figure index

Figure 1-1	Project overview	3
Figure 2-1	Alternatives considered (GHD, 2024)	19
Figure 2-2	Overview of shortlisted options (BecaHunterH2O, 2023)	21
Figure 3-1	Project Overview	29
Figure 3-2	The Project	34
Figure 3-3	Thrumster WWTP process flow diagram	40
Figure 3-4	3D model layout and overview of the Thrumster WWTP	45
Figure 3-5	Plant site arrangement	46
Figure 3-6	Discharge to Kooloonbung Creek	50
Figure 3-7	Pipeline installation construction methods	58
Figure 5-1	Port Macquarie-Hastings Council Complaints Handling Flowchart	79
Figure 7-1	Existing Conditions – Flood Depth and Level 5% AEP	90
Figure 7-2	Existing Conditions – Flood Depth and Level 1% AEP	91
Figure 7-3	Existing Conditions – Flood Depth and Level PMF or Extreme Flood	92
Figure 7-4	Surface water monitoring locations	96
Figure 7-5	Kooloonbung Creek monitoring data – Salinity (2014-23).	97
Figure 7-6	Kooloonbung Creek monitoring data – Total Nitrogen (2014-23)	99
Figure 7-7	Kooloonbung Creek monitoring data – Total Phosphorus (2014-23)	99
Figure 7-8	Kooloonbung Creek monitoring data – Thermotolerant/Faecal (2014-23)	100
Figure 7-9	Water temperature measured in Kooloonbung Creek and the Hastings River between March 2023 and September 2024	101
Figure 7-10	Flood Rise Times	106
Figure 7-11	Predicted annual median concentration of Total Nitrogen (average rainfall year)	109
Figure 7-12	Predicted annual median concentration of Total Phosphorous (average rainfall year)	109
Figure 7-13	Predicted change in annual median Total Nitrogen concentrations – Impact scenario relative to background (average rainfall year	110
Figure 7-14	Predicted annual median concentrations of Chlorophyll a (lower rainfall year)	111
Figure 7-15	Predicted annual median concentrations of Salinity (average rainfall year)	112
Figure 7-	Predicted annual median concentrations of Enterococci (higher rainfall year)	114
Figure 13-1	Key road network	200
Figure 13-2	Thrumster WWTP access road upgrade	206
Figure 14-1	Sensitive receptors - air quality	218
Figure 14-2	Sensitive receptors within 20 metres of pipeline – air quality	219
Figure 14-3	WWTP operation - predicted odour concentration for scenario 1	223
Figure 14-4	WWTP operation - predicted odour concentration for scenario 2	224
Figure 14-5	WWTP operation - predicted odour concentration for scenario 3	225
Figure 15-1	Assessment segments	228
Figure 15-2	Naturally occurring asbestos	236
Figure 15-3	Acid Sulfate Soils Risk probability map	237
Figure 16-1	Waste management hierarchy	256
Figure 17-1	Sensitive receptors and noise monitoring locations	263
Figure 17-2	Noise catchment areas	264
Figure 18-1	Land use zoning	280
Figure 19-1	PHA process	299
Figure 19-2	Bushfire prone land mapping	301

Figure 19-3 Asset protection zone map 314
Figure 20-1 Coastal Erosion – Historical studies and relevant classifications 322
Figure 20-2 Estimated coastal hazard limit in Town Beach (SMEC 2005) 324
Figure 21-1 Site location and surrounding land uses 328
Figure 21-2 Landscape character zones 332
Figure 21-3 Key viewpoints 336

Appendices

Appendix A Secretary's Environmental Assessment Requirements
Appendix B Statutory Compliance
Appendix C Community Engagement Table
Appendix D Summary of Mitigation Measures

Technical Reports

Technical Report 1	Water Resources and Flooding
Technical Report 1A	Water Resources and Flooding Assessment
Technical Report 1B	Operational Water Quality Impact Assessment
Technical Report 2	Aboriginal Cultural Heritage Assessment
Technical Report 3	Historical Heritage Assessment
Technical Report 4	Social Impact Assessment
Technical Report 5	Biodiversity Development Assessment Report
Technical Report 6	Aquatic Ecology Assessment
Technical Report 7	Traffic and Transport Assessment
Technical Report 8	Air Quality Assessment
Technical Report 9	Soils and Contamination Preliminary Site Investigation
Technical Report 10	Waste and Chemical Assessment
Technical Report 11	Noise and Vibration Assessment
Technical Report 12	Health Impact Assessment
Technical Report 13	Landscape Character and Visual Impact Assessment
Technical Report 14	Bushfire Risk Assessment
Technical Report 15	Preliminary Hazard Analysis Report
Technical Report 16	Ecologically Sustainable Development Assessment
Technical Report 17	Climate Risk Assessment
Technical Report 18	Greenhouse Gas Assessment
Technical Report 19	Aviation Impact Assessment

1. Introduction

This chapter provides an overview of the Thrumster Wastewater Scheme project. It provides an overview of the local context of the project within its locality, identifies the proponent and outlines the structure and purpose of the Environmental Impact Statement.

1.1 Overview

1.1.1 Project background

Port Macquarie-Hastings Council (Council) is proposing to develop the Thrumster Wastewater Scheme including a new wastewater treatment plant (WWTP), associated pipelines and infrastructure at Port Macquarie on the NSW Mid North Coast (the project). The project has been declared as a State Significant Infrastructure (SSI) and is a priority project for Council to ensure communities have access to necessary resources in a safe and reliable manner.

The project would provide servicing for over 7,000 additional homes across the Port Macquarie-Hastings local government area (LGA) and would also indirectly cater for over 3,000 additional dwellings via in-fill development within Port Macquarie. This represents almost 25 per cent of the required 41,300 extra dwellings on the North Coast that will be needed to support growth over the next 20 years as identified in the North Coast Regional Plan 2041. The project is aligned to the land-use principles outlined in Council's Shaping our Future 2040 Local Strategic Planning Statement ensuring critical infrastructure supports growth (further discussion in Chapter 2).

The primary objective for the project is to support recent and future urban growth at Thrumster, Sancrox and Fernbank Creek and surrounding areas located in the outer suburbs of Port Macquarie. The new wastewater scheme will reduce demand on the existing Port Macquarie WWTP and improve the resilience, redundancy and ongoing capacity of Council's infrastructure services, and facilitate planned future growth in the identified areas. The scheme would also minimise the environmental impact of wastewater management by implementing reuse of recycled water.

1.1.2 Key features of the project

The proposed WWTP is situated within Lot 14, DP1339180 on 433 Fernbank Rd, about 6 kilometres west of Port Macquarie Central Business District (CBD). The project, as shown in Figure 1-1 generally includes the following:

- New WWTP, including a recycled water plant within Lot 14, DP 1139180 on 433 Fernbank Creek Road, about six kilometres west of Port Macquarie CBD.
- Return treated effluent pipeline to Kooloonbung Creek.
- Main access road to the WWTP and a flood-proof, all-weather access road.
- New sewer pump stations, sewer rising mains, recycled water mains and a potable water connection.
- Upgrade works at identified existing sewer pump stations (SPSs) to reduce the current load on the existing system.
- Improvements to site access, optic fibre connection and electricity supply.

It is anticipated that construction of the project would commence in 2025, subject to the required planning and regulatory approvals and is anticipated to take 2-3 years to complete.

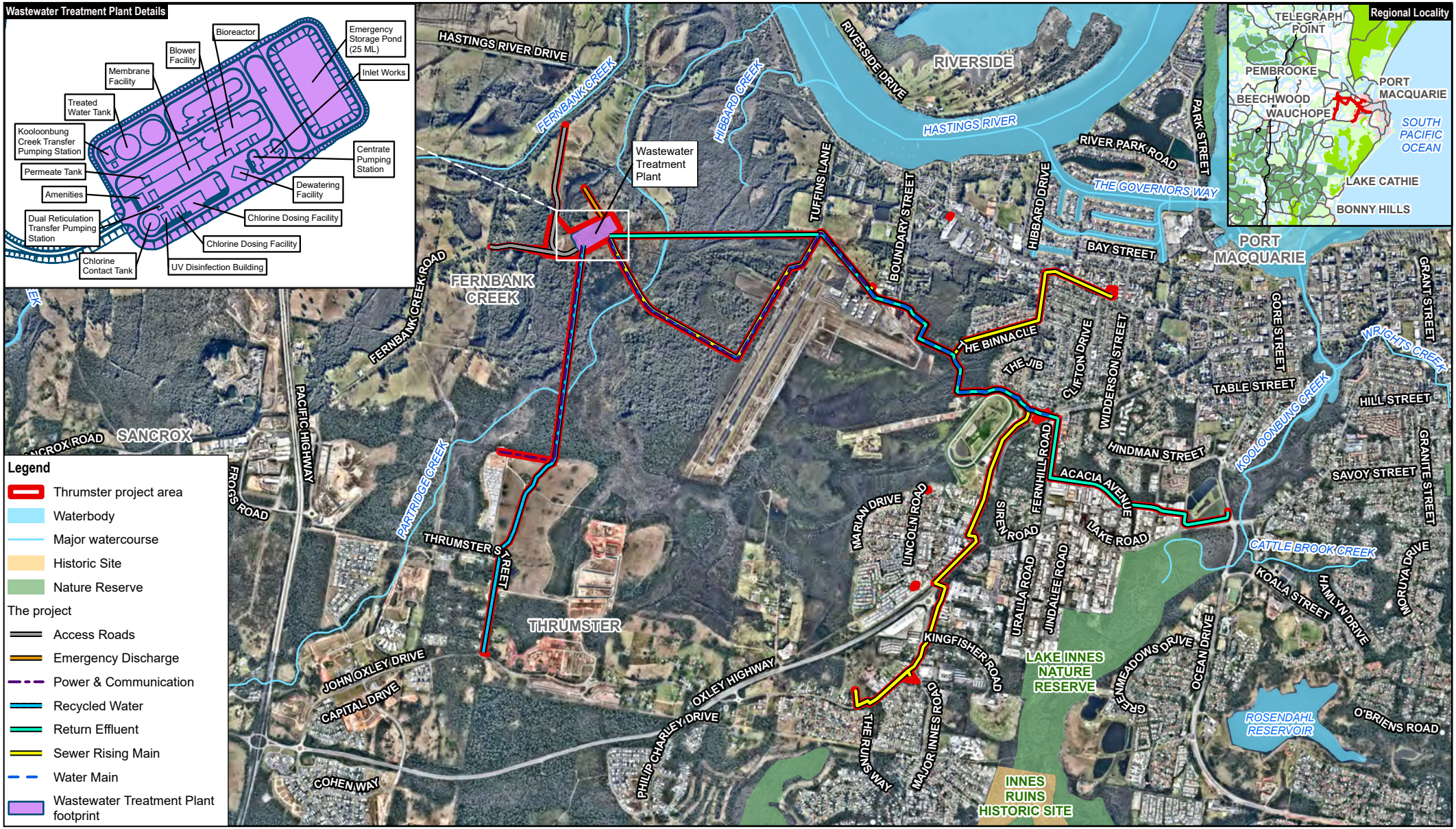
Site compounds would be established within close proximity to the WWTP and at key locations along the pipeline routes (refer to Figure 1-1). Each site compound has been chosen as they are cleared of native vegetation, outside of natural drainage lines and do not contain known Aboriginal heritage.

The Thrumster WWTP would service the areas of Sancrox, Thrumster, Fernbank Creek and catchment diversions from the Port Macquarie Wastewater Scheme. The project seeks approval for a WWTP to provide a treatment capacity for 40,000 equivalent population (EP) with design flow of 9.2 mega litres per day (ML/day).

The WWTP treatment process includes a continuous bioreactor with submerged membrane separation. The membrane bioreactor (MBR) is an advanced wastewater treatment technology capable of mechanical and biological nutrients reduction. The WWTP is equipped with UV and chlorine disinfection systems to provide multiple barriers against pathogens for the non-potable recycled water with recycled water design capacity of 4.7 ML/day included in the project.

The 40,000 EP capacity is anticipated to be reached by around 2039 or later based upon residential and non-residential growth within the Thrumster, Sancrox and Fernbank Creek development areas. The WWTP has been designed to be expandable in the future to an ultimate capacity of 80,000 EP. The WWTP design considers the space requirements for future upgrade, including the duplication of bioreactor and membrane systems. Consideration for a future upgrade has also been given as part of the hydraulic design, site layout and process sizing of some treatment units that would be difficult to upgrade at a later date, such as the civil structures for the inlet works screening and grit removal facilities.

Further detail on the staging allowances, key infrastructure components, construction activities and timeframes are provided in Chapter 3 (Project description).



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project overview

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 1.1

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Print date: 22 Jul 2024 - 11:11

Data source: PMHC: Infrastructure data, 2023; BECCA: WTP Design, 2024; Geoscience Australia: 250k Topographic Data Series 3, 2006; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023.
Created by: fmackay

1.2 Project objectives

The key objectives of the project are:

- To construct and commission the Thrumster Wastewater Scheme upgrade by 2028 to address the existing capacity constraints and operational risk faced by Council.
- To provide treatment capacity to allow for future growth and reduce the load on the current Port Macquarie WWTP to minimise loss of sewerage network containment, environmental contamination, and allow important preventative maintenance to occur.
- To promote Council as a regional leader through the project delivery and improve the standard of community and environmental outcomes in areas including:
  - Network odour and loss of containment events in the sewerage network impacting the community.
  - Energy efficiency and power usage associated with sewer collection, transfer and treatment.
  - Providing high quality recycled water for third pipe scheme including potential future industrial users.
  - Enable Council to implement biosolids resource recovery processes and manage biosolids stabilisation as part of Council's broader centralised organics recycling strategy.
- To provide a reliable and resilient sewerage scheme.

1.3 The proponent

The proponent details are as follows:

- **Proponent:** Port Macquarie-Hastings Council
- **ABN:** 11 236 901 601
- **Address:** 17 Burrawan Street Port Macquarie NSW 2444

Council owns and operates wastewater schemes for Lake Cathie/Bonny Hills, Telegraph Point, Comboyne, Long Flat, Camden Haven, Kew/Kendall, Port Macquarie, and Wauchope. The LGA has an estimated population of 86,762 with over 25 townships and localities spread over 3,686 square kilometres of land area. There are remote villages and rural localities throughout the LGA without a municipal wastewater service. The methodology for sequencing growth in major growth areas has been based on vicinity to the existing infrastructure and approved development applications.

1.4 Purpose of this report

This report has been prepared by GHD Pty LTD (GHD) on behalf of Council to address the Secretary Environmental Assessment Requirements (SEARs) as issued by the then Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure (DPHI)) for the project. This EIS provides an assessment of the potential impacts that may arise from the construction and operation of the project, and recommends management measures to avoid, mitigate, or manage identified impacts. This EIS has been prepared having regards to the *State Significant Infrastructure guidelines – preparing an environmental impact statement* (DPE, 2022).

1.4.1 Scope and limitation

This report has been prepared by GHD for Port Macquarie-Hastings Council and may only be used and relied on by Port Macquarie-Hastings Council for the purpose agreed between GHD and Port Macquarie-Hastings Council as set out in Section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Port Macquarie-Hastings Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.5 Related development

The project is one of two infrastructure schemes that Council has identified to assist with the anticipated population growth projection in the Port Macquarie-Hastings LGA. The other complimentary scheme is the Cowarra Water Supply Scheme, subject to a separate SSI application being developed concurrently to the Thrumster scheme.

The ultimate EP for the catchments to be serviced by the Thrumster WWTP is projected to grow to approximately 80,700 by 2071 assuming complete development of the nominated areas. An increase in capacity of the treatment plant beyond the 40,000 EP design capacity subject to this application will be subject to a separate approval process which would likely be via a modification to the Infrastructure Approval.

1.6 Summary of planning and statutory requirements

On 1 March 2023 the NSW Minister for Planning declared the project to be State Significant Infrastructure (SSI) under Division 5.2 section 5.12(4) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), by reason of clause 10 of Schedule 4 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP). The project requires the approval of the Minister for Planning and Public Spaces under section 5.14 of the EP&A Act.

The SEARs for the project were issued on 28 April 2023 (refer to Appendix A). This EIS has been prepared to address the SEARs and the requirements of the *Environmental Planning and Assessment Regulation (2021)* (EP&A Regulation), in particular, the requirement for the form of the EIS as outlined in Part 8 of the EP&A Regulation.

A referral under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was lodged on 12/03/24 (EPBC 2023/09582). The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined that the project is not a controlled action under section 75 of the EPBC Act on 03/05/2024.

The environmental assessments documented within this EIS focus on the environmental issues presented in the SEARs. Each assessment considers the areas directly and indirectly affected by construction and operation of the project, as relevant to each technical assessment, as well as cumulative impacts. Therefore, this EIS has been prepared to satisfy both the NSW Government requirements in accordance with the EP&A Act and the Commonwealth requirements in accordance with the EPBC Act. Appendix A (Secretary's Environmental Assessment Requirements) and Appendix B (Statutory Compliance) of this EIS provide further detail on how this EIS is compliant with the SEARs and other statutory requirements.

Should the project be approved to proceed, the project would be constructed and operated in accordance with the mitigation and management measures proposed in this EIS, any subsequent commitments outlined in the submissions report as well as the conditions of approval.

The EIS documents the range of consultation activities that Council has undertaken with the community and key stakeholders about the project. The public exhibition of the EIS will provide further opportunity for the community, government agencies and other interested parties to gain a better understanding of the project and allow those parties to provide comment.

Further discussion on the statutory requirements and regulatory requirements are in Chapter 4 (Statutory context).

1.7 Structure of this EIS

This EIS has been prepared to address the requirements of both the State and the Commonwealth as set out in the SEARs (refer to Appendix A – SEARs checklist). The structure and content of the EIS is outlined in Table 1-1.

Table 1-1 Structure and content of the EIS

Chapter	Description
Chapter 1	**Introduction** Provides a background to the project, an overview of the key features of the project, identifies the proponent and project objectives. The chapter also outlines the overall structure and content of the EIS.
Chapter 2	**Strategic context:** Provides the following: – An overview of the strategic context and need for the project. – A description of the regional context of the project. – A description of the key features of the project and surrounds that could affect or be affected by the project including important features in the natural and built environment. – Identifying whether the project is likely to generate cumulative impacts with other developments in the area. – Identify any agreements that will occur to mitigate or offset the impacts of the project. – An analysis of feasible alternatives that were considered during the design stages and an outline of the preferred option.
Chapter 3	**Project description** Provides a description of the project features and operation, as well as a description of the construction process, activities and supporting construction facilities. The chapter identifies any uncertainties associated with the project description, including areas that will be subject to potential future design changes, and how these uncertainties will be addressed during further design development.
Chapter 4	**Statutory context** Provides an overview of the statutory requirements relevant to the project that are required for consideration by the approval authority before the determination of the project application.
Chapter 5	**Engagement** Provides a summary of: – The engagement activities that have occurred during the development of the projects design development and environmental assessment process. – The feedback received from engagement activities carried out to-date. – How the outcomes of engagement activities have been incorporated into the design and planning of the project. – Future planned engagement activities for the project that are proposed during public exhibition, detailed design, and delivery.
Chapter 6	**Approach to impact assessment** Provides a description of the overall approach used to undertake the environmental assessment of the project, including how uncertainties have been addressed.
Chapter 7 – 24	**Assessment of impacts** Describes the results of the assessments completed to understand the potential impacts of the project, as identified by the SEARs. For each environmental aspect considered in the EIS, the assessment includes the assessment approach, information on the existing environment, potential construction and operational impacts and the proposed approach to the avoidance, mitigation and management of these impacts.
Chapter 25	**Environmental management** Provides a description of the proposed approach to environmental management and a compilation of the mitigation measures for the project.

Chapter	Description
Chapter 26	**Project justification and conclusion** Provides a summary of, and justification for, the project as a whole, having regard to environmental, economic and social considerations and the principles of ecologically sustainable development.
Chapter 27	**References** Provides a list of references used to inform the EIS.
Appendices	
Appendix A	**Secretary's Environmental Assessment Requirements checklist**
Appendix B	**Statutory compliance table**
Appendix C	**Community engagement table**
Appendix D	**Summary of mitigation measures**
Technical Report 1A	**Water Resources and Flooding Assessment**
Technical Report 1B	**Operational Water Quality Impact Assessment**
Technical Report 2	**Aboriginal Cultural Heritage Assessment**
Technical Report 3	**Non-Aboriginal Heritage Assessment**
Technical Report 4	**Social Impact Assessment**
Technical Report 5	**Biodiversity Development Assessment Report**
Technical Report 6	**Aquatic Ecology Assessment**
Technical Report 7	**Traffic and Transport Assessment**
Technical Report 8	**Air Quality Assessment**
Technical Report 9	**Soil and Contamination - Preliminary Site Investigation**
Technical Report 10	**Waste and Chemical Assessment**
Technical Report 11	**Noise and Vibration Assessment**
Technical Report 12	**Health Impact Assessment**
Technical Report 13	**Landscape Character and Visual Impact Assessment**
Technical Report 14	**Bushfire assessment report**
Technical Report 15	**Preliminary Hazards Analysis report**
Technical Report 16	**Ecologically Sustainable Development Assessment**
Technical Report 17	**Climate Risk Assessment**
Technical Report 18	**Greenhous Gas Assessment**
Technical Report 19	**Aviation Impact Assessment**

2. Strategic context

This chapter describes the strategic planning context, the key issues and demands that have influenced the need for, and the development of, the project. This includes description of key features of the site and surrounds that could affect or be affected by the project as well as include an analysis of feasible alternatives considered.

2.1 Project need

Port Macquarie is one of the fastest growing regional cities in NSW with an additional 9,100 new homes required to meet the anticipated growth projections outlined in the North Coast Regional Plan 2041. The population is expected to 115,302 residents by 2046 (PMHC 2024), increasing demand on existing infrastructure and utilities.

Council has been undertaking planning investigations to provide a new WWTP to service Area 13 for over 10 years, seeking to provide the optimal location for the WWTP with consideration to statutory, community, environmental, population growth and engineering design considerations. The proposed Thrumster Wastewater Scheme project aims to service the predicted population growth. The project is required to provide a secure and reliable wastewater scheme to service residential growth across the Thrumster, Sancrox and Fernbank Creek areas of the LGA.

The project is intended to deliver a WWTP and recycled water supply to existing and proposed residences of Thrumster, Sancrox and Fernbank Creek areas of Port Macquarie. The project would support the growth of urban and industrial areas in these suburbs. This project will provide the required redundancy for Council's sewage treatment and reticulation network.

2.2 Consistency with government plans, policies, and guidelines

The strategic context of the project is influenced by, and would meet the outcomes of, strategic plans and policies of the State, regional and local levels.

2.2.1 NSW State Infrastructure Strategy 2022-2042

The NSW State Infrastructure Strategy (NSW SIS) (Infrastructure NSW 2022) is a 20-year infrastructure investment plan for NSW Government that places strategic fit and economic merit at the centre of investment decisions. The NSW SIS outlines the importance of diversifying the infrastructure investment pipeline and maintaining service reliability to best grow the State's economy, enhance productivity and improve living standards for NSW communities.

The strategy is framed around 9 long-term objectives to achieve better outcomes for NSW. Of relevance to the project is the objective regarding service growing communities and enhancing long-term water security. Delivering quality infrastructure is fundamental to service the predicted population growth and the evolving needs of the community. The project will provide sewage treatment capacity to service the residential growth across Thrumster, Sancrox and Fernbank Creek ensuring the required redundancy for Council's sewage treatment and reticulation network is achieved. As the project aims to deliver a WWTP and associated services to provide a secure and reliable wastewater scheme to service the growing population it is considered to respond to the objectives of this strategy.

2.2.2 NSW Government Regional Water Strategies 2020

The NSW Government is taking action to improve the security, reliability, quality and resilience of the State's water resources. Regional water strategies are an integrated package and look out over the next 20 to 40 years to understand how much water a region will need to meet future demand, the challenges and choices involved in meeting those needs, and the actions that can be taken to manage risks to water availability. Strategy objectives relevant to the project include:

– Provide safe, secure and sustainable water and wastewater services to regional NSW towns. This is supported by the NSW Government Safe and Secure Water Program.
– Protect and enhance the environment through improve the health and integrity of environmental system and assets, including improvements of water quality.
– Enable economic prosperity (improve water access reliability for regional industries).

2.2.3 NSW State Plan: NSW 2021

The NSW State Plan (NSW Government, 2011) is a 10 year plan to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability and strengthen our local environment and communities. The project aligns strategically with the following objectives:

– Invest in critical infrastructure in regional areas to assist economic development and growth.
– Protect natural environments.
– Recognising and protecting the State's most significant heritage places and value to ensure future generations can enjoy them.

The project is a critical infrastructure that aims at supporting the urban and industrial growth in Thrumster, Sancrox and Fernbank Creek by providing a secure and reliable wastewater scheme. The WWTP operation including discharge of treated effluent will be conducted in accordance with an Environmental Protection Licence. This EIS prepared for the project aims at assessing the potential impacts of the project and outline mitigation measures to protect the natural environment surrounding the project.

2.2.4 North Coast Regional Plan 2041

The *North Coast Regional Plan 2041* (DPE, 2022) is a 20-year blueprint for the future of the North Coast. It sets out the NSW Government vision for the North Coast which is 'healthy and thriving communities, supported by a vibrant and dynamic economy that builds on the region's strengths and natural environment'. To achieve this vision the NSW Government has set three goals for the region:

– Liveable, sustainable and resilient
– Productive and connected
– Growth change and opportunity

The provision of a secure wastewater system is closely linked to the ability to plan to meet the needs of projected population growth within the region. A key objective that is relevant to the project is to sustainably manage and conserve water resources. In particular, the Plan acknowledges that new greenfield areas must be able to be serviced by community services and key infrastructure, including water, sewer, road and waste services.

The LGA covers an area of approximately 3,626 square kilometres and has an estimated population of 86,762 (ABS Census, 2021) spread over 25 localities. Port Macquarie is one of the fastest growing regional cities in NSW with an additional 9,100 new homes required to meet the anticipated growth projections outlined in the North Coast Regional Plan 2041.

The project will aim to protect areas of environmental value through the design of the scheme to avoid areas of high environmental value and inclusion of mitigation measures that are to be implemented to protect the natural environment. The provision of a wastewater treatment system is closely linked to the ability to plan to meet the needs of projected population growth within the region. Importantly this would respond to Objective 1: Provide well located homes to meet demand.

2.2.5 Imagine2050 – Port Macquarie Hastings Community Strategic Plan

Imagine2050 (Council, 2022a) is Port Macquire Hastings Community Strategic Plan that defines the community's vision and provides actions required to reach their vision. Council aims to adopt sustainable and innovative practices to conserve natural assets and ensure integration of good planning for the delivery of infrastructure to strengthen the liveability of surrounding communities.

The project aims to deliver a critical infrastructure that will provide a secure and reliable wastewater scheme that services the predicted population growth. The scheme will minimise the environmental impact of wastewater management by introduction of an advanced wastewater treatment process and provision for recycled water schemes.

2.2.6 Urban Growth Management Strategy 2017-2036

The Urban Growth Management Strategy 2017-2036 (Council, 2018) aims to achieve well planned growth in the right places, to create a more diverse and prosperous economy to maintain a healthy environment. Port Macquarie is one of the fastest growing regional cities in NSW with an additional 9,100 new homes required to meet the anticipated growth projections, with population expected to grow by 14,200 people over the next 20 years. The project is intended to deliver a WWTP and recycled water supply to existing and proposed residences of Thrumster, Sancrox and Fernbank Creek areas of Port Macquarie. The project would support the growth of urban and industrial areas in these suburbs. This project will provide the required redundancy for Council's sewage treatment and reticulation network. The project is consistent with this strategy as it addresses future demand of the growing population by providing a secure and reliable wastewater scheme.

2.2.7 Shaping our future 2040

Shaping our Future 2040 is a local strategic planning statement for Port Macquarie Hastings (Council 2020) that outlines the vision for land-use planning in our local area of the next 20 years and sets the direction for our community's environmental, social and economic land-use needs. Shaping our Future 2040 bridges the space between the Community Strategic Plan and the local planning framework. The following planning priorities are relevant to the project:

– Protect, conserve and enhance our biodiversity and areas of high environmental value.
– Increase our community's resilience to the impacts and risks of natural hazards and environmental change.
– Protect and improve the health of our waterways and aquatic habitats.
– Sustainably and efficiently manage our energy, water, waste, emissions and natural resources.
– Protect, respect and embrace our natural, built or cultural heritage (including our Aboriginal cultural heritage).
– Ensure existing and future infrastructure is resilient to natural hazards and human-related threats.

2.2.8 Delivery Program 2022-2026

The Delivery Program 2022-2026 represent Council's response to Imagine2050 (Community Strategic Plan). It integrates the strategic themes and objectives outlined in Imagine2050 with Council's business and services to turn the community's aspirations into actionable operational priorities and activities. The Delivery Program details Council's plan over the next four years concentrating on the following priority areas:

– Reduced traffic - less congestion with a clear transport network approach to address present and future needs.
– Stable infrastructure – a sustainable approach that ensures sewer, water, stormwater capability now and in the future.
– Improve pathways – footpaths, shared paths, cycleways and access to public transport across the region.
– Protected environment – protection for our natural environment and built heritage and support for climate friendly initiatives.
– Affordable living – current and future generations to have access to affordable lifestyles (e.g. housing).

– Thriving economy – initiatives which support and grow local jobs and businesses.
– Inclusive community – opportunities to celebrate our history, work alongside our First Nations people and build community spirit.
– Collaboration – a greater level of trust between the community and decision-makers.
– Transparency – a clear understanding and demonstration of how resources are prioritised and allocated across the region.
– Quality of life – quality amenities and effective management of assets to ensure good quality of life outcomes.

The project is consistent with the objectives of the delivery program and the Thrumster wastewater scheme is directly referenced as a key project in the delivery program. A sustainable infrastructure that is well planned and maintained is essential to provide the strength of economy and quality of life required to meet the demands of expected population growth. The infrastructure aims at servicing the predicted population growth in Port Macquarie by providing the required redundancy for Council's sewage treatment and reticulation network.

2.2.9 Operational Plan 2023-2024

The Operational Plan 2023-2024 represents Council's response to Imagine2050 (Community Strategic Plan) and the Delivery Plan 2022-2026. The project is directly referenced as a key project for Council and that the planning for delivery has begun. The project aims at delivering a wastewater scheme that services the residential growth in the area. The operation of the treatment plant and effluent discharge will be in accordance with the approved EPL to ensure the environmental requirements are met.

2.2.10 Port Macquarie Regional City Action Plan 2036

The Port Macquarie Regional City Action Plan (Council 2021a) (RCAP) has been developed by the NSW Government, in collaboration with Council, to help Port Macquarie fulfil its potential as a thriving regional centre and build on the city's growth, strong employment base, diversified economy and local character. Development of the Port Macquarie RCAP is a priority action of the North Coast Regional Plan 2036, which was released in March 2017 by the NSW Minister for Planning.

In particular, the RCAP addresses housing affordability with a coordinated approach to align infrastructure delivery with sustainable housing. This will ensure a steady supply and mixture of homes to cater for future population growth. The project would reply to this item of the RCAP by creating the water infrastructure delivery to support the housing growth occurring in the LGA. Particularly enabling the delivery of infrastructure in alignment with population and housing growth, critical to supporting increased housing density and diversity in line with Objective 1 *Deliver a compact city which provides housing diversity* of the RCAP.

2.2.11 Blueprint for Generation Equity

Council's long-term vision for future investment in long-lasting infrastructure and managing growth is outlined in the Blueprint for Generational Equity (Council 2023). The draft blueprint is one of three key strategic documents from Council part of their Strategies for our Future initiative focusing on current priorities and pathways to facilitating future priorities. It revolves around four key focus areas including corporate planning, master planning, land use planning and infrastructure. It consolidates findings and insights from Council's Strategic Plan 'Imagine 2050', connecting them into a cohesive blueprint across the four focus areas to determine how best to respond to current and future challenges and opportunities. Each focus area contains immediate key actions to prioritise from the consolidated plans and strategies, as well as outlining those to set targets for and measure over time in order to encourage meaningful and relevant outcomes.

The blueprint recognises STP capacities across the LGA are reaching design limits and won't meet the demands of population and urban growth, including areas identified for potential rezoning in the Urban Growth Management Strategy. A key priority outlined under the infrastructure focus area is to facilitate fit for purpose water and sewer services and invest in critical components of the sewer network to serve the community now and into the future (2050). The blueprint identifies Thrumster wastewater scheme as one of Council's major priorities to build and renew its sewer infrastructure to ensure reliability and resilience of the sewer management system.

2.2.12 Infrastructure Strategy 2022-2042

The Infrastructure Strategy (draft) 2022-2042 is one of the three strategic draft documents from Council as part of their Strategies for our Future initiative, with a focus on infrastructure delivery. The strategy takes an LGA-wide view which aims to identify significant challenges and issues concerning infrastructure assets and provide direction to guide investment and resourcing over the next 20 years. As the first infrastructure strategy for the LGA, this first iteration intends to outline the key priorities and principles for Council, in order to demonstrate how infrastructure will be managed practically and sustainably throughout periods of pressure and growth.

The strategy highlights limited infrastructure provision in conjunction with an increase in dwelling demand throughout the LGA has resulted in a backlog of works to service newly zoned residential land. This backlog has resulted in capacity and dilapidation constraints and an inability to adequately integrate new residential developments into local areas.

As a greenfield growth area, the strategy recognises Thrumster as one of the several areas in the LGA which has experienced increased housing density and pressure to extend infrastructure to accommodate urban growth. A key consideration is the availability and capacity of infrastructure to support new development, and a need to invest in ‘stepped’ capacity increases for water supply and wastewater infrastructure. …points include enhancing long-term water security, minimising the effects of sewerage discharge on the environment and greater use of recycled water (where it is fit-for purpose).

2.3 Key features of project surrounds

The project area is located on the North Coast of NSW in the Port Macquarie-Hastings LGA, approximately 160 kilometres south of Coffs Harbour. Land use around the WWTP is a mixture of rural residential, environmental management (coastal wetland), and transport infrastructure (Port Macquarie Airport). The pipeline routes cover recreational land use, Crown Land (Port Macquarie Racecourse and Rifle Range), local roads, and current or future urban residential land use. New pipelines for sewer, returned effluent, and recycled water rising mains would generally be located within utility easements and road reserves, passing through a number of zones.

The major features associated with the project are:

– Port Macquarie airport
– Roadways including Oxley Highway, Hastings River Drive
– Recreational areas including Port Macquarie Racecourse and Rifle Range
– Surrounding landholders and residential areas

2.3.1 Port Macquarie airport

Port Macquarie airport is owned and operated by Port Macquarie-Hastings Council. The airport serves the greater Port Macquarie and wider Mid North Coast region, and caters for approximately 230,000 passengers per year, making it the fifth largest regional airport in NSW.

The proposed WWTP is positioned approximately 1.5 kilometres west of the airport. The sewer rising main, power and communication and water main pipeline infrastructure would run adjacent to the airport runway, approximately 200 metres west, and divert along Tuffins Lane immediately north of the airport (refer to Figure 1-1). These pipeline components would be predominantly constructed via open trenching methods.

An Aviation Impact Assessment was undertaken to address potential aviation-related impacts associated with the construction of the project (refer to Technical Report 19 - Aviation Impact Assessment).

2.3.2 Recreational areas

Port Macquarie Racecourse

Port Macquarie Racecourse is operated by the Port Macquarie Race club and hosts approximately 20 race meetings annually. The track is situated on the Oxley Highway, approximately 3 kilometres west of Port Macquarie CBD and 3.2 kilometres east of the proposed WWTP.

The water main, sewer rising main, and return effluent to Kooloonbung Creek pipeline components would be located directly north from the racecourse along a section of Lady Nelson Drive. The sewer rising main would divert south along the Oxley Highway to the east of the racecourse. All components would be predominantly constructed via open trenching methods. The Oxley Highway underbore launch pit would be located on part of Lot 6 DP0790668 on the Crown Land managed by the Port Macquarie Racecourse.

Rifle range

The Port Macquarie Rifle Range (also known as the Port Macquarie Clay Target Club) is located approximately 2.5 kilometres east of the proposed WWTP site. The range is situated between the Port Macquarie Airport (approximately 900 metres west) and the Port Macquarie Racecourse (approximately 600 metres north-east).

No proposed works would occur on the range or in proximity to the range. However, the range is accessed via an unnamed road off Lady Nelson Drive. Construction of the water main, sewer rising main, and return effluent to Kooloonbung Creek pipeline components would occur along a section of this access road and Lady Nelson Drive, and therefore may disrupt access. Further detail on accessibility impacts is discussed in Chapter 13.

2.3.3 Surrounding landholders

There are several communities and townships in proximity to the project.

The proposed WWTP is to be constructed on a vacant cleared lot which has an adjoining landowner to the south-west on Lot 13 DP1139180. The project would acquire an easement to enable the construction of the proposed all-weather flood-proof access road.

The associated pipeline components and their proposed route would traverse several land use zones and be constructed in the vicinity of predominantly low-density residential land holdings, and industrial areas. The route is proposed along existing roads and easements and access to surrounding land uses would experience some disruptions during construction. Further detail regarding accessibility and the proposed mitigation measures is provided in Chapter 18 (Land use and property.)

2.4 Aligning with other major projects

Other NSW Government Infrastructure project and other major projects either underway or proposed near the project cumulative impacts were considered. Cumulative impacts were considered where there was enough project information available and if there is likely to be an overlap in construction or operational impacts. A search of the major projects register was undertaken on 16 October 2023 to identify other major projects that may contribute to cumulative impacts.

The potential cumulative of the following projects are addressed further in the impact assessment chapters of the EIS:

– Cowarra Water Supply Scheme SSI-57056461
– Hastings Secondary College Port Macquarie Campus Upgrade (SSD-11920082)
– Port Macquarie Health and Education Precinct (SSD-19888478)
– Cairncross Waste Management Facility Expansion (SSD-5792)
– John Oxley Drive Upgrade (Port Macquarie Hastings Council)
– Proposed Sancrox Quarry Expansion Project (Port Macquarie Hastings Council)

2.4.1 Consideration of cumulative impacts

Pursuant to the Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE 2022), the required approach to cumulative impact assessment (CIA) involves collecting additional data, investigating mitigation measures, agreeing on common methods and assumptions, and determining the scale and nature of the cumulative impacts in accordance with any relevant government standards or performance measures.

The following details the appropriate CIA methodology adopted for the purposes of this project:

– Confirmation that all studies and investigations supporting this EIS adequately represent both the local and broader impacts of the project.
– Collate data on approved or proposed developments on land surrounding the project site or which are likely to have an impact on (or be impacted by) the project.
– Review similar project, where required.
– Reviewing mitigation measures for the project to ensure the outcomes of the project are reasonable and feasible.
– Coordinating with proponents of adjoining projects to reduce potentially significant cumulative impacts.

Chapter 23 of the EIS also considers the project impacts on other utilities and infrastructure and how Council will work closely with other major projects to coordinate construction.

2.5 Offset agreements

SSI applications are subject to biodiversity assessment requirements under the Biodiversity Conservation Act 2016 (BC Act). Entry into the Biodiversity Offset Scheme (BOS) has been triggered for the project which necessitates the need for a biodiversity development assessment report (BDAR). Residual impacts to native vegetation will require retirement of 105 ecosystem credits and 895 species credits in accordance with the Biodiversity Offsets Scheme (summarised in Chapter 11 (Terrestrial biodiversity) and in full detail in Technical Report 5– Biodiversity Development Assessment Report). The proponent is considering options to apply for a biodiversity stewardship agreement, however these are yet to be confirmed. The proponent intends to acquire credits from a combination of sources, including from within existing resources, the open market, and the Biodiversity Conservation Fund.

2.6 Alternatives

As detailed in Section 2.1, Council has been developing the provision to construct a new WWTP since the early 2000s to service additional growth forecasted for the areas of Sancrox, Fernbank Creek, Thrumster and several catchment areas currently serviced by the existing Port Macquarie WWTP.

Several key studies have been previously undertaken to inform the design, function and overall facilitation of the Thrumster Wastewater Scheme which have highlighted the need for a new WWTP (CH2M Hill 2005).

The alternatives considered are detailed in the following sections to demonstrate the concept design process, and reasoning behind the selected preferred option.

2.6.1 Do nothing

The do-nothing option would result in continued pressure on the existing Port Macquarie WWTP, which is already operating at, and in heavy rainfall events, beyond its design capacity. The Do nothing alternative will not service new growth areas in Thrumster, Sancrox and Fernbank Creek areas of Port Macquarie. Additionally, the do-nothing option would likely result in a loss of maintenance and loss of sewage network containment, and therefore potential environmental contamination due to operational risks associated with capacity constraints. Existing system studies (PWA, 2020) have identified that this is not a feasible forward option.

2.6.2 Thrumster wastewater scheme

A Strategic Wastewater Management Plan (Beca HunterH20, 2023) was prepared to evaluate alternatives to address capacity constraints at Port Macquarie WWTP and service the new growth areas in the outer suburbs of Port Macquarie. The Strategic Management Plan built upon decades of investigations regarding alternatives to provide wastewater services to the growing population in Port Macquarie. Four options were included as part of the Strategic Wastewater Management Plan process including:

– Option 1 – Separate treatment facilities (Port Macquarie WWTP and Thrumster WWTP)
– Option 2 – Centralised treatment at Port Macquarie WWTP

– Option3 – Centralised treatment at new Thrumster WWTP
– Option 4 – Separate treatment facilities at Port Macquarie and Lake Road WWTP

A multi-criteria workshop was undertaken on 14 June 2023 with Council and key stakeholders to determine the preferred alternative for the scheme.

Option 1 – Separate treatment facilities (Port Macquarie WWTP and Thrumster WWTP)

Option 1 involves the continued operation of the existing Port Macquarie WWTP and a new treatment plant constructed at the Sand Plains site at Thrumster.

This option provides the ability to deliver treatment capacity by 2028 to service existing capacity constraints, provides opportunity to position the new WWTP away from areas with highest population density and has lower constructability and operational risks associated with construction during ongoing operations at an existing WWTP Under this option, Council anticipates minor refurbishment requirements may still be required at the existing Port Macquarie WWTP subject to separate approvals processes. This includes upgrading inlet works, refurbishing surface aeration and decants, and upgrading switchrooms. Further stages may involve decommissioning sludge lagoons and refurbishing sludge handling facilities. Notably, the existing UV system at Port Macquarie WWTP, currently in a flood zone and nearing the end of its service life, requires replacement.

Option 2 – Centralised treatment at Port Macquarie WWTP

Option 2 proposes centralising wastewater treatment at the existing Port Macquarie WWTP. This would involve an upgrade and conversion of the Port Macquarie WWTP to accept and treat all load during and after construction. This alternative necessitates the installation of fine screens, MBR (Membrane Bioreactor), and CIP (Clean-In-Place) chemical systems, alongside longer-term upgrade initiatives. A comprehensive condition assessment report for Port Macquarie WWTP indicated that certain elements of the longer-term works, such as inlet works upgrades, may be deferred for 10 to 30 years. Further investigation was deemed essential to facilitate sewage transfer from Sancrox west of the highway, with inherent complexities posing a risk of cost escalation.

High level capital, operational and present value cost estimates developed identified that Option 2 would potentially have the lowest capital and lifecycle cost however, Option 2 was considered to have a higher constructability risk due to construction on a brownfield and operational site (Beca HunterH20, 2023). In considering both cost and non-cost criteria, Option 2 was discounted.

Option 3 – Centralised treatment at Thrumster

Option 3 deviates from the current strategic plan in that the TWWTP would become a centralised plant. The TWWTP would accept and treat all loads. Port Macquarie would be rationalised to a centralised sewer pump station (Beca HunterH20 2023).

As part of the Strategic Wastewater Management Plan (Beca HunterH20, 2023), a high-level capital and operating cost estimates have been prepared for the purposes of comparing each option. Option 3 has a considerably higher capital and lifecycle cost than the other options. Non-cost aspects were also considered and assessed at the scoping workshop in May 2023.

Option 4 – Separate Treatment Facilities (Lake Road and Port Macquarie WWTP)

Option 4 involves establishing separate treatment facilities at the existing Port Macquarie WWTP and a newly constructed plant at Lake Road in Port Macquarie. The Lake Road site currently suffers from contamination issues, necessitating extensive earthworks and remediation efforts, which pose geotechnical and contamination risks. The proposed sewer rising main pipeline route to Lake Road runs adjacent to a wetland area, National Park, and residential zones, raising concerns about environmental impact and community sensitivity. Additionally, the site's proximity to a retirement village makes it closer to sensitive receivers compared to Thrumster WWTP. Upgrading the transfer main for recycled water would be necessary to accommodate increased capacity.

Unlike centralised treatment options, Option 4 involves managing two operational sites, which may not yield the same efficiency benefits. Redirecting wastewater to Lake Road instead of Thrumster may not optimise network benefits and could potentially increase risks of septicity and odour in Port Macquarie due to the transfer of sewage rather than effluent. Therefore, Option 4 has been discounted.

Preferred Option

An MCA workshop was facilitated by Beca HunterH20 on the 14 June 2023 in which Council scored the non-cost criteria for each option. The resultant scoring shows Option 1 construction of separate treatment facilities at Port Macquarie WWTP and TWWTP as the highest scoring option followed by Options 2 and then 3. The results of the MCA were presented the Strategic Wastewater Management Plan (Beca HunterH20, 2023) and identified that while Options 1 and 2 were similar in terms of cost within the level of accuracy of the option assessment, the Option 1 scored higher than Option 2 across many of the non-cost criteria including:

– Ability to deliver treatment capacity by 2028, as investigation and planning approvals are already underway for Option 1.
– Ability to address community concerns, as Option 1 limits expansion of the Port Macquarie WWTP operation which is located close to residents with associated odour, noise and traffic impacts.
– Lower constructability risks, as expansion of Port Macquarie WWTP as proposed in Option 2 was considered to have a higher constructability risk due to construction on a brownfield and operational site.

Option 1 involving a new WWTP at Thrumster and ongoing operation of the Port Macquarie WWTP was selected as the preferred option.

2.6.3 Thrumster WWTP site location

The specific location of the proposed WWTP site has been thoroughly discussed in previous studies sought to implement the Thrumster WWS. Previous site investigations have been undertaken since the early 2000's as part of an initial EIS (CH2M Hill, 2005), however multi-criteria analysis (MCA) was undertaken again in 2023 (Beca HunterH20, 2023) to ensure options were informed by current relevant data and site context.

The 2005 EIS (CH2M Hill, 2005) identifies four potential locations for the WWTP, including three locations to the south of the Port Macquarie Airport and one being the sandplains site. These are detailed in the following sub sections and are shown in Figure 2-1 for further reference and locational understanding. In determining the most suitable location for the proposed WWTP site, several constraints formed the basis for a comparative assessment of potential sites.. These included, but were not limited to, ecosystem protection, acid sulfate soils, Indigenous heritage, site access, proximity to service area, flooding potential, airport proximity, open water storage or ponds, proximity to urban areas.

Site A

Site A is located on a lower section of south-facing slope of small hill immediately south of the Port Macquarie Airport and east of the flight path (Figure 2-1). This site is extensively cleared of original forest vegetation however contains a moderate level of threatened species habitat and many Indigenous artefacts. The site was deemed unsuitable for other development due to isolation and proximity to flight path.

Site B

Site B is located on a south-facing slope of prominent hill in the south-east, approximately 1 kilometre south of the Port Macquarie Airport flight path (Figure 2-1). This site is extensively cleared of original forest vegetation however would pose possible odour and noise interference with potential development due to proximity to future urban land use (250m south). The proximity to the airport also poses height restrictions and increased risk of bird strike, as well as space limitation of expansion potential.

Site C

Site C is located on a north-west facing slop at the base of a prominent hill immediately south of the Port Macquarie Airport (Figure 2-1). This site is extensively cleared of original forest vegetation and is unlikely to interfere with potential urban development and existing residencies located 500 metres to the south. However, proximity to the airport poses height restrictions and increased risk of bird strike, as well as space limitation of expansion potential. The site was considered potentially useful for other land purposes which may be more appropriately suited to its characteristics, such as industrial or Council depot.

Site D

Site D is referred to as the 'sand plain site' and is located on flat open plain approximately six kilometres west of the Port Macquarie CBD and 1.8 kilometres west of the Port Macquarie Airport (Figure 2-1). This site comprises a flat sandy plain which has been extensively slashed and grazed with low elevation. It is positioned considerably distant from existing residencies and would be unlikely to interfere with potential development and poses greater opportunity for site expansion based on land availability. The site is also well distanced from the airport which possess no height restrictions in construction or operation of the WWTP. However, flooding potential is present across access routes to the area and the site would require land acquisition.

The non-cost criteria selected for evaluating the suitability of potential WWTP locations are listed in Table 2-1 including the evaluation of each site (Council, 2022b). Criteria were based off prominent natural and built environment characteristics across the area of Thrumster which posed key site constraints and thus would go on to inform the suitability and design of the preferred option.

Table 2-1 WWTP site location options – non-cost criteria option evaluation

Non-Cost comparison	WWTP site location option			
Criteria	**A**	**B**	**C**	**Sand Plain**
Cultural heritage	Fail	OK	~	OK
Hazard for airport	~	Fail	Fail	OK
Threatened species / Koala habitat	Fail	OK	OK	OK
Bushfire hazard (required clearing)	Fail	OK	OK	OK
Flooding hazard (required clearing)	OK	OK	OK	~
Access during dry weather and flooding	OK	~	~	~
Buffer zone	Fail	Fail	Fail	OK
Land acquisition	OK	OK	OK	OK
Risk of river crossing of mains	OK	OK	OK	OK
Distance from SPS and discharge points	OK	OK	OK	OK
Acid sulfate soils (ASS) / Contaminated soil	OK	OK	OK	~
Soil erosion	Fail	Fail	Fail	OK
Space for expansion	Fail	Fail	Fail	OK

Note:

OK: risk doesn't exist or is negligible and can be eliminated

~: risk exists but can be effectively and feasibly mitigated

Fail: risk is major and cannot be feasibly and effectively mitigated.

The comparative analysis of shortlisted options from both cost and non-cost criteria indicated that the sand plain site is the preferred location for construction of the Thrumster WWTP.

When the project was reconsidered as part of the TWWTP Site Location Option Evaluation (Council, 2022b), the four existing site options were considered and two extras added including Site E (north of the Hastings River) and Site F (south of the Oxley Highway), shown on Figure 2-1. This evaluation identified that Sites A, B and C failed due to a combination of reasons as listed above and site E and F failing due to threatened species risks, bushfire hazard, site access, land acquisition risks from the Hastings River, distance from existing facilities, discharge locations and soil erosion.

Site selection review and workshop

Once the preferred discharge location for treated effluent had been selected, it was identified that this would now be a considerable distance from the WWTP site and ongoing investigations have identified a geotechnical and environmental constraints at the sand plains site. Council has therefore undertaken a review of the criteria for selection of the preferred wastewater strategy to ensure that the proposed Thrumster WWTP provides the optimum solution to address Port Macquarie's wastewater servicing requirements.

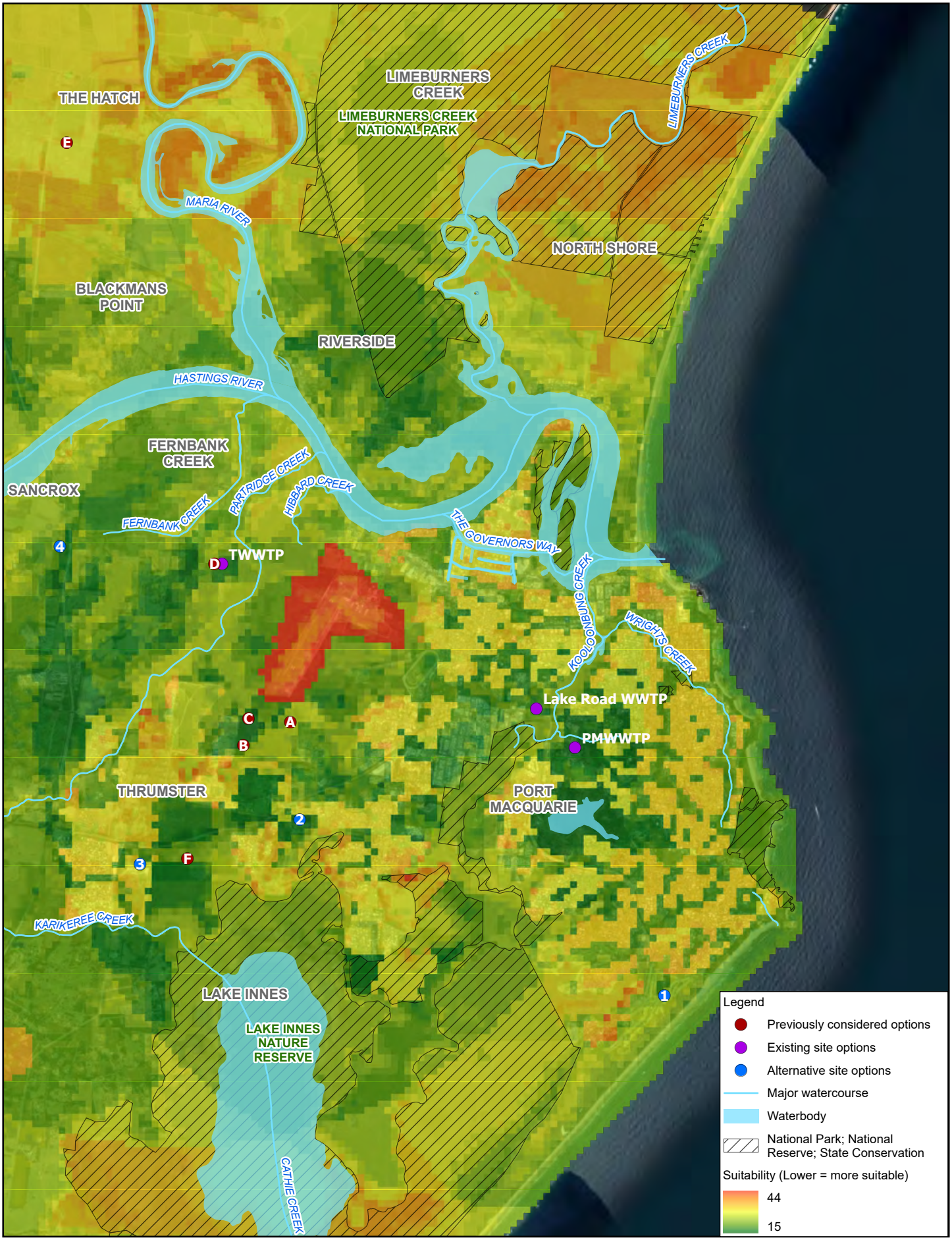
Following several workshops with the regulators and local communities, a Strategic Management Plan Review Workshop was undertaken on 15 December 2023 with GHD, Beca HunterH20 and Council to return to first principles and identify any potential "blue sky options" that may not have been previously considered as part of option development. The multi-criteria assessment (MCA) was reviewed with consideration of findings from initial environmental and ecological investigations. To undertake this exercise a Geographical Information System (GIS) based multicriteria analysis took was utilised to support the workshop, known as the Infrastructure Development - Geospatial Options (InDeGO) method to quantitatively evaluate potential siting locations based upon existing available GIS data.

Through the InDeGO method, stakeholder input is gathered throughout the process and the outcome is essentially creates a heat-map of potential sites based upon a suitability rating for environmental, heritage and surrounding land use criteria (refer to Figure 2-1). This process identified four additional sites for consideration and comparison. These are outlined below and reasoning for selection or otherwise.

1. Port Macquarie Golf course. Historically considered by Council as WWTP option. Old Lighthouse treatment plant which was decommissioned in 2008.
    a. Not consider further due to flood risk, distance from chosen effluent discharge, small size, conflicting use with golf course and proximity to residents.
2. Rural zoned land south of airport, near Innes Gardens Memorial Park. Site is proposed for rezoning as future residential.
    a. Not considered further due to landownership (private), future proposed zoning, constraints associated with emergency overflow to the sensitive environmental lands and surrounded by residential land.
3. Northwest of Lake Innes Nature Reserve, previously considered by Council. Slope/topography issues, steep site, core koala habitat, drainage toward nature reserve and contains naturally occurring asbestos.
    a. Not considered further due to being core koala habitat, is a steep site issues and drainage to Nature Reserve.
4. Rural site west of highway (Lot 50, DP1192295). Rural land, cleared paddock, cleared of vegetation, out of flood zone. Slope/topography issues, private ownership, and distance from network.
    a. Not considered further due to distance to chosen effluent discharge location at Kooloonbung Creek and possible approval issues with changing discharge location to Hastings River (upstream of oyster growers). Also, due to topography issues, private ownership, and distance from network.

Preferred option

After consideration of the initial six sites, then the additional four blue sky options, the GIS multicriteria showed that the sand plan site (proposed WWTP site) as most suitable. The existing Port Macquarie WWTP and adjacent site were mapped as potentially favourable however, the location in close proximity to high density of sensitive receivers, operational and constructability constraints, potential environmental impacts and additional time implications were present for these options. Following a number of MCA and associated workshops, Council re-affirmed its strategy to continue to provide wastewater treatment at the existing Port Macquarie WWTP to be augmented by the new WWTP at the Sand Plains site. Therefore, Site D is the preferred option for the project.



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Port Macquarie-Hastings Council.
Thrumster Site Selection MCA

Alternate options

Project No. **12587218**
Revision No. **A**
Date **18/07/2024**

FIGURE 2.1

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Print date: 18 Jul 2024 - 14:46

Data source: Geoscience Australia: 250k Topographic Data Series 3, 2006; LPI: DTDB / DCDB, 2023; World Imagery: Earthstar Geographics. Created by: afoddy

2.6.4 Effluent discharge alternatives

Three options were initially shortlisted for further consideration for the discharge location:

– Option 1 – Discharge to Partridge Creek via a polishing wetland
– Option 2 – Discharge to the Hastings River via a deep-water diffuser outfall
– Option 3 – Discharge to Kooloonbung Creek via a shoreline outlet

During the review of these options and discussion with stakeholders, two additional options were added:

– Option 4 – Discharge to the mouth of the Hastings River via a deep-water diffuser outfall on an ebb tide
– Option 5 – Discharge to the ocean via deep sea outfall from the North shore

These options are illustrated in Figure 2-1 and described in more detail in this section.

An MCA workshop with community and regulatory stakeholders was completed on 17 July 2023 to discuss four options initially pre-selected. The main outcome was the decision to further investigate the feasibility of the ebb-tide discharge (option #4) and the introduction of a fifth option, corresponding to an ocean outfall. A revised report, the Thrumster Wastewater Scheme Discharge Options (Beca HunterH20 2023a) was prepared to present the five pre-selected options. Stakeholders involved in these workshops included representatives from:

– Port Macquarie Hastings Council (PMHC)
– Department of Planning and Environment (DPE)
– Environmental Protection Agency (EPA)
– New South Wales Health – Mid North Coast
– North Side Progress Association (NSPA)
– Hastings Birdwatching Association
– Friends of Kooloonbung Creek

Two additional workshops were organised on 14 and 19 September 2023, to present the findings of the additional investigations and confirm the way forward (Beca HunterH20 2023a). The outcomes of these workshops and reporting are outlined in the options summaries below.

Figure 2-2 Overview of shortlisted options (BecaHunterH2O, 2023)

Option 1 – Discharge to Patridge Creek via polishing wetland

Under Option 1, treated effluent from the TWWTP is released to Partridge Creek and or Fernbank Creek via a treatment wetland. Discharge to the wetland would occur by gravity with flows varying with the diurnal flow patterns from the treatment plant. This option would require regular operational input for the maintenance of the wetland, with re-establishment of the wetland required every five years.

The construction of this option may impact the existing wetland ecosystem due to the clearing and earthworks required to form the polishing wetland's berm area. During operation, impacts to aquaculture would be present as this option has the potential to increase pathogen load for discharge (due to wildlife). Due to the environmental sensitivity of this option, performance would be highly dependent on the design, maintenance, and operation of the wetland. Other operational risks include vulnerability to climatic conditions and difficulty in accurately monitoring wetland treatment effectiveness.

As identified in the Thrumster Wastewater Scheme Discharge Options (Beca HunterH20 2023a), the wetland option was initially considered as the preferred option due to:

– The ability to mitigate acid sulphate soils and assist in management or remediation of bushfires.
– Higher sustainability values, specifically with regards to scope 2 emissions.
– Additional treatment barrier and nutrient removal prior to discharge.
– Potential to improve the current natural environment using diverse plant community types and standing water.

However, some risks associated with this option were identified. Concerns were notably raised by stakeholders around potential environmental impacts of discharging treated effluents upstream of the aquaculture zone.

Key risks identified include (Beca Hunter H20, 2023a):

– Hydraulic capacity of Partridge and Fernbank Creeks to be further evaluated.
– Salinity profile impact of freshwater discharges to be further investigated.
– Storm sewage flow management to be further investigated.
– Further definition of the project proposal including treatment plant process, extents of wetland and local discharge location.

– Investigation of potential environmental and ecological impacts on the existing wetland, and determination of offset costs accordingly.
– Assess potential impact on downstream agricultural land and risk of impacting on enjoyment of land. Define potential need for easements and/or acquisition accordingly.
– Potential impacts during construction on the acid sulphate soils to be investigated.
– Operation and maintenance requirements of the wetland.

This option was subsequently discounted.

Option 2 – Discharge to the Hastings River via a deep-water diffuser outfall

Option 2 corresponds to the transfer and discharge of treated effluent to the Hastings River, at the confluence with the Maria River. Discharge would be made through an outfall with a submerged deep-water diffuser system. The proposed pipe route follows the existing road network to the Hastings River.

This option would require additional operational input from Council, and additional assets to operate including one pumping station, one storage pond, three kilometres of large diameter pipeline and a deep-water outfall. The maintenance of these assets would require specialist contractor. During construction, this option would result in impacts to environmentally sensitive areas as pipelaying works would cross areas requiring clearing. This option also has the highest potential to increase the nutrient concentrations within the Hastings River and therefore result in impacts to estuary water quality. Potential impacts to aquaculture are also present in this option, as discharge would occur upstream of the oyster farms. Although dilution targets could be achieved in the estuary before oyster leases are reached, public acceptance of discharge occurring in proximity to the oyster farms would be difficult.

This option would also result in a permanent limitation of activities around the diffuser, unknown long-term impact on the river hydro-geomorphology and potential damage to the diffuser due to flood.

The MCA identified that (Beca Hunter H20, 2023a), although scoring ranked higher for Hastings River then Kooloonbung, all stakeholders agree that the Hastings River discharge is the least preferred discharge arrangement due to:

– Food Authority and oyster grower concerns over discharge located close to oyster growing areas and resulting water quality requirements.
– Potential for oyster lease closures and risk of impacting the oyster farmers' permits to export their products.
– Changing contours of the riverbed adds complexity to an outfall diffuser option.
– Conflict of river outfall with ability to use the river for large boats including business such as Birdon.
– Water body closures for construction and maintenance.

Therefore, this option is discounted.

Option 3 – Discharge to Kooloonbung Creek

Option 3 corresponds to the transfer and discharge of treated effluent to Kooloonbung Creek. Discharge would be made to the existing Port Macquarie WWTP discharge point at the Lake Road Lagoons before ultimate release to Kooloonbung Creek. This option is the original proposed discharge location for the WWTP since the early 2000s and would comprise the following facilities:

– Effluent storage pond at Thrumster WWTP
– Pumping station at Thrumster WWTP
– Rising main
– Gravity main to Kooloonbung Creek

Similarly to option 2, this option requires additional operational input from the Council. While there would be a longer length of pipe to operate and maintain, there is no new outfall included in this option. Discharges to Kooloonbung Creek are currently dominated by flows from Port Macquarie WWTP, and modelling of effluent discharges show that potential impacts to water quality and sewage overflows would be manageable with no perceived increase to concentrations.

This option presents the potential impact and public acceptance of discharge downstream of the oyster farms, with dispersion upstream depending on tidal conditions, even if dilution targets in the estuary before oyster leases are reached. Public acceptance of discharge to the Creek was considered a key social impact considering several community groups associated with Kooloonbung Creek, such as Friends of Kooloonbung Creek.

Key risks for this option identified during the MCA process (Beca Hunter H20, 2023a) that require further investigation include:

1. Hydraulic capacity of Kooloonbung Creek
2. Salinity profile impact of freshwater discharges
3. Flooding impacts
4. Storm sewage flow management
5. Potential environmental and ecological impacts on the creek and possible offset costs

Key opportunities for this option are:

– Configure pumping arrangement to transfer sewage to Kooloonbung Creek during storm events.
– Single discharge locations for Port Macquarie and TWWTP.
– Potential to use Lake Road lagoons for flow balancing of discharge.
– Co-construction opportunity for raw sewage rising mains and effluent transfer main.

After extensive consultation with the stakeholders, including regulators and public, considering the modelling, and MCA results (Beca HunterH20, 2023), and relatively lower impacts on the receiving environment, this option was selected as the most suitable discharge option. Option 3 is the preferred option for the project.

Option 4 – Discharge to the mouth of the Hastings River via a deep-water diffuser outfall as an ebb tide discharge

Under Option 4, treated effluent from the TWWTP would be pumped through a discharge pipeline to the Hastings River mouth for discharge via an outfall on outgoing tides (i.e. from high tide to low tide) to avoid transport upriver to the oyster areas. The discharge would be dependent on tidal conditions. Discharging on the outgoing tide and in a high flushing area would avoid the accumulation of nutrients or pathogens in the river.

This option requires additional operational input from the Council. The additional assets to operate include one pumping station with very large pumps, one large storage pond, 6.3 kilometres of large diameter pipeline and a 1-kilometre deep-water outfall. Maintenance of the latter would require specialist contractor. Furthermore, the ebb-tide discharge functioning would also add complexity to the system. Operating time would be updated daily based on tidal conditions. While this can be automated, it would require careful monitoring and supervision from the Council. This option is expected to attract the highest level of operation and maintenance involvement from the Council.

This option was recognised to have a significant impact on the following:

– Traffic and access along the pipe route, including Hastings River Dr and commercial zones.
– Construction noise and vibration associated with drilling works located at Westport Park for extended periods of time impacting residential, commercial and recreational (campground) areas.
– Recreational activities on the river due to installation of coffer dam and barge for six months, with potential safety issues.

Option 4 also presents several risks and is expected to have the highest carbon footprint. The key risks to facilitate this option would include:

– Delays due to complexity of the works for outfall installation.
– Potential damage to the diffuser due to flood or recreational activities in the channel.
– Potential for failure and inadvertent discharge during incoming tides and severe impact on oyster leases.
– Unknown long-term impact on river hydro-geomorphology (potential scouring effect around diffusers).

– High energy requirements due to very large pumps which may require significant upgrade of the local power supply system.

Therefore, Option 4 is discounted.

Option 5 – Deep sea outfall

Option 5 corresponds to the transfer and discharge of effluent to the ocean via a deep-sea outfall on the North Shore. The proposed pipe route follows the existing road network to the Hastings River crossing, it then continues along the road to the north shore beach with a second crossing at Limeburners Creek.

This option composes of the following facilities:

– Effluent storage pond at Thrumster WWTP
– Pumping station at Thrumster WWTP
– Discharge main
– Deep sea outfall

This option is considered to have the lowest impact on the Hastings River water quality due to avoidance of the river entirely. This option would result in impacts on traffic and access along the pipe route on the North Shore, and access to the North Shore beach during outfall installation. Potential delays are apparent due to the complexity of works required for the outfall installation and tidal conditions.

This option was discounted due to the following reasons:

– Potential disturbance to marine and aquatic ecology, and impact on water quality during installation of the outfall.
– Aboriginal and cultural heritage sites of significant value along the pipeline route (in vicinity of known midden sites and potential massacre site).
– Additional Aboriginal stakeholders north of Hastings River.
– Potential native title claims.
– Land acquisition and easement of Crown Land for the outfall.
– Highly complex works, risk of delays, cost increase and limited qualified contractors.
– Construction within the ocean can be highly affected by climate variability (large tides, wind, etc).

Preferred option

Option 3 involving a transfer to Kooloonbung Creek was selected as the preferred option for effluent discharge. The option was selected based upon extensive consultation with the stakeholders, including regulators and public, considering the modelling, and MCA results (Beca HunterH20, 2023), and relatively lower impacts on the receiving environment.

2.6.5 Treatment process alternatives

The proposed WWTP would be a modern treatment facility that would produce effluence of a quality suitable for discharge to the nominated location, considering environmental and community impacts. Three treatment options were considered for the WWTP:

– Intermittent reactor with pressurised membrane filtration
– Continuous reactor with clarifiers and pressurised membrane filtration
– Continuous reactor with submerged membrane filtration (MBR)

The following sections summarise the treatment options considered for the WWTP.

Option 1 – Intermittent with pressure membranes

The intermittent process is a commonly used activated sludge process in NSW and Australia, where both biological process and clarification are undertaken in one vessel. Commonly these are referred to as an intermittently decanted extended aeration (IDEA) reactors or sequencing batch reactors (SBRs).

The process operates on a time cycle of react with aeration occurring, settlement and a final decant. Most of the removal of biological oxygen demand (BOD) pollutant and nutrients occur in the react phase. Sewage is continually fed to the process even during the settle and decant phases.

Prior to discharge, a tertiary treatment system would provide filtration and disinfection. Filtration would be provided using pressurised membranes. Disinfection would be provided by chlorination. De-chlorination would occur prior to discharge.

An emergency storage pond of five mega litres (ML) was adopted for this option. A reuse plant to meet dual reticulation requirements would be provided, this includes UV disinfection. Filtration would be provided by the pressure membranes and chlorination would be provided by a chlorine system. Chlorine gas storage would be common for the discharge and reuse requirements.

Option 2 – Continuous with clarifiers and pressure membranes

Unlike an intermittent process, a continuous configuration de-couples treatment from solid-liquid separation allowing for continuous treatment. This means that timed cycles are not required, and the bioreactor is constructed with dedicated zones that are either anerobic, anoxic or aerobic. The mechanisms that occur in these zones do not change.

This option includes a bioreactor which would be a Continuous Stirred Tank Reactor (CSTR) consisting of:

– Anaerobic zone with mixers to facilitate biological phosphorus removal
– Anoxic zone with mixers to enable denitrification
– Aerobic zone with diffused aeration to enable nitrification
– Internal mixed liquor return (MLR) to recycle biomass for effective treatment

De-chlorination is required to prevent disinfectant entering the environment. For the dual reticulation demand, UV disinfection would be required to achieve the reuse log reduction requirements.

If power is lost to the facility and sewage was still being accepted, the plant would act as a primary settling process with solids separation provided by the clarifiers. This option is relatively straight forward to operate with the conditions within the reactor being constant. The return activated sludge (or sludge return from the clarifier to the anaerobic) is run at a fixed multiple of inflow. If needed the plant can be run at fixed conservative settings for a period if the programmable logic controller is lost without operator attendance.

Option 3 - Continuous with submerged membranes

This option utilises a continuous process with all the same treatment aspects compared to option 2 except for the following key differences:

– Fine screening to protect the membranes.
– Removal of the final aerobic zone as the immersed membranes require aeration for air scour which provides polishing nitrification.
– S-recycle de-aeration zone prior to the anaerobic zone. Returns from the membranes are at a higher rate of inflow than the clarifier option. The higher rate is required to ensure the solids concentration in in the membrane tanks are within concentration limits.
– Additional clean in place chemicals (sodium hypochlorite, citric acid and sulphuric acid).

The immersed membrane control logic is complex and, in the event of a major failure would be significantly more difficult to operate than the other process options. The submerged membranes (MBR) process requires regular maintenance cleans and period clean in place activities. Operationally this needs careful management to avoid breaching the ammonia limit.

For this option only, a full generator power backup was allowed for. As the membranes require recycle pumps, air scour and permeate pumps to move flow through the plant they do not fail safe hydraulically like the clarifier or intermittent option. It is important that a backup power supply is available for local power outages where the sewerage catchment is not impacted.

A storm storage pond has been allowed for to capture short increases of flow. If extensive rainfall occurs, then the storm pond may overflow to the environment. More membrane capacity could be added to the process however this increases the capital cost, moves more of the sludge biomass to the membrane train and increases aerobic mass fraction which complicates operation and nutrient removal. For environmental discharges, effluent will be chlorinated, and de-chlorination will occur prior to environmental release. For dual reticulation UV disinfection is required.

Preferred option

The multi criteria analysis (Beca HunterH20, 2023) identified treatment option 3 – a continuous process with submerged membranes (MBR) as the preferred treatment option.

– Option 3 had the highest overall score following the MCA and was the lowest cost option. This option was regarded as generally acceptable on non-cost criteria.
– Option 3 provides robust barriers to protect aquaculture from potential virus loads from the treated effluent and membrane filtration is required to remove solids for reliable chlorine disinfection for beneficial reuse.
– When comparing Options 2 and 3, Option 3 is preferred because:
    - MBRs have evolved significantly over time to provide reduced operating and purchase cost as well as a small bioreactor footprint which improves constructability.
    - Growing evidence to suggest that pressure membrane filtration such as that in Option 2 may be less robust as evidence by reports of failing validation testing for virus removal. The MBR process by comparison, has been found to provide a more robust pathogen removal barrier than pressure membrane filtration.

2.7 Preferred option

This section discusses the preferred options as discussed in Section 2.6. Consultation was also undertaken to deliberate on option development and the selection of the preferred alternative, including consideration of geotechnical and environmental constraints, and is detailed in Section 5.4.3.2.1. This was undertaken to ensure that the proposed WWTP provides the optimum solution to address Port Macquarie's wastewater servicing requirements.

2.7.1 Wastewater scheme option

Findings of the MCA in December 2023 were reviewed with consideration of the latest findings from initial environmental and ecological investigations. The MCA showed that Option 1 yielded the highest score and benefits against the applicable criteria. Council re-affirmed its strategy to provide wastewater treatment at two sites – the existing Port Macquarie WWTP and a new WWTP constructed at the Thrumster Sand Plains (Option 1). This option also enables future expansion to occur at both the Port Macquarie WWTP and Thrumster WWTP, particularly as the treatment facility in Thrumster is located in an area of future growth beyond the current horizon. With tradewaste managed at Thrumster, this option allows the recycled water schemes to be managed separately and yield potential benefits to any potable water reuse.

2.7.2 WWTP site location

Site D (the Sand Plain site), located to the east of Fernbank Creek Rd and west of Port Macquarie Airport, has been deemed the most suitable location for the construction of Thrumster WWTP and preferred option for the project.

The plant shall be located in vicinity of the Thrumster area to ensure efficient, feasible, and practical transfer of raw sewer to the WWTP via SPSs in compliance with Council's development policy of sequencing growth in Council's major growth areas (i.e., Area 13 as discussed in Section 1.1.1 and Section 2.1) based on vicinity to the existing infrastructure.

The preferred WWTP location was selected mainly for environmental reasons. Other site options were ruled out largely due to the presence of Aboriginal heritage areas, proximity to the airport, space limitations, and potential for other development.

The proposed WWTP site off Fernbank Road in a predominantly cleared area is considered to be of the most strategic and practical. It provides great opportunity for site expansion based on land availability and is less likely to be suitable for other development due to the surrounding wetlands. The tenure of the site being Council owned was also a contributing factor. The landscape of the site being predominantly flat and previously cleared, including shorter distance to SPSs, and already constructed rising mains made the sand plain option to most viable. Particularly when considering the lower power consumption and asset renewal costs associated with the preferred option in comparison to the alternatives.

Additionally, as it is situated in a considerably isolated area, it is less likely to interfere with existing or future residencies and is a suitable distance from the airport, reducing the restrictions associated with the height of structures and bird strikes (from bird accumulation at storage ponds) which prevailed at some of the other alternative sites. A comparison of options from both cost and non-cost criteria identified the sand plain site as the most suitable location for construction of the Thrumster WWTP and therefore the preferred option.

2.7.3 Discharge option

Option 3, discharge to Kooloonbung Creek is considered as the preferred option for the project. This option will consolidate effluent discharges with Port Macquarie WWTP discharges downstream from aquaculture leases in the Hastings River estuary and minimise risk to the environment.

2.7.4 Treatment option

The multi criteria analysis (Beca HunterH20, 2023) identified treatment option 3 – a continuous process with submerged membranes (MBR) as the preferred treatment option.

The recommendations of the Treatment Plant Options Assessment (Beca HunterH20, 2023) identified that:

– The treatment options for the Thrumster WWTP have been developed based on the construction of the Thrumster WWTP at the Sand Plains site. The options include costs associated with providing a higher treatment flow and storm pond storage to provide additional treatment to mitigate potential impact on the oyster growers downstream of this site.

3. Project description

This chapter provides a detailed description of the project features associated with construction and operation based on the current design. This includes infrastructure components, proposed construction methodology, program and working hours, temporary construction compounds, workforce numbers, access arrangements and how it would operate.

3.1 Overview

3.1.1 Project summary

The Thrumster Wastewater Treatment Scheme involves the development of a new WWTP located in Thrumster with associated pipelines and infrastructure in the Port Macquarie region on the NSW Mid North Coast.

The primary objective for the project is to support recent urban growth in the outer suburbs of Port Macquarie. The new wastewater scheme will reduce demand on the existing Port Macquarie WWTP and improve the resilience, redundancy and ongoing capacity of Council's infrastructure services, and facilitate planned future growth in the Thrumster, Sancrox and Fernbank Creek development areas.

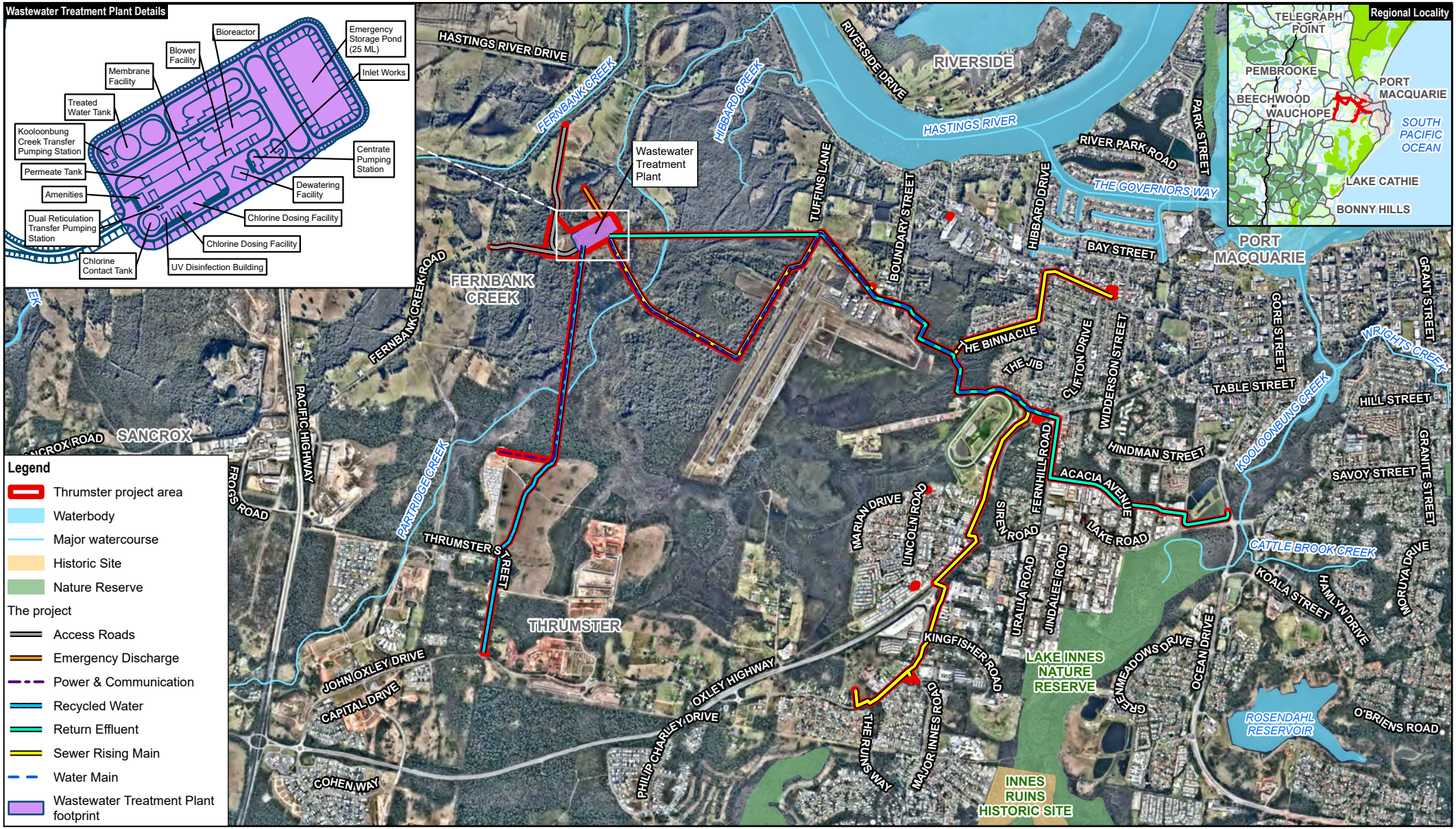
The project would include:

– New WWTP, including a recycled water plant within Lot 14, DP 1139180 on 433 Fernbank Creek Road Thrumster.
– Return treated effluent pipeline to Kooloonbung Creek.
– New access road to the WWTP and a supplementary flood-proof, all-weather access road.
– New sewer pump stations, sewer rising mains, recycled water mains and potable water connection.
– Upgrade works at identified existing sewer pump stations (SPSs) to reduce the current load on the existing system.
– Improvements to optic fibre and electricity supply.

An overview of the project and key components is presented in Figure 3-1 and described in Table 3-1.

The WWTP would be constructed on Council owned land on the floodplain adjacent to Partridge Creek, about six kilometres west of the Port Macquarie Central Business District. The treatment plant will be constructed on a raised earthen pad formed with imported fill to meet Council's flood protection requirements. A 20 metre Asset Protection Zone (APZ) has been applied to the current design and would be fully incorporated within the proposed cleared, filled and built area.

The project also includes sewerage infrastructure including sewer rising mains and recycled water mains, pump stations, an access road, an effluent pond, storage area, works compounds, and administration buildings. The indicative layout of each these key components of the project is shown in Figure 1-1. Key strategies to avoid, minimise or offset the impacts of the project have been considered through the design of the project. Pipelines routes have been designed to follow existing easements and cleared land, where practical, to avoid areas of high ecological value and potentially sensitivity of native vegetation/communities in the locality. Consultation with affected property owners, stakeholders and the local community will continue throughout the project assessment, design and construction phases to minimise impacts where possible.



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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Project overview

FIGURE 3.1

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Data source: PMHC: Infrastructure data, 2023; BECCA: WTP Design, 2024; Geoscience Australia: 250k Topographic Data Series 3, 2006; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023.
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Table 3-1 Project summary

Project element	Summary of the project	Reference
Site description		
Local Government Area (LGA)	Port Macquarie LGA	Refer to Section 1.1.1
Project Location	The WWTP would be located on Lot 14 DP1139180 at 433 Fernbank Creek Road approximately 6 km west of the Port Macquarie CBD. The project's linear infrastructure will be approximately 33.5 km long located within the Port Macquarie LGA as shown on Figure 3-1.	Refer to Section 3.1.1
Project disturbance area	The project disturbance area is approximately 55.042 ha.	Refer to Figure 1-1
Land tenure	– Port Macquarie-Hastings Council – Private land – State Roads – Crown Land	Refer to Section 18t
Wastewater Treatment Plant		
Process overview	– Stage 1 of the Thrumster wastewater scheme includes a WWTP to provide treatment capacity for 40,000EP and a design average dry weather flow (ADWF) of 9.2 ML/day. – WWTP provides capacity for treatment of flows up to 4 x ADWF or 36.8 ML/day. – The design of WWTP allows for future expansion to an 80,000 EP with ADWF of 18.4 ML/day (subject to future approval process). – WWTP treatment process includes a continuous bioreactor with submerged membrane separation or membrane bioreactor (MBR) providing mechanical and biological nutrient reduction in wastewater. – Biosolids dewatered onsite and transported for further treatment at the existing Cairncross organics recycling facility. – A recycled water plant incorporating UV and chlorine disinfection systems is included in design to provide treatment for up to 4.7 ML/day for non-potable reuse.	
Effluent management	– Effluent treated within MBR process will be pumped via return effluent pipeline to discharge with Port Macquarie WWTP effluent via existing discharge structure to Kooloonbung Creek. – Storm flows greater than 4 x ADWF will be temporarily stored in a 25ML storm pond and returned through the MBR process for full treatment. – Storm pond designed to overflow in extremely rare wet weather events to swale running through adjoining wetland to Partridge Creek). – Recycled water will be pumped offsite for use in the Area 13 (Thrumster) dual reticulation network using a duty/standby transfer arrangement.	Refer to Section 3.3.1 and Figure 3-4
Site access	– Access to the WWTP is via Fernbank Creek Rd from Hastings River Drive to the north, or Winery Rd to the south. • Primary access to WWTP via new 1.15 km access road to Fernbank Creek Rd to the north. • A secondary 563 metre flood-proof all- weather access road will provide access Fernbank Creek Rd to the west during flood conditions (see Figure 3-1).	Refer to Section 3.3.1

Project element	Summary of the project	Reference
Power supply	– Power would be supplied to the WWTP site from Essential Energy Boronia Street Zone substation via the grid in Boundary Street. – The maximum demand for the site is calculated to be 1.47 MVA for Stage 1 (2039), and 2.4MVA (3440A) for ultimate design capacity. – Two 1500 kVA transformers have been proposed for the site ~~transformer has been proposed for the site~~ to be installed above the Probable Maximum Flood Level (PMFL).	Refer to Section 3.3.5
Utilities and ancillary infrastructure	– All light fittings will be LED for energy efficiency and longevity. Lighting within buildings will be by motion sensor. – During detailed design site services including Closed Circuit TV system, smoke and fire detection and alarm systems, site and building security and access control systems design will be undertaken.	Refer to Section 3.4.3
Communication connection	– A Supervisory Control and Data Acquisition (SCADA) network would be provided. The switch rooms and amenities building (control room) would be connected via a multi-core multi-code optical cable.	Refer to Section 3.3.5
Linear Infrastructure		
Discharge main pipeline to Kooloonbung Creek	– Total length of 7.9 km including: • Pressure main length of 6.2 km • Gravity main length of 1.7 km	Refer to Section 3.3.4
Sewer rising mains	11.4 km of new sewer mains from Port Macquarie's outer suburbs	Refer to Section 3.3.2
Recycled water mains	3.3 km connection to the Area 13 dual reticulation system	Refer to Section 3.3.3
Potable Water main	5.2 km potable water connection the site	Refer to Section 3.3.1
Power and telecommunications	– Power and communication component would be approximately 5.2 km in length (Figure 1-1). – Power conduits from the future Thrumster Zone substation would also be installed as an alternative future power supply.	Refer to Section 3.3.5
Pumping Stations		
Sewage Pumping Stations (SPS)	Three new SPS and upgrades to five existing pumping stations within the sewerage system.	Refer to Section 3.4.2
Construction		
Compound sites	The construction of the project would involve establishment and use of compound sites and lay down areas for plant and equipment. Several of these are located within or directly adjacent to either new pump stations or upgrades to existing pump stations as part of the project.	
Construction workforce	Work force of approximately 60-100 full time equivalent (FTE) employees would be required during the construction phase of the project.	
Construction work hours	– Monday to Friday: 7:00 am to 6:00 pm – Saturday: 8:00 am to 1:00 pm – No work on Sundays or public holiday	
Out of hours work	– The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons. – Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm.	

Project element	Summary of the project	Reference
	– Situations where agreement is reached with affected receivers. – Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.	
Indicative construction schedule	It is anticipated that the construction works would commence in 2026 and reach completion by the end of 2027. Key project milestones and their estimated timeframe are currently indicative, nonetheless, are expected to be staged as follows: – Mobilisation and site establishment – Year 1. – Civil Works – Year 1 to Year 2. – WWTP and RWTP construction – Year 1 to Year 3. – Pipeline installation, including set out any underboring locations and laydown areas – Year 2 to Year 3. – Testing and commissioning – Year 3. – Site demobilisation and surface rehabilitation – Year 3.	
Vehicle movements	Vehicle movement would compromise both heavy vehicles and light vehicles. Access for emergency vehicles would be maintained at all times. Expected vehicle movements would consist of: – 110 light vehicles will arrive at construction site and 12 light vehicles will depart the construction site in the AM peak hour (typically around 6:00 am – 7:00 am). – 110 light vehicles will depart construction site and 12 light vehicles will arrive at the construction site in the PM peak hour (typically around 5:00 pm – 6:00 pm). – Up to 22 heavy vehicles with arrive and depart from the site during both the AM and PM peak hour.	
Plant and equipment	A range of plant and equipment will be required, including excavators of various sizes, concrete trucks, welding machines, bulldozers, contractor service vehicles, asphalting machines, dump trucks, rollers, boring/under boring/horizontal direction drilling equipment, mobile cranes of various sizes, rock breakers, concrete pumps, elevated work platforms, semi-trailers and vacuum trucks.	

3.1.2 Project application area

The project would be located at Port Macquarie on the Mid North Coast of NSW.

The WWTP is proposed to be located at site on 433 Fernbank Creek Road, approximately six kilometres west of Port Macquarie Central Business District. It would be constructed on the sand plains within the Partridge Creek and Fernbank Creek catchments, west of the Port Macquarie Airport and east of the Pacific Highway.

The WWTP would occupy an area of up to 12 hectares (about 400 x 300 metres) including ancillary facilities such as access, parking, and managed vegetation buffer for bushfire protection (see Figure 3-3 and Figure 3-4). The proposed site for the WWTP is situated adjacent to mapped coastal wetlands and intersects the proximity area for wetlands.

The project's linear infrastructure will be approximately 33.5 kilometres long located within the Port Macquarie-Hastings LGA.

The project application area incorporates the footprint of the proposed infrastructure together with areas required during construction including activities such as clearing, earthwork, building and similar activities, as well as ancillary activities such as laydown areas, access ways, or temporary structures.

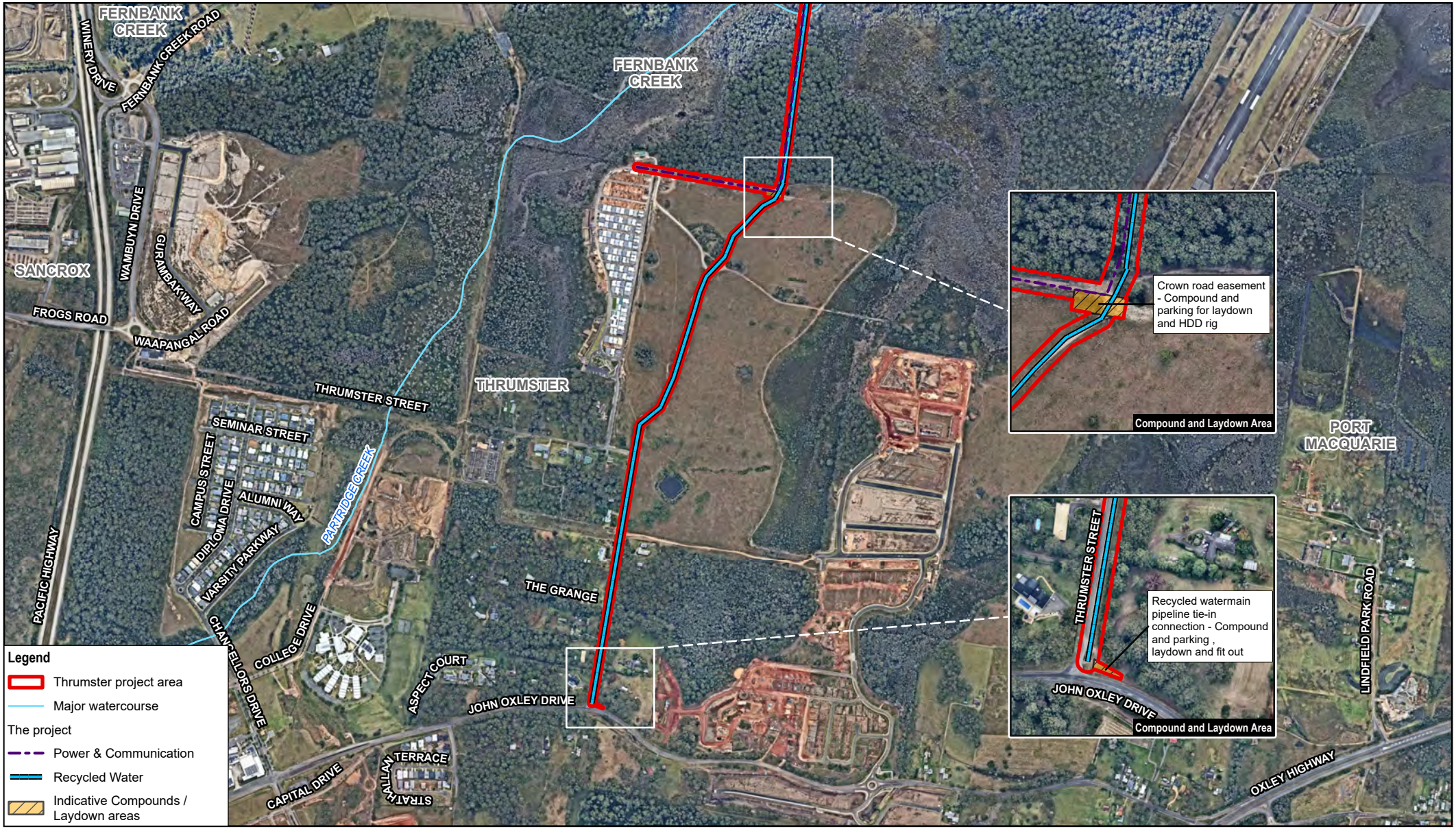
An outline of the project application area is shown on Figure 3-2a to d including indicative infrastructure layouts, construction footprints and laydown areas. The properties that are expected to be intersected by the project components are listed in Table 3-2.

Table 3-2 Project footprint

Project component			Lot and DP
Wastewater Treatment Plant			Lot 14, DP 1139180
Sewerage network	Lot 6, DP790668 Lot 2, DP1025083 Lot 132, DP754434 Lot 2, DP547484 Lot 1, DP242345 Lot 121, DP115661 Lot 686, DP722727	Lot 686, DP722727 Lot 121, DP115661 Lot 686, DP722727 Lot 25, DP1123026 Lot 10, DP1154561 Lot 239, DP754434 Lot 4, DP115306	Lot 238, DP754434 Lot 14, DP1139180 Lot 1, DP1087368 Lot 12, DP867928 Lot 4, DP255002

3.1.3 Estimated development cost

The estimated development cost (EDC) previously known as the capital investment value (CIV) for the project is $134 Million (excluding GST, contingency and escalation costs). This is based on a Concept Design Cost Estimation Report (Beca HunterH20, 2024) prepared in accordance with *PS 24-002 Changes to how development costs are calculated for planning purposes and the Standard Form of Estimated Development Cost Report (State significant projects)*.



Sheet Index

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

The Project
sheet 1 of 4

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 3.2a

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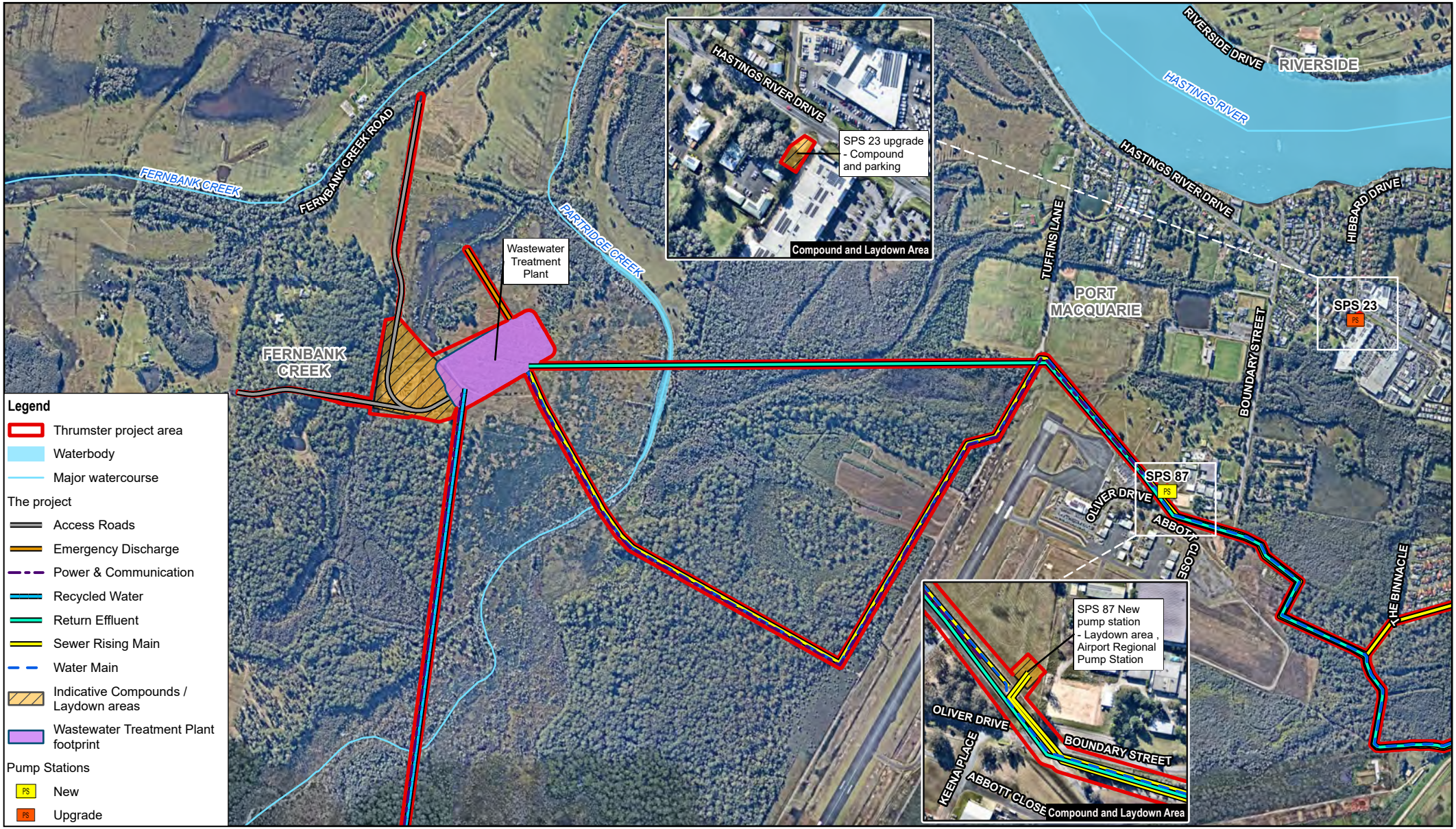

Sheet Index

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Horizontal Datum: GDA 1994
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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

The Project
sheet 2 of 4

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 3.2b

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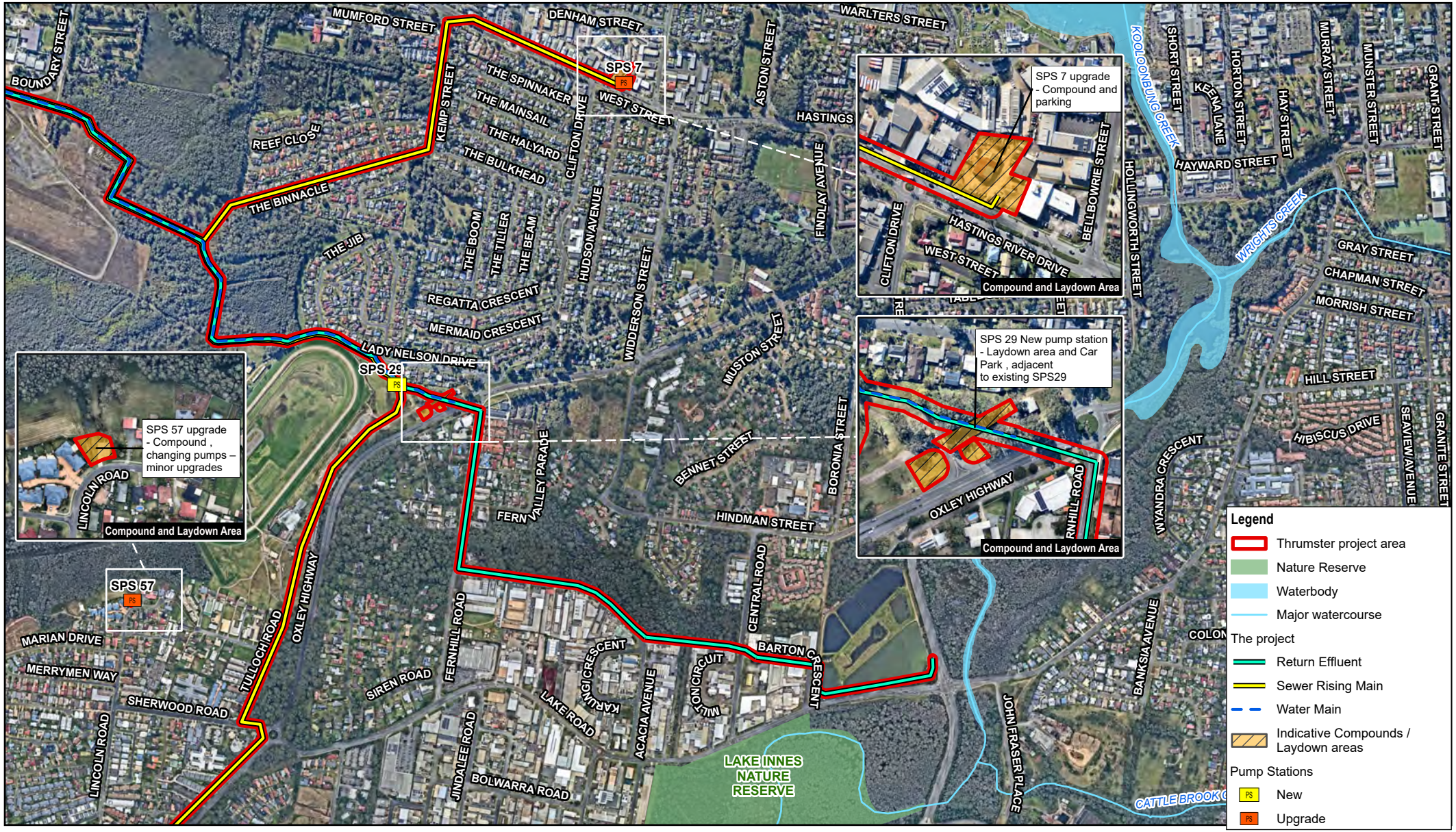

Sheet Index

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Horizontal Datum: GDA 1994
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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

The Project
sheet 3 of 4

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 3.2c

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Sheet Index

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

The Project
sheet 4 of 4

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 3.2d

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3.2 Design

3.2.1 Wastewater treatment plant

3.2.1.1 Process overview

The infrastructure approval application seeks approval for Stage 1 of the Thrumster Wastewater Scheme including a WWTP with a design capacity of 40,000 EP with a design flow of 9.2 ML/day. The WWTP is expected to be commissioned in 2027 and will reach the design horizon of 40,000 EP by around 2039 or later based on future growth projections.

The Thrumster WWTP will treat a portion of wastewater currently directed to Port Macquarie WWTP and service new connections from the Thrumster, Sancrox and Fernbank Creek development areas. The Stage 1 design horizon is based upon flows transferred from the existing Port Macquarie WWTP sewerage catchment and the predicted development in the outer suburbs of Port Macquarie. The flow projections incorporate a conservative allowance for flows from industrial and warehouse facilities. It is noted that the design horizon and operational life for Stage 1 of the scheme may extend beyond 2039 if residential and non-residential flows are lower than assumed in growth projections delaying the need for an expansion of the plant.

The design of the WWTP allows for the future expansion to an ultimate capacity of 80,000 EP and a design flow 18.5 ML/day with an ultimate design horizon of 2071. Consideration for a future upgrade has been given as part of the hydraulic design, site layout and process sizing of treatment units within the Stage 1 development.

The WWTP treatment process includes a continuous bioreactor with submerged membrane separation. The membrane bioreactor (MBR) is an advanced wastewater treatment technology capable of mechanical and biological nutrients reduction in wastewater.

The WWTP provides full treatment for flows up to four times the average dry weather flow (ADWF) or 36.8 ML/day. Flows in excess of 4x ADWF will be directed for temporary storage in a 25 ML storm storage pond, prior to being returned for full treatment when inflows return below the capacity of the plant.

The WWTP includes a recycled water plant with an ultimate design capacity of 4.7 ML/day to provide water to the Thrumster Area 13 recycled water scheme. The recycled water plant is located will be located within the footprint of the WWTP and is equipped with UV and chlorine disinfection systems to provide multiple barriers against pathogens for the non-potable recycled water.

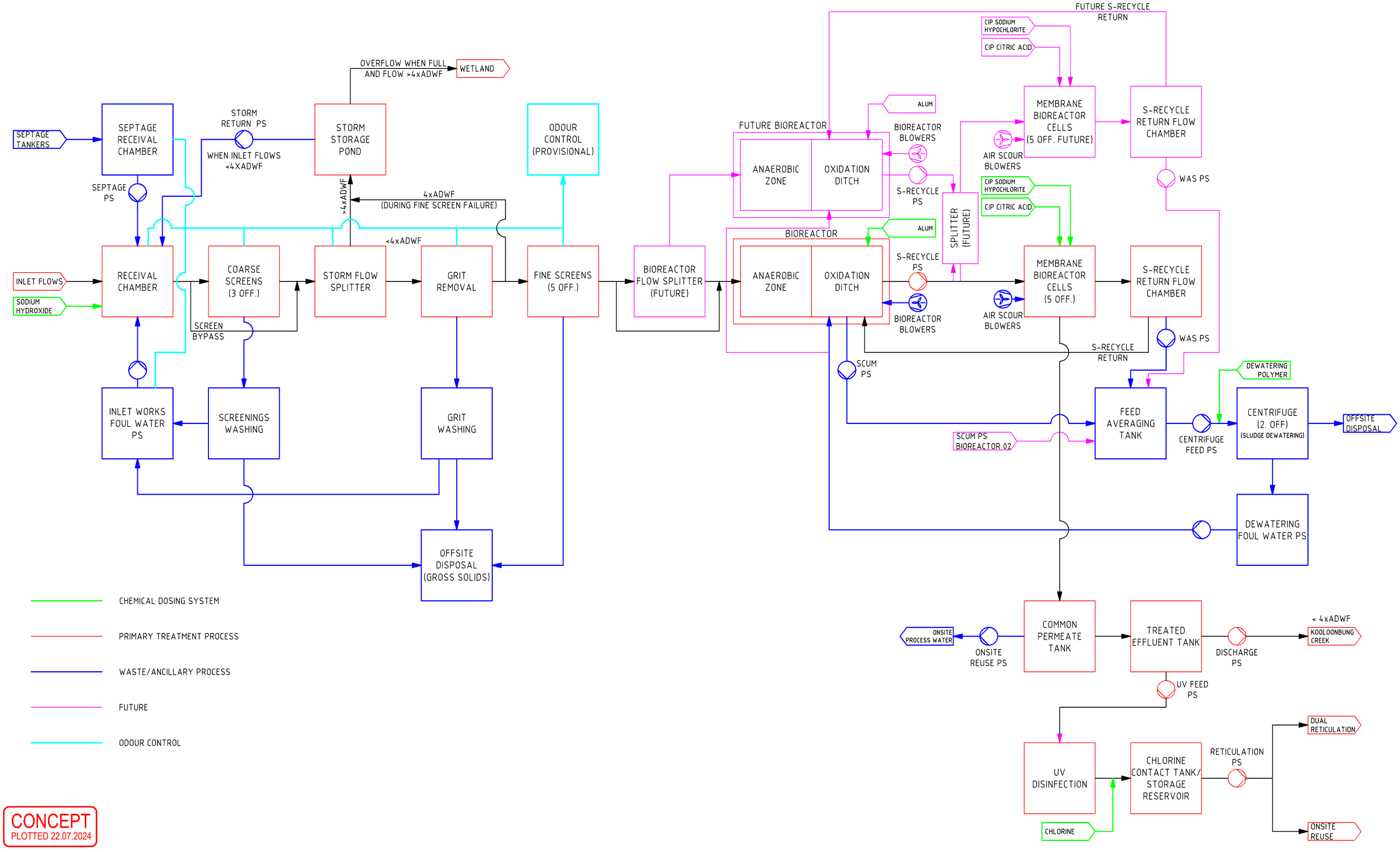
Biosolids produced by the treatment process would be dewatered and transported for further treatment at the Cairncross organics recycling facility, owned by Council and operated by Remondis. The detail design of each of the key components and structures of the project would be in accordance with all applicable industry standards and will continue to be refined through the approval process.

An overview of treatment process for the WWTP is summarised in Table 3-3 and with a process flow included on Figure 3-3.

Table 3-3 Thrumster WWTP process overview

Treatment	Summary
Inlet reception	– A dedicated septage receival area will accept and hold tankered waste delivered to the site. The tankered waste will be screened and transferred to the inlet works using a pumping station. – Foul water from various pumping stations throughout the plant will also be returned to the inlet works.
Preliminary treatment	– Combined raw influent is screened using three 5 mm aperture band screens. – Captured screenings are transferred to and washed within one of two screenings wash presses. Washed and dewatered screenings are deposited into a bin for collection. – Excess influent passes over a weir to the storm storage pond. – Grit in the raw influent is removed by a vortex style grit chamber. Dense particles settle to the bottom of the grit chamber, lighter organic particles continue to fine screening.

Treatment	Summary
	– The pump transfers grit to the grit washer to separate any captured organic material. Cleaned grit is dewatered and deposited into a bin for collection. – Excess liquid from the screening and grit washing is returned to the inlet works via inlet works foul water pumping station. – Fine screened influent will gravitate through a pipe to the bioreactor anaerobic zone.
Storm storage and return	– Storm flows into the balance tank greater than 4x ADWF will bypass the secondary treatment process and flow to the storm storage pond. – The storm storage pond will have a working volume of 25 ML. It will have an emergency flow relief via a drainage channel through wetland to Partridge Creek. – Once flow returns back to less than 4x ADWF, storm return pumps will transfer stored influent back to the inlet works for treatment.
Secondary treatment	– Three anaerobic zones in series combine sludge from the membranes (s-recycle) with the incoming raw feed. – Within the bioreactor, mixed liquor circulates around the ditch cycling between anoxic and aerobic conditions. – Diffused aeration grids with air supplied by blowers raise the dissolved oxygen concentration to the target levels. – Pumps transfer mixed liquor to the membrane trains. – Membrane trains perform solid liquid separation, clean permeate is removed using a dedicated pump per train and the remaining solids will overflow the internal weir in the outlet channel and return by gravity fed back to the anaerobic zone of the oxidation ditches.
Effluent management	– Membrane permeate will be pumped to the permeate storage tank, the permeate pumps can also operate in reverse for membrane cleaning. – The permeate tank is designed to stay full unless a membrane maintenance or CIP clean is occurring. – The Kooloonbung Creek discharge pumps connected to the treated effluent storage tank will transfer effluent discharge flows to Kooloobung Creek.
Solids management	– Solids generated in the bioreactor are removed as waste activated sludge (WAS). – WAS pumps will be used to maintain the required plant sludge residence time (SRT) and will be duty/standby dry mounted submersible pumps. – The WAS pumps remove thickened sludge from the membrane outlet channel. – The WAS will be pumped to a smoothing tank in the dewatering building. – Dewatered sludge will enter a horizontal screw conveyor and be evenly distributed across the trailer using slide gates. Trucks will dispose of the dewatered biosolids offsite. – The foul water from dewatering will flow into the dewatering foul water pump station to be pumped back into the bioreactor anaerobic zone.
Chemical systems	– Alum can be dosed into the aerobic zone of the oxidation ditch, just prior to the secondary anoxic zone. Sodium hydroxide can be dosed in two locations: the inlet works receival chamber and the CIP return line.
Recycled water system	– A portion of the effluent will be transferred from the treated effluent storage tank, through an in-pipe UV system arrangement to a chlorine contact tank. – The UV disinfected effluent is dosed with chlorine on the inlet. The chlorine contact tank will also act as a storage reservoir by maintaining a minimum level for chlorine contact. – The recycled water will be pumped offsite for use in the Area 13 (Thrumster) dual reticulation network using a duty/standby transfer arrangement. – A small booster pumpstation will supply recycled water around site which may come in contact with operators (i.e. hose reels and chlorine carrier water), it is also used for onsite toilet flushing.
Process water system	Process water used for equipment washing will be drawn from the permeate storage tank, this is for systems which have the appropriate guarding (i.e. screens, washing systems, carrier water, etc). The process water is distributed around site using a duty/duty/standby booster pumpstation.
Potable water system	Potable water is supplied to site via gravity and will be used for amenities, safety showers, polymer batching and firefighting purposes.



CONCEPT
PLOTTED 22.07.2024

REV.	DESCRIPTION	INITIAL	DATE
C	100% SUBMISSION	SRB	22/07/24
B	FINAL DRAFT - 90% SUBMISSION	SRB	11/06/24
A	PRELIMINARY	SRB	12/04/24

PORT MACQUARIE HASTINGS COUNCIL

SCALE @ A1

Beca hunterH2O

DESIGNED: DE
DRAWN: SRB
SURVEYED:

COORDINATE SYSTEM: N/A
ORIGIN OF LEVELS:
N/A

FILE PATH: P:\HH2O\Port Mac C\9036 Thrumster WWTP Concept Design\PID DWGS\1 - CURRENT WORKING\9036 THRUMSTER WWTP CD\PID DWG\DWGs\9036-006 PROCESS FLOW DIAGRAM.dwg

APPROVAL

ENGINEERING DESIGNER DATE

DESIGN MANAGER DATE

GROUP MANAGER INFRA DELIVERY DATE

PROJECT: THRUMSTER WASTEWATER TREATMENT PLANT CONCEPT DESIGN

DRAWING TITLE: PROCESS FLOW DIAGRAM

SHEET 006 OF 091

PROJECT NUMBER: 9036

REVISION: C

3.2.1.2 Effluent management

Effluent treated within the MBR process will primarily be pumped via the return effluent pipeline to discharge with Port Macquarie WWTP effluent via existing discharge structure to Kooloonbung Creek. A treated water tank is included at the WWTP for storage and flow balancing prior to pumping to the discharge location approximately eight kilometres east of the site. Three transfer pumps are provided to operate as duty, assist and standby mode will be capable to transfer up to 4 x ADWF or 36.8 ML/day of treated effluent for discharge to Kooloonbung Creek.

Flows in excess of 4x ADWF will be directed for temporary storage in a 25 ML storm storage pond, prior to being returned for full treatment when inflows return below the treatment capacity of the plant. The 25 ML storm storage pond is designed to overflow in extremely rare wet weather events (approximately four in 12 years for Stage 1 development) to a swale running through the adjoining wetland to Partridge Creek.

The MBR is an advanced wastewater treatment technology which produce a high quality effluent quality suitable for either environmental discharge or recycled water reuse.

The adopted design effluent criteria for discharge to Kooloonbung Creek is presented in Table 3-4.

Table 3-4 Adopted effluent quality design criteria

Parameter	Units	90%ile	100%ile
Biological Oxygen Demand (BOD)	mg/L	10	15
Total Suspended Solids (TSS)	mg/L	15	20
Ammonia (NH_4)	mg/L	2	5
Total Nitrogen (TN)	mg/L	10	15
Total Phosphorous (TP)	mg/L	1	3
Oil and Grease	mg/L	5	10
Faecal Coliforms	cfu/100mL	200	600
pH			6.5 – 8.5

The Thrumster MBR process provides superior pathogen reduction 2.0 log LRV of virus in comparison the 0.5 LRV of virus from existing Port Macquarie WWTP. The combined flows are discharged to Kooloongbung Creek and additional disinfection for discharges from the Thrumster WWTP is not proposed.

Chlorine and UV disinfection systems are included within recycled water plant for provision of recycled water to the Thrumster Area 13 Recycled water scheme. Two guidance documents outline the specific log reduction targets associated with direct human exposure to pathogens for recycled water schemes in NSW including:

– Australian Guidelines for Water Recycling (AGWR)
– NSW DPE Recycled Water Management Systems Guidance Document

The log reduction requirements associated with dual reticulation are provided in Table 3-5 with the most conservative guideline value selected for the project.

Table 3-5 Log reduction credits for dual reticulation

Guideline	Virus	Protozoa	Bacteria
NSW DPE	6.4	5.0	5.1
AGWR	6.5	5.0	5.0
Adopted requirement	***6.5***	***5.0***	***5.1***

3.2.1.3 Bioreactor process

The bioreactor facilitates the necessary organics and nutrient removal required to meet effluent quality requirements. The bioreactor (activated sludge process) would comprise of the following key components:

– Oxidation ditch including submersible mixers
– Three anaerobic tanks including submersible mixers
– Diffused aeration system
– Membrane feed system
– WAS pump station
– Scum Harvester

A distribution channel would provide flexibility to introduce the anaerobic cell mixed liquor at different points within the oxidation ditch, which would fine tune nutrient removal performance. Anaerobic cells provide the required conditions required for the removal of pollutants.

Submersible mixers within the oxidation ditch would maintain channel velocities to ensure mixed liquor remains in suspension and provides high levels of internal recycle that enhances the nutrient removal process. As the mixed liquor moves away from the aeration grids, the dissolved oxygen decays as it is utilised by the bacteria before reaching anoxic conditions prior to the introduction of incoming sewerage.

The diffused aeration system would comprise of three positive displacement, variable speed blowers operating in a duty/ assist/ standby arrangement. These blowers would be housed within a dedicated blower building that would also accommodate the membrane system blowers and would be contained within an acoustic enclosure. The blowers would be fitted with inlet and outlet pressure switches to identify fault conditions.

The membrane feed system would comprise of five membrane feed pumps which would extract mixed liquor from the oxidation ditch and deliver it to membrane tanks. The pumps selected are large dry mounted submersible pumps to ensure operation during a flood and reduce recovery time once flood waters recede. The mixed liquor overflows each membrane tank and enters a common channel before returning to the oxidation ditch aerobic zone via gravity.

A scum harvester has been included in the design to remove the build-up of scum from the bioreactor and deliver it to the dewatering system. The scum harvester uses a system of scum collectors which scrape the oxidation ditch surface minimising the entrainment of water from the oxidation ditch.

3.2.1.4 Membrane system

The MBR system comprises five membrane trains and are configured in a 4x duty and 1x standby arrangement. The four duty trains will be able to extract up to 4x ADWF as permeate (matching the maximum flow rate through the treatment process). The membrane racks are fixed to brackets mounted on the concrete tank walls and support brackets on the floor. Each rack is connected to permeate and air supply headers that respectively remove permeate and provide process air to the system.

The feed is introduced into each membrane tank through a channel and inlet plate designed to direct the flow between the membrane trains for even distribution. The permeate pumps provide the suction across the membrane to draw permeate (effluent) through the membrane and deliver it to the permeate storage tank. Reverse operation allows flow through the membranes and into the membrane tanks during maintenance washing and clean in place.

The membrane racks are fitted with designated lifting points for installation and removal that requires the use of a mobile crane. Sufficient space has been allowed to park a crane on the road or washdown bund behind the membrane facility (on the lower tier level). Access has been provided across the whole membrane structure to enable safe access to all equipment and racks for removal. An area designated for membrane maintenance has been provided. Drainage from this area is returned to the foul water pumping station.

The level within each membrane tank is continuously monitored by a level transmitter. The permeate and backwash flows are monitored and controlled by a flow meter. Sample lines upstream and downstream of the permeate pumps allow use of turbidity analysers in both forward and reverse. Flow through the sample lines is regulated by a solenoid valve to ensure samples can be collected when the pump is running in either direction. Sample drains are directed towards a common drainage system that gravitates back to the inlet works.

3.2.1.5 Sludge handling system

Waste activated sludge is taken from the membrane system outlet using duty/standby dry mounted submersible pumps. Two centrifuges will be provided and operate in a duty/standby configuration to enable biosolids dewatering. Centrifugal forces applied to polymer conditioned sludge within the rapidly rotating bowl separate the solids from liquid. Sedimentation occurs on the bowl wall as it rotates, i.e. solids accumulate on the outside of the bowl with 'water' forming a supernatant (centrate) layer 'on top' of the solids. Polymer dosed for the centrifuges will be an emulsion type polymer that aligns with the Port Macquarie WWTP.

Dewatered biosolids will be discharged into a horizontal screw conveyor to a truck for transport to the Cairncross organics recycling facility. A series of slide gates will determine the location of where the biosolids are deposited across the truck trailers. The centrifuges and conveyor are elevated above the trucks, which drive in one end of the building and out of the other facilitating a drive through arrangement. Position sensors and traffic light (red/green) notification will indicate to the truck driver when the trailer is in the correct position. Level of the trailers is to be monitored using cameras.

Centrate and foul water from the dewatering system is directed to a sludge handling foul water pumping station for return through the bioreactor process.

3.2.1.6 Bulk chemical storage and dosing

The bulk chemical dosing system consists of the storage of alum and sodium hydroxide to meet licence requirements and ensure process stability. Membrane clean-in-place (CIP) bulk chemical storage for sodium hypochlorite and citric acid is also included in the bulk chemical storage area. Polymer dosing is considered separate, operating exclusively in the dewatering building.

Chemicals would be delivered by bulk delivery tanker and stored in the bulk storage tank. Level alarms measured by a dual radar level instrument would indicate when the storage tank nears empty so that a delivery can be ordered.

Deliveries would arrive by tanker and be pumped from the tanker to the storage tank. The pump would be powered by a local panel at the filling station. The power to the pump would be automatically inhibited once the bulk storage tank is full, preventing overflows. The local level indicator panel would also assist the tanker delivery operator with filling. Any spills that occur would be captured in a road delivery bund and transferred to the septage pump station.

The storage tank and dosing pumps would be located within a bunded area. The bund is sized to contain more than the volume of the storage tank in case of tank or pipe rupture. Flush points would be provided for each pump and dosing line to allow flushing of chemical prior to maintenance. Eyewash and safety showers would be provided in the unloading area, within the bund and near the dosing pumps. If a safety shower is used for a delay time, an alarm would be raised.

3.2.1.7 Effluent reuse through recycled water treatment

Council currently supplies recycled water to the customers in Port Macquarie and part of the Thrumster area through third pipe scheme via approximately 11 kilometres of diameter nominal (DN)250 trunk main between the Port Macquarie RWTP and the Thrumster recycled water reservoir.

The recycled water produced by the Thrumster WWTP would be of a dual reticulation standard that aligns with the current AGWR. The following infrastructures are proposed as part of the project:

– Recycled water plant with the capacity of 4.7 ML/day providing UV and Chlorine disinfection following tertiary treatment within the Thrumster WWTP.
– Recycled water pump station.

– New recycled water trunk mains between the and the existing Thrumster RW reservoir to supply the Area 13 (Thrumster) dual reticulation network.

Effluent produced from effluent storage tanks would be pumped using the UV feed pumps to the chlorine contact tank via the in-pipe UV disinfection units. Post UV disinfection, the effluent would be chlorinated using chlorine solution. The chlorine contact tank would provide the necessary contact volume to provide the required performance for virus removal.

Chlorine gas would be provided to enable disinfection. The system would be contained in a standalone building with a drum storage room and ejector room. The chlorine rooms will be fitted with mechanical ventilation, chlorine leak detection and provision made for a chlorine scrubber.

A duty/standby dual reticulation pumping station will transfer disinfected effluent into the dual reticulation network and to the Area 13 storage reservoir.

A connection on the discharge main would provide onsite use of recycled water for hose reels, amenities toilet flushing and chlorine service water.

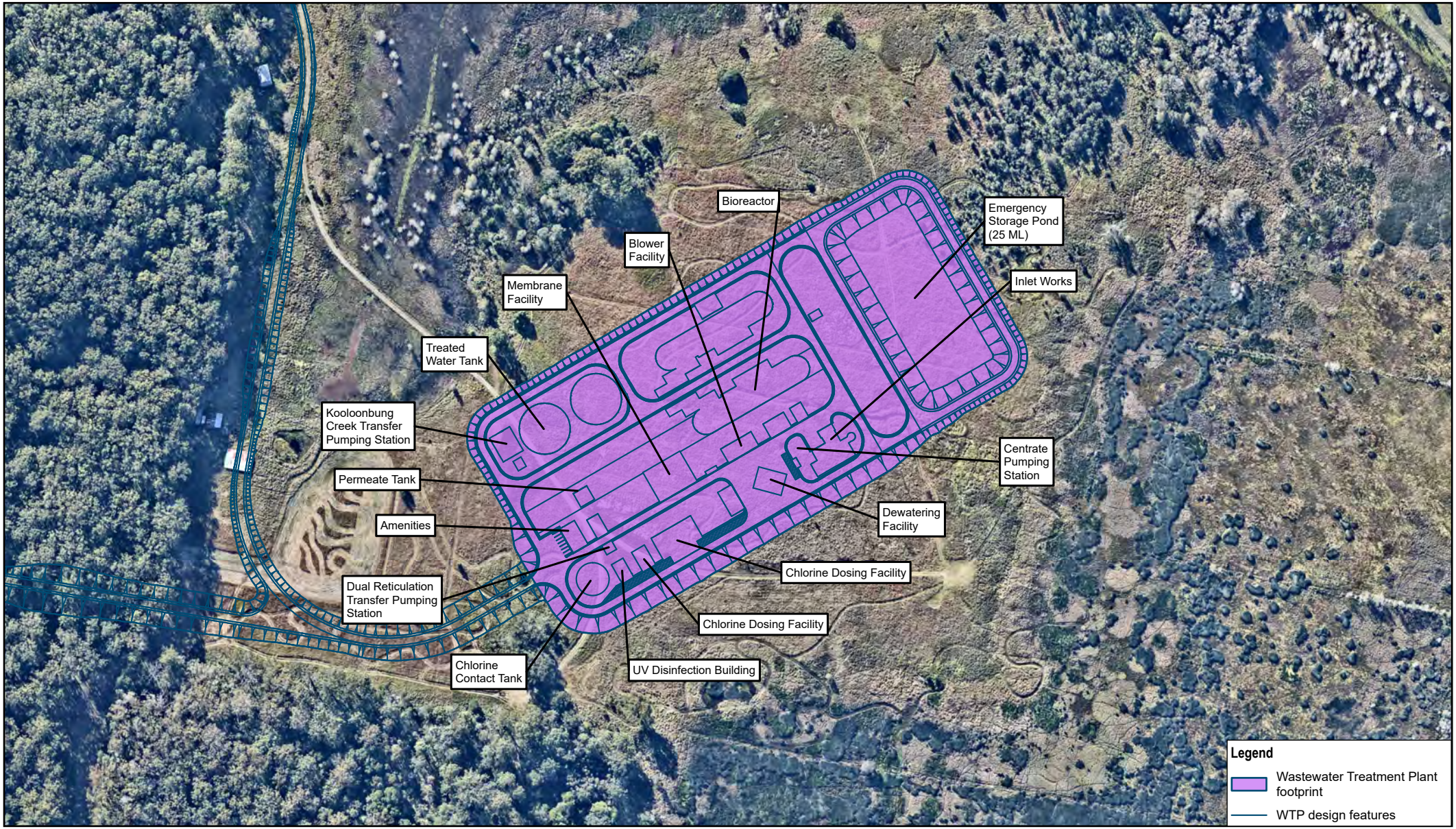
3.2.1.8 WWTP site layout

A 3D model is included on Figure 3-3 and an overview of the WWTP site arrangement is included on Figure 3-4. The layout of the site comprises the following key features:

– Operator amenities building located at the entrance to the site, providing operators with good visibility of people accessing the site. Parking has been provided at the amenities building to help reduce unnecessary traffic moving further into the plant.
– Road design of the treatment plant separates heavy vehicle traffic from other operational areas. The heavy vehicle traffic route onsite provides access for chemical deliver, septage delivery, dewatered sludge removal and removal of screening and grit skips from the site.
– The WWTP will be positioned on an elevated pad developed above Flood Planning Level (FPL) 3 at 4.1 metres AHD with critical infrastructure positioned above FPL 4 at 6.7 metres AHD.
– A space allowance for a future expansion for construction of a future bioreactor and additional treated water tank.
– Location of the blower building close to linked structures allowing air transfer pipework to be constructed in overhead main and reducing the need to underground pipe runs.
– Locating switch rooms close to equipment with the larger power demands to reduce run lengths and improve supply efficiency.

The current layout also includes corridor allowances for pipe plant work, electrical conduits, and other services.

Figure 3-4 3D model layout and overview of the Thrumster WWTP



Paper Size ISO A4

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

WWTP site arrangement

FIGURE 3.5

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Print date: 22 Jul 2024 - 11:15

Data source: BECCA: WWTP Design, 2024; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

3.2.1.8.1 Access roads and parking

Access to the WWTP is proposed via a new access road off Fernbank Creek Road to the north of the WWTP which is accessible from Hastings River Drive and the Pacific Highway.

The main access road would follow the general alignment of the existing unformed dirt track (crown road) and will be subject to inundation in a 5% AEP flood. The main access road will provide access for a 19 metre articulated vehicle to enter the site. The access road will comprise a sealed pavement with rollover kerb and gutter and slowly grade up from Fernbank Creek Road to the WWTP pad level. In areas where heavy vehicles are turning, rigid pavement will be provided maximise the service life of the road.

An alternative all weather access road has also been proposed across the neighbouring property directly west of the site, connecting directly with an elevated section of Fernbank Creek Road to the west and south. This road would only be used in flood conditions, allowing access and egress from the site during a 1% AEP event including for heavy rigid vehicles.

The administration building overlooks the main access road and parking has been provided at near the plant entrance to reduce unnecessary vehicle traffic around the plant and help alert operators to incoming traffic such as chemical deliveries.

The structure and road arrangement has been designed as such that heavy vehicles will remain on the top pad and a separate bay is provided for delivery vehicles to pull into, adjacent to the chemical storage area, minimising traffic disruption to the rest of the plant.

Dedicated areas have been provided for the trailer bays at the dewatering facility and industrial bins for screenings from the inlet works. A demarcated area for the septage receival zones has also been provided.

3.2.1.8.2 General buildings and facilities

The general building and facilities are to include:

– Control/amenities building including:
  - Control room/operator working area
  - Offline testing area (and associated fixtures/plumbing)
  - Standard amenities, including bathrooms and a basic lunchroom
– Blower facility.
– Switchrooms.
– A small store/shed room intended for minor supplies and critical spares storage. This shed would not include a workshop and is not for wider storage of Council assets.

3.2.1.8.3 Power supply

The site supply would originate from an Essential Energy 11kV/400V transformer connected to the Plant Main Switchboard (MSB) which distributes power around the plant via process specific motor control centres. This supply is located at the Boronia Street Zone Substation via the grid in Boundary Street.

The MSB is used for power distribution to the Motor Control Centres (MCCs) and would not contain any motor control. This design strategy reduces the maintenance requirements for accessing the MSB which improves switch room safety and reliability. Consideration shall be given to having remote switching function to further enhance safe operation by removing operators from the vicinity of the switch board should an arc fault occur during switching. These remote switching functions would be provided for the circuit protection devices on the MSB and the incomers on each of the Process MCCs.

Considering the flood prone nature of the proposed WWTP site, the substation and all infrastructure associated with supply connection would be installed above Probable Maximum Flood Level.

Backup power to the MSB would be provided by a dedicated onsite diesel generator connected with an Automatic Transfer Switch (ATS) to automatically start and transfer power on loss of Essential Energy supply.

3.2.1.8.4 Storm pond

A 25ML storm pond has been provided on the eastern side of the pad to capture wet weather flows above the treatment capacity. Flows above the peak full treatment flow (PFTF) or 4 x ADWF will be stored in the storm storage pond and returned for full treatment through the MBR during periods of lower inflow. Any overflows will be directed to an existing drainage swale extending through the adjoining wetland for release to Partridge Creek.

3.2.1.8.5 Security

During detailed design site services including Closed Circuit TV system, smoke and fire detection and alarm systems, site and building security and access control systems design will be undertaken.

3.2.1.8.6 Chemical storage

The WWTP would be designed to store 40 days of chemical operating at peak design flows.

3.2.1.8.7 Landscaping

Landscaping would be incorporated throughout the WWTP in order to minimise maintenance works and protect the embankment. Topsoil removed from areas that are to support foundations would be retained for re-use in landscaping. The topsoil and underlying sands and clays at the site are considered susceptible to erosion on exposure where vegetation is removed or where exposed to concentrated flows.

3.2.1.8.8 Stormwater drainage

Stormwater drainage is proposed to be captured in zones on each of the pad levels either as overland flow channels/dish drains or a pit and pipe network to designated outlets around the perimeter of the pad. The use of separate zones would help reduce flow concentrations and the size of the required infrastructure to manage flows. Protection and or localised dissipation structures would likely be required at each of the outlet locations to protect the embankment.

3.2.1.8.9 Plant ancillary services

The new WWTP would include the following general ancillary services:

– Compressed air
– **Service water (non-potable):** A process service water pumping station connected directly to the permeate tank. This pumping station provides process service water around site (i.e. screen washing, screening and grit washing, chemical carrier water, etc). The purpose is to supply all process mechanical equipment that requires washing but won't come in contact with operations staff.
– **Potable water:** Potable water is supplied to site and will be used for amenities, safety showers, polymer batching and firefighting purposes. It would also be used in the sludge handling system to dilute the emulsion stock solution in the blending unit and prior to dosing to the dewatering unit.

3.2.2 Sewerage network and ancillary infrastructure

3.2.2.1 Sewage pumping stations

A number of existing SPS will need to be upgraded and new SPS established to service the new rising mains within the sewerage network. The SPS sites will also serve as key construction compounds for works on the sewer rising mains in the vicinity of each site.

Table 3-6 Sewage Pumping stations

Sewage Pumping Station	Required works
– SPS 01: Major Innes Road/John Oxley Drive Junction – Located on Lot 2, DP23450	– New pumping station – Use as a construction compound and parking area
– SPS 29: Oxley Highway/Port Macquarie Racecourse – Located on Lot 6, DP 790668	– New pump station, laydown area and carpark adjacent to existing SPS 29

Sewage Pumping Station	Required works
– SPS 87: 124 Boundary Street – Located on Lot 121, DP1156615	– New pump station and laydown area
– SPS 54: John Oxley Drive – Located on Lot 10, DP1088869	– Upgrade to existing SPS 54 and new pumps, compound and parking
– SPS 23: 176 Hastings River Drive – Located on Lot 1, DP808448	– Upgrade to existing SPS23 and parking
– SPS 07: 71 Hastings River Drive – Located on Lots 24 & 25, DP579278 and Lot 12, DP867928	– Upgrade to existing SPS 07 and carpark and compound
– SPS 53: Lincoln Road (Newport Village) – Located on Lot 1, DP748837	– Upgrade to existing SPS 53 and parking
– SPS 57: Lincoln Road (Newport Village) – Located on Lot 22, DP1046267	– Changing pumps and minor upgrades to existing SPS 57, and compound

3.2.2.2 Sewer rising mains

The project includes 11.4 kilometres of new sewer mains to service Port Macquarie's outer suburbs as described below:

– New sewer rising main connecting an existing pump station on Hastings River Drive to an upgraded pump station near Oxley Highway/Clifton Drive intersection. Then a new sewer rising main from an upgraded pump station to Thrumster WWTP.
– A connection from a new pump station proposed at John Oxley Drive (near the intersection with Major Innes Road) to Thrumster WWTP via an upgraded pump station near Oxley Highway/ Clifton Drive intersection.

The proposed route for the sewer rising mains would parallel the discharge pipeline route up to the Racecourse and follow existing road formations as far as practicable. The proposed pipeline would split into two separate routes diverting north from the Binnacle and south from the Oxley Highway (refer to Figure 3-2).

The northern sewer rising main would run along existing local roads within a residential area, diverting from The Binnacle north along Kemp Street then east on Hastings River Drive before concluding at existing SPS7 on Lot 12, DP867928.

The southern sewer rising main would divert past the PM Racecourse along Lady Nelson Drive before running south along Tulloch Road, Oxley Highway and John Oxley Drive before concluding at existing SPS54 on Lot 1, DP772163.

3.2.2.3 Recycled water mains

The proposed route for the 3.3 kilometre recycled water main would be connected at the WWTP to the existing main at the junction of Thrumster Street and John Oxley Drive. The route would predominantly follow existing access tracks and roads, and utilise HDD installation methods to minimise impacts to highly vegetated areas.

3.2.2.4 Discharge to Kooloonbung Creek via Fernhill Rd

Treated effluent produced onsite would be discharged to the existing WWTP discharge point at the Lake Road Lagoons before ultimate release to Kooloonbung Creek. The proposed route for the discharge of treated effluent to Kooloonbung Creek is via Fernhill Rd and would require approximately 7.9 kilometres of pipeline and a transfer pumping station.

– Pressure main length of 6.2 kilometres
– Gravity main length of 1.7 kilometres

This route offers the shortest pipe-length, a combined discharge point and proximity to the Hastings River mouth. The route would traverse east from the WWTP across Partridge Creek, passing the Port Macquarie Airport and Racecourse before reaching the discharge point at the Lake Road Lagoons flora and fauna reserve (see Figure 3-6).

A portion of the pipeline would intersect residential zones directly north of the Port Macquarie Airport along Boundary Street, and along Lady Nelson Drive and Fernhill Road. The pipeline route is mainly concentrated in areas zoned for industrial, recreational and conservation uses.

Figure 3-6 *Discharge to Kooloonbung Creek*

Thrust blocks

The route would traverse Oxley Highway to Acacia Avenue via a sharp descend which will require the construction of three major thrust blocks. These blocks are required when considering the topography of the route and the presence of sharp corners. They will be installed to mitigate thrust force by protecting bolted joints for connection of valves, preventing the separation of these joints and stabilising pipe movement. The accurate design and location of these thrust blocks are to be developed during detailed design phases.

Equalisation chamber

The construction of an equalisation chamber would also be required and is proposed to be located on the corner of the Fernhill Riad and Acacia Avenue junction (see Figure 3-6). The equalisation chamber will function as a buffer, collecting the raw incoming effluent passing through at fluctuating rate, and passing it through to the STP at a steady flow rate.

Surge vessel

The discharge route allows for surge mitigation via an installation of a surge vessel on the rising main. This vessel would enable the mitigation of problems associated with pressure changes in the discharge pipeline caused by the start-up, shut-down or potential power failure in pumping stations. The exact location and size of the surge vessel will be determined during the detailed design phase. However, the preferred location for the surge vessel and associated instrumentations and valves is within the new pump station building SPS29 and the Lake Road lagoon site.

Valves and odour control units

Additionally, the discharge infrastructure will include sets of air valves with associated pits, drains, vent stacks and odour control units (OCU). The installation of scour valves, with the required pits and connection ports were provisioned to facilitate schedules and unscheduled cleaning and maintenance of the pipeline. The exact number of required air valves, scour valves and associated infrastructures will be determined during the detailed design of the project.

3.2.2.5 Potable water connection

A 5.2 kilometre potable water connection will be installed to provide a water supply to the WWTP site. The potable water main will be installed along the same alignment as the return effluent pipeline to Kooloonbung Creek as shown in Figure 3-2.

3.2.2.6 Site power supply

The site supply would originate from an Essential Energy 11kV/400V transformer connected to the Plant Main Switchboard (MSB) which distributes power around the plant via process specific motor control centres. This supply is located at the Boronia Street Zone Substation via the grid in Boundary Street. The power connection will follow the same alignment as a portion of the return effluent pipeline to Kooloongbung Creek as shown in Figure 3-2.

Power conduits from the future Thrumster Zone substation would also be installed as an alternative future power supply. The conduits would be installed in the same trench for recycled main and optics fibre with the required separation.

3.3 Construction

3.3.1 Program

The construction of the project is expected to take place over three years. Subject to the approval and detailed design process, it is anticipated that site works would commence in 2025. Construction activities and indicative timeframes are:

1. Mobilisation and site establishment including laydown areas
2. Civil works
3. WWTP and RWTP construction
4. Pipeline installation including set out under boring locations and laydown areas
5. Testing and commissioning
6. Site demobilisation and surface rehabilitation

Key project milestones and their estimates timeframe are included in Table 3-7.

Table 3-7 Indicative construction program for Thrumster WWTP

Phase	Year 1	Year 2	Year 3
Mobilisation and site establishment			
Civil works			
WWTP construction			
RWTP construction			
Pipeline installation			
Testing and commissioning			
Site demobilisation and surface rehabilitation			

3.3.2 Construction methodology

3.3.2.1 Mobilisation and site establishment

3.3.2.1.1 Site compounds

Primary and secondary site compounds would be established at the commencement of the construction phase of the project. Indicative primary compound sites, including their construction duration and vehicle movements, are detailed in Table 3-8 and would predominantly be located within or adjacent to new SPSs, or upgrades to existing SPSs.

Primary compounds would include as required office facilities, ablutions, stockpile areas, machinery and equipment storage, and car parking for workers. They would be appropriately fenced where required with signage outlining construction contact details and site access restrictions.

Secondary site compounds would be predominately used for storage of minor plant, equipment and materials. Nominal amenities may also be provided in these locations. Secondary site compounds would also be located in areas close to major construction works. However, the area of secondary site compounds would generally be smaller than primary site compounds. Each site would be securely fenced with temporary fencing. All necessary signage advising the general public of access restrictions relevant to each site would be provided. These areas would be reinstated at completion of use. Location of the site offices would be determined and arranged by the nominated Construction Contractor.

Upon completion of construction, the temporary site compound, work areas and stockpiles would be removed, the site cleared of all rubbish and materials and rehabilitated to pre-existing condition prior to occupation.

Table 3-8 Site compounds and SPS works

Compound Location	SPS	Detail	Construction duration	Light vehicle movements per day	Heavy vehicle movements per day
Compounds including pump stations					
Major Innes Road /John Oxley Drive (Lot 2, DP23450)	SPS01	New pump station, Compound and parking area	2-3 months	10-20	20-30
Oxley Highway Racecourse (Lot 6, DP 790668)	SPS29	New pump station, laydown area and carpark adjacent to existing SPS 29	4-5 months	20-30	40
124 Boundary Street (Lot 121, DP1156615)	SPS87	New pump station and laydown area	4-5 months	20-30	40
John Oxley Drive (-31.458952, 152.869014) (Lot 10, DP1088869)	SPS54	Upgrade to existing SPS 54 and new pumps, pumping station and parking	2-3 months	20-30	40
176 Hastings River Drive (Lot 1, DP808448)	SPS23	Upgrade to existing SPS23 and parking	4-6 months	16	6
71 Hastings River Drive (Lots 24 & 25, DP579278 and Lot 12, DP867928)	SPS07	Upgrade to existing SPS 07 and carpark and compound	6 months	50	80
Lincoln Road (Newport Village) (Lot 1, DP748837)	SPS53	Upgrade to existing SPS 53 and parking	2 months	8	2

Compound Location	SPS	Detail	Construction duration	Light vehicle movements per day	Heavy vehicle movements per day
Lincoln Road (Newport Village) Located on Lot 22, DP1046267	SPS57	Changing pumps and minor upgrades to existing SPS 57, and compound	2-3 months	8	2
Compound sites only					
-31.442971, 152.844456 Thrumster Street Access (Located within Crown Road easement)	N/A	Compound and parking Horizontal Directional Drilling rig laydown area	2-3 months	12	10
Thrumster Street / John Oxley Drive junction	N/A	Compound (laydown and fit out) and parking Recycled watermain pipeline tie-in connection	2-3 months	12	2

3.3.2.1.2 Pipe laydown

Council has nominated an existing, cleared land alongside the road verge for the purpose of laydown areas adjoining SPS29 and SPS87.

However, one laydown area is proposed within an isolated area immediately adjacent to the northern boundary of Lot 13, DP1301758 within a Crown Road easement for the purpose of the horizontal directional drilling (HDD) rig laydown area. This area is cleared of vegetation and is well positioned away from traffic and nearby receptors.

It is noted that proposed pipe laydown areas would be progressively moved as the works are undertaken. Pipes would likely be delivered by semi-trailers to pipe lay down areas adjacent to existing roads and accesses at approximately five to 10 kilometres intervals nearby to the pipeline route. The pipes would be removed from the trucks and placed in the lay down areas using mobile cranes. Leases for lay down areas are usually negotiated with landholders and in some areas, Council may have adequate areas within existing road reserves which could be used for this purpose. Pipe lay down areas located within Council Road reserves, Council land and private land would be fenced and public safety warning erected. Drainage controls would also be constructed where required.

3.3.2.2 Civil works

Following site establishment activities, earthworks would be undertaken to achieve appropriate site levels for the WWTP, and associated pipeline infrastructure components. The treatment plant would be constructed on a raised earthen pad formed with imported fill to meet PMHC's flood protection requirements.

The base of the earth pad will be at 4.6 metres AHD to meet FPL3 with 0.5 metre freeboard. Critical infrastructure will be positioned above the probable maximum flood at 6.7 metres AHD.

Excess fill from other PMHC sites; such as Cowarra WTP is being considered for re-use at the Thrumster WWTP site, with some general testing to confirm the qualities of this fill undertaken. This fill was found to comprise primarily of residual clay and weathered rock.

The concept design (Beca HunterH20, 2024) estimate around 146,990 m3 of fill will be imported onto the site, with the majority of the fill coming from the Cowarra water treatment plant project, comprising a mixture of excavated clay and weathered rock.

The geotechnical report (RGS, 2024) summarises the expected requirements of the fill pad construction including additional investigations where required. Where embankment construction is proposed the proposed filling areas will be subject to consolidation settlement due to the presence of underlying soft soils over the eastern half (approximately) of the proposed WWTP area (RGS, 2024).

All fill placed for the support of structures or pavements would be placed and compacted as outlined below:

– Proposed fill material would comprise suitable fill as defined in AS 3798-2007 Guidelines on Earthworks for Residential and Commercial Developments.

– Proposed filling areas would be undertaken in consideration of the preliminary settlement estimates under 1.5 m and 3.8 m embankment and 1 m pre-load surcharge in line with Table 14 of the geotechnical report (RGS, 2024).
– Unsuitable material would be stripped and the exposed natural subgrade should be proof roll tested to highlight any soft, wet or excessively deflecting areas. Excavated areas would be backfilled with an approved granular material.
– Prior to placement of fill, tests would be undertaken in foundation sands to confirm a density index of 60% to at least 1.5 metres depth.
– Drying back of the foundation and the site won fill materials is likely to be required prior to filling. Some subgrade improvement works may also be required in the low lying areas of the site. Treatment options can be determined once the materials are exposed, or predicted once the depths of excavations are known.
– Fill is likely to be predominantly site won material from Cowarra Treatment Plant excavations and, depending on the depth and location of the excavations could comprise site won sand, clay, or weathered rock.
– Maximum particle size for general building area and road embankment fill is 100 mm.
– Where filling is required beneath structures, approved fill would be placed in layers not exceeding 250 mm loose thickness and compacted to a minimum dry density ratio of not less than 98% of standard compaction.
– Where filling is required beneath pavement layers, suitable fill should be placed in layers not exceeding 300 mm loose thickness and compacted to a minimum dry density ratio of 98% standard compaction.
– All fill for the support of structures would be placed and compacted in accordance with the recommendations outlined in AS3798-2007 Guidelines on Earthworks for Residential and Commercial.
– Developments, under Level 1 supervision. Areas of the site that are filled to support pavements would be filled under Level 2 supervision and testing.
– Fill batters would be over-placed and trimmed back to the design batter to ensure that compaction is achieved to edge of formation.
– Careful management of moisture sensitive blended clay and rock material would be required during and after placement as fill. This may include grading of the subgrade towards embankment shoulders or edges of fill platforms and temporary drainage diversion measures to prevent water pooling on the surface.

Larger or heavier structures such as the bioreactor or structures founded across the multiple pad levels are expected to require additional foundation works to prevent differential settlement occurring. These additional foundation works are expected to comprise of piling, with the arrangement and extents to be confirmed by the detail designer.

Structures expected to include additional foundational works such as piling include but are not limited to the following:

– Stage 1 Bioreactor
– Membrane Facility
– Permeate Tank

3.3.2.3 WWTP construction

Construction of the WWTP would include the following features:

– A raised earthen pad formed with imported fill to meet Council's flood protection requirements. The engineering requirements of the fill pad including fill source, embankment construction and stabilisation are still being developed in conjunction with the progression of the geotechnical investigations.
– The WWTP would be constructed in sequences, which has been allowed for in design via space allowances for the construction of batters required for excavation of the bioreactor and a work pad area at the base of the bioreactor.
– Some large structures such as the bioreactor or structures founded across the multiple pad levels may require additional foundation works to prevent differential settlement occurring. These additional foundation works are expected to comprise of piling into the in-situ soil levels or rock.

– Liquid retaining concrete structures within the WWTP would be constructed with regard to the minimum durability requirements of AS3735 and utilise standard formwork and compaction techniques during construction.
– The amenities, blower and switchroom buildings are proposed to be blockwork construction with consideration given to concrete tilt panel construction to improve sustainability where possible.
– The dewatering building will be a steel framed portal with sheeted cladding.

3.3.2.4 Pipeline installation

A summary of the construction methods which would be utilised to facilitate the installation of the pipeline components of the project is included below in Table 3-9. The lengths of each component listed in Table 3-9 also detail the lengths of some existing infrastructure that would be utilised.

The construction methods that would be used include open trenching and horizontal direction drilling (HDD). As shown in Table 3-9, most components utilise both components interchangeable between sections, dependent on-site characteristics. A description of these construction methods is detailed in the following sections.

Table 3-9 Pipeline component and associated construction method(s)

Pipeline component	Construction method	Approximate length (km) of new component (to be constructed)	Approximate length (km) of existing component to be utilised	Total
Water main	Open trenching	4.55	N/A	5.19
	HDD	0.64		
Sewer rising main	Open trenching	8.19	2.51	11.43
	HDD	0.09	0.64	
Recycled water main	Open trenching	1.65	N/A	3.3
	HDD	1.65		
Return effluent to Kooloonbung Creek	Open trenching	4.29	N/A	6.34
	HDD	2.05		
Emergency discharge	Open trenching	0.26	N/A	0.26
Power and communications	Open trenching	2.93	N/A	5.19
	HDD	2.26		
Total open trenching (approx.) = 24.38 km				
Total HDD (approx.) = 7.35 km				

3.3.2.4.1 Open trenching

Open trenching would be undertaken at the locations shown in Figure 3-7, broken by discrete segments of horizontal direction drilling.

Table 3-10 details the expected trenching that would occur in verges next to some roads within Port Macquarie.

Table 3-10 Open trenching occurring in verges

Road	Approx length of trenching (m)
Southern side of The Binnacle west of Kemp Street	540
Western side of Kemp Street south of Hastings River Drive	380
Northern side of Acacia Avenue east of Fernhill Road	590
Northern side of Hastings River Drive west of Kemp Street	500
Western side of Fernhill Road south of the Oxley Highway	480

Road	Approx length of trenching (m)
Southern side of Barton Crescent east of Central Road	200
Northern side of Lady Nelson Drive west of Doncaster Avenue	230
North-western side of Oxley Highway south of Lakes Road	460
South-eastern side of John Oxley Drive between Major Innes Road and the Ruins Way	380
North-western side of John Oxley Drive west of the Ruins Way	100
Eastern side of Tulloch Road north of Sherwood Road	500

Progressive excavation would be undertaken for the trenching proposed along the pipeline route. A construction corridor of 10 metres either side of pipeline and around the WWTP would provide sufficient space to construct the trench while providing enough space for the following:

– Excavated spoil material to be placed beside the trench
– A trench safety area
– Pipes to be strung out beside the trench prior to installation
– The movement of trucks, plant and equipment besides the trench

Despite the 10-metre buffer, it is noted however that this would be reduced where construction occurs in proximity biodiversity values are present or there are private properties.

The width of construction corridor would be narrowed to avoid specific obstacles such as large trees, EECs, significant landscape or built infrastructure. The general process for the open trench methodology would be:

– Preparation of construction corridor including of trees and vegetation, where required, and removal of topsoil and other obstructions (e.g. rocks).
– The pipes would be stockpiled at nearby locations suitable for a semi-trailer truck. The pipes would be transported to the cleared construction corridor for assembly.
– Excavation of pipeline trench approximately one metre wide and to a nominal depth of 1.5 to 2 metres below ground surface using either a tracked excavator or a tracked chain trencher. The excavated material would be deposited within the construction easement adjacent to the trench for backfilling or disposal where appropriate.
– Trench boxes or terracing would be utilised for deeper trenches to protect construction personnel.
– The corrosive sleeve protection wrapped pipeline would be lifted into the trench using an excavator or crane. The pipeline segments are then pushed together.
– Tipper trucks would be used to place backfill sand around the trench and to transport material to and from stockpile areas.
– Scour valves, air valves and divide valves would be constructed periodically along the pipeline which would involve installing pre-cast concrete components and some concrete pours where required.

Stockpile areas of approximately 10 by 10 metres wide would be located intermittently along the pipeline easement, within the pipeline corridor. These stockpile areas would contain sand and other material that would be used for backfilling where the natural material is too coarse for use. Following construction, an easement (of approximately 10 metres in width) would be maintained with grass cover to allow access for ongoing maintenance activities.

3.3.2.4.2 Horizontal direction drilling

HDD involves construction of a horizontal bore hole for installation of a pipeline beneath surface features. This is typical undertaken in area which cannot be open trenched due to major disruption, environmental impacts, services and utilities or road infrastructure.

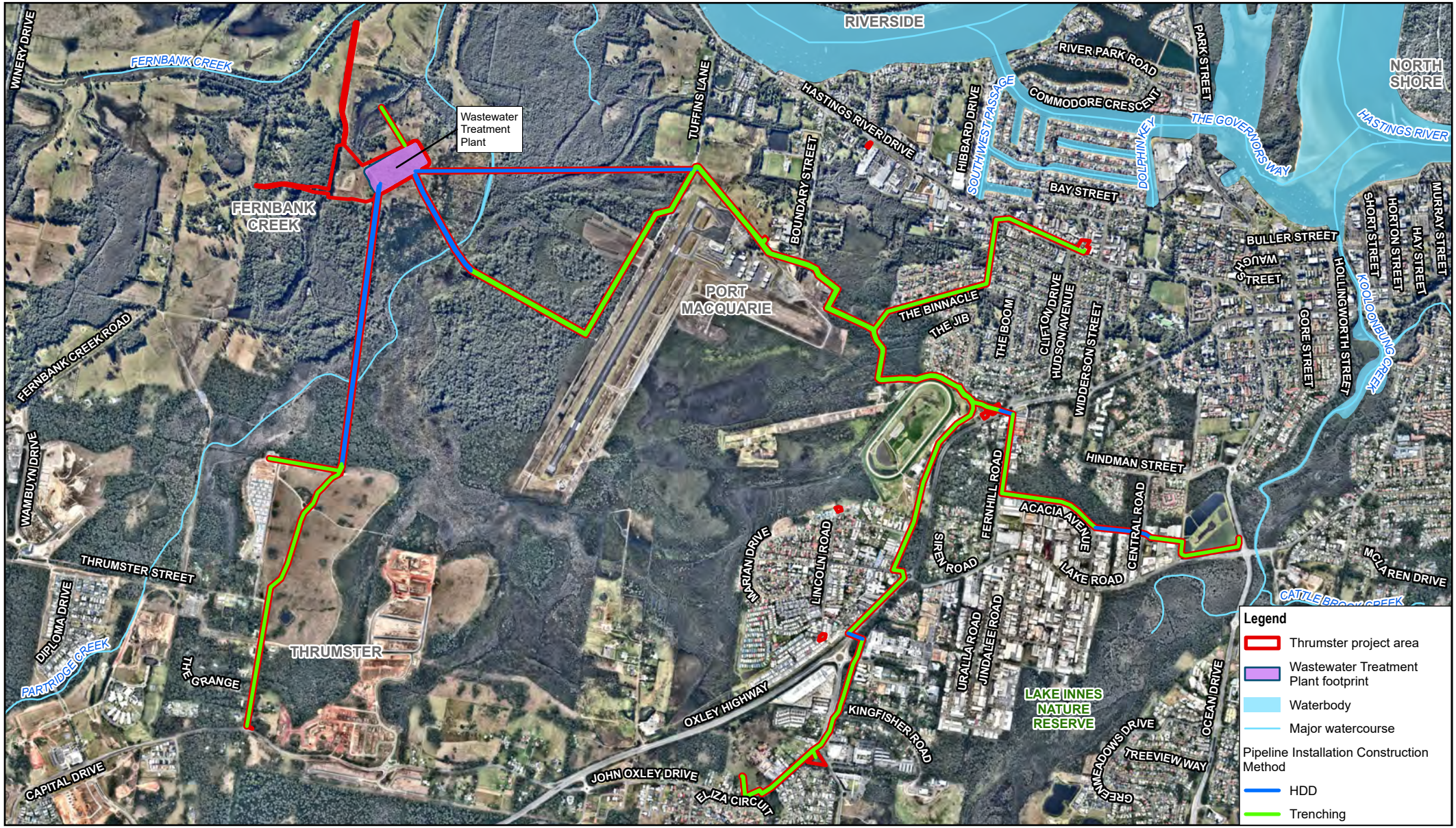
The general process for HDD a crossing point is as follows:

– Excavation and identification of both entry and exit pits.
– Set up of controls and any auxiliary equipment, drilling rig, guidance system, slurry lines and hydraulic hose.
– Drill pilot hole through to the exit pit.

– Attach reamer, and commence the reaming process.
– When the bore is large enough, commence pipe pull back process.
– Pipe testing and inspection.
– Removal of the drill rig and dispose of any slurry and spoil.
– Grouting of the annular space between the exterior pipes surface with the internal surface of initial installed conduit.
– Lateral services connections (if applicable).
– Restoration.

The drilling fluid used for HDD is a slurry that is modified by adding a mixture of polymer and water. The fluid acts to stabilise and lubricate the borehole, cool down the transmitter, carry spoil and debris away from the borehole, and assist in the cutting process. Environmentally suitable and compatible drilling fluid would be used to prevent any environmental harm in sensitive areas. The HDD process relies on the drilling fluid as the main means of ensuring the borehole does not collapse.

Several locations are proposed to utilise HDD methods, which would significantly minimise potential disruptions to sensitive receivers and traffic users. The proposed locations of the HDD are shown in Figure 3-7.



Paper Size ISO A4

0 0.25 0.5 0.75 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Pipeline installation construction methods

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 3.7

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Print date: 22 Jul 2024 - 11:15

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

3.3.2.5 Commissioning activities

Commissioning activities for the project would include:

– Testing all equipment and components of the wastewater treatment plant (including hydraulic testing, electrical testing and functional testing).
– Pipe pressure testing.
– Testing structural components.
– Seeding and establishment of activated sludge process.
– Proof of performance testing and validation.

3.3.2.6 Site demobilisation and surface rehabilitation

Demobilisation and site rehabilitation would be undertaken progressively throughout the project and would include the following typical activities:

– Demobilisation of construction compounds and temporary amenities.
– Removal of materials, waste and redundant structures not required during operation of the project.
– Removal of temporary environment controls and temporary site buildings and fences.

Disturbed areas would be restored to their previous condition as far as practicable. Some disturbed areas would be landscaped, which would include replacement of topsoil and establishment of grass or suitable vegetation. Topsoil stockpiled during the project would be reused for revegetation and rehabilitation work, where applicable.

3.3.3 Construction hours

Most construction would be undertaken within the recommended standard construction hours in accordance with the Interim Construction Noise Guideline (DECC, 2009) as follows:

– Monday to Friday: 7:00 am to 6:00 pm
– Saturday: 8:00 am to 1:00 pm
– No work on Sundays or public holidays

Some construction activities may be undertaken outside the recommended standard construction hours, which may include:

– Work determined to comply with the relevant noise management level at the nearest sensitive receiver.
– The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons.
– Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm.
– Situations where agreement is reached with affected receivers.
– Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours such as to minimise disruption to traffic on the local road network.

3.3.4 Estimated workforce

It is anticipated that a work force of approximately 60-100 full time equivalent (FTE) employees would be required during the construction phase of the project.

3.3.5 Construction materials

The following materials presented in Table 3-11 are generally proposed for use across the site. These materials would be confirmed during detailed design.

Table 3-11 Proposed materials

Structure type	Component/Material
WWTP	
Liquid retaining concrete structures	– S40 Reinforced Concrete – Galvanised Steel or Aluminium for Roof Framing
Non-liquid retaining structures	– N32 Concrete (slabs, footings, foundations, etc.) – N20 Concrete (blinding, mass concrete, etc.) – Building Roof - Galvanised Steel or Aluminium for Roof Framing – Buildings Walls – Blockwork or Pre-cast Tilt Up Panels
Metalwork and access structures	– Galvanised Steel or Aluminium framing and walkways
Pipework	– Stainless Steel for all above ground pipework – DICL/MSCL/HDPE for all below ground pipework

3.3.6 Construction access and traffic

Two construction access arrangements have been identified for the WWTP (refer to Figure 3-1):

– A typical access arrangement – via Hastings River Drive and Fernbank Creek Road (north)
– The flood proof access arrangement – via Fernbank Creek (south)

The flood proof route would support access and egress to and from the WWTP during a one in a twenty-year flooding event (or worse). The flood proof access route would require an easement through a private property.

Construction traffic volumes

The construction of the project is expected to generate up to 166 vehicle movements per day, with movements generally being associated with the morning and afternoon peak hours as staff travel to and from site. Heavy vehicles would also be required for delivery of materials, which would occur throughout the workday. It is expected that up to 22 heavy vehicles would arrive and depart from the site during both the morning and afternoon peak hour.

Heavy vehicle routes

Preliminary routes for the movement of construction heavy vehicles, based upon the output from Transport for NSW (TfNSW) Restricted Access Vehicle (RAV) map, shows the Pacific Highway and Oxley Highway are both unrestricted 26-metre B-double routes. These roads would be used for inbound and outbound construction traffic.

Other unrestricted 26-metre B-double routes include:

– Winery Drive
– Wambuyn Drive

An approved route with travel restrictions is provided on Hastings River Drive, as follows:

– For use in emergency situations, when directed by TfNSW, NSW Police or Hastings River Council
– Travel not permitted between 7:00 am – 9:00 am and 4:00 pm – 6:00 pm

The largest heavy vehicle that is expected to access the WTP construction site is a 26 metre B-double. All heavy vehicles will access the WWTP site from the Pacific Highway. These routes would allow the vehicles to access and egress the arterial road network in a safe and efficient manner for such activities as delivery of construction plant, supplies and infrastructure components and transportation of spoil and waste material.

Construction heavy vehicle movements would be scheduled to occur outside peak periods as far as practicable. The transport of over-sized loads would need to be undertaken outside peak traffic periods.

Further information on the vehicle routes is summarised in Chapter 13 (Traffic and transport) and Technical Report 7 – Traffic and Transport Assessment.

Construction workforce parking

Construction workers would primarily park within each of the construction compounds located across the project site. The number of construction workers requiring parking would vary over the duration of the construction phase. Parking of construction vehicles would need to be managed within urban areas of Port Macquarie. The construction contractor is to confirm any on street parking for the construction of pipeline components with Council prior to commencing. Measures to manage any potential parking impacts during construction are discussed in Chapter 13 (Traffic and transport) and in Technical Report 7 - Traffic Impact Assessment and Technical Report 4 - Social Impact Assessment.

3.3.7 Plant and equipment

Construction plant and equipment that could be used during the construction of the project is listed in Table 3-12. Type and quantity of plant and equipment may vary depending on the construction staging and construction methods and would be determined by the construction contractor.

Table 3-12 Indicative construction equipment

Construction equipment		
Excavators- various sizes	Concrete trucks	Welding machines
Bulldozers	Contractor service vehicles	Asphalting machines
Tipper trucks	Rollers	Boring / underboring / horizontal direction drilling (HDD) equipment
Mobile cranes- various sizes	Rock breakers	Concrete pumps
Elevated work platforms	Semi-trailers	Vacuum trucks
Chainsaws	Concrete cutters	

3.3.8 Earthworks

The project would require earthworks for the surface levels at the WWTP site (estimated heights up to 3.8 metres) and for the construction of the pipeline components. In addition to the civil works detailed in Section 3.3.2.2, the following additional considerations for the bulk earthworks phase of construction to be considered as part of the detail design are:

– Earthworks should be undertaken progressively, minimising the area and length of time that any part of the site is denuded of vegetation at any one time.
– Fill batters should be overplaced to allow appropriate preparation.
– Re-vegetation or other erosion protection should be undertaken as soon as possible.
– The erodibility of the soils should be taken into account in the long-term stormwater management plan for the site. The clay soils that will be exposed by the pile boring will be prone to rapid softening, fretting, and potential strength loss on exposure. It is therefore critical that concrete be poured as soon as the drilling of the pile is completed. A geotechnical professional should be on site at least during the initial stages of pile drilling and installations to assess the founding materials encountered and confirm required founding depths.

Concept design for the treatment plant estimates around 146,990 m3 of fill to be imported. The majority of fill will be imported, with the majority to be derived from excavations at the nearby Cowarra water treatment plant. Past experience on that site indicates the fill would therefore comprise a mixture of excavated clay and weathered rock (RGS, 2024).

Where possible, excavated soil would be reused during construction. The total quantity of spoil generated from earthworks would be dependent on the quality of excavated material, depth to bedrock and suitability of the material for reuse during construction. Some excavated material (including excavated public road materials and excavated natural materials) would be subject to the resource recovery exemptions in accordance with the clauses 91 and 92 of the *Protection of the Environmental Operation (Waste) Regulation 2014.* This would not be applicable for areas where Naturally Occurring Asbestos is present.

Excavated material would be stockpiled at the construction compounds and reused for fill where material quality is suitable. Topsoil is not suitable for reuse as engineered fill. This material may be reused for landscaping purposes.

Should any existing fill require removal off-site, it will require waste classification for disposal to landfill, or alternatively, for re-use on another approved filling site it will require assessment for a Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014 in accordance with the Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 – The Excavated Natural Material (ENM) Order 2014 (RGS, 2024).

3.3.9 Utilities and services

The following buried assets can be anticipated, particularly for the SRM and RWM:

– Essential Energy high voltage cables
– NexGen cables
– AARnet cables
– Telstra cables
– Optus Fibre Options

An assessment of the potential impacts to public infrastructure, utilities and services has been provided in Chapter 18 (Land use and property). Utilities and services are to be confirmed during detailed design.

3.4 Operation

3.4.1 Overview

The WWTP has been designed to treat a portion of wastewater currently directed to Port Macquarie WWTP and new connections from the Thrumster, Sancrox and Fernbank Creek area. The WWTP would have a design capacity of 40,000 EP (Stage 1) and design flow of 9.2 ML/day by 2039.

The WWTP proposed to incorporate advanced wastewater treatment technology capable of mechanical and biological nutrients reduction, equipped with UV and chlorine disinfection systems to provide multiple barriers against pathogens for the non-potable recycled water. The ultimate recycled water design capacity of 4.7 ML/day is provisioned for the project.

The WWTP operators are expected to be on site each weekday during normal working hours. The greatest duration of non-attendance is assumed to be four days: during Easter and Christmas. The design will include remote monitoring and alarm generation. The criticality of the alarms will be set in the control system with the most critical alarms resulting in remote notifications (e.g. text messages). The response time to critical alarms is assumed to be one hour from the time an alarm is generated to the time the operator arrives at site. Problem rectification is assumed to be four hours.

The following operational requirements have been included as the basis of WWTP design:

– Works to be ‘operationally practical’, which is defined as being designed such that an operator can carry out routine operations without the need to shut down units, carry tools or the like.
– The need for good system operability and ease of control.
– Low noise generation and minimisation of other environmental and social impacts. Minimise noise at source and provide suitably designed acoustic enclosures where necessary to ensure working environment does not require operators to use personal protective equipment (PPE).
– Minimising vibration at the source and providing suitably designed vibration mounts/isolation to prevent the transferring of vibration to other process units, etc.
– Providing robust instrumentation in operator friendly locations as appropriate for monitoring, control, calibration, and compliance purposes. All calibration and adjustment points must be safely accessible from floor to platform level.
– All valves accessible for operation from the normal operational position.

– Means provided to isolate every item of equipment (electrically and mechanical/process).
– Ease of placement and removal of consumables (i.e. belts, bearings, seals etc.) for cleaning, repair and replacement purposes.
– Ease of receiving chemicals and lifting of equipment, minimise structure penetrations where possible.
– Automated with essential alarms.
– Provide suitable and safe functionality to allow for sampling of key process lines.

3.4.2 Operational work hours

The WWTP would operate 24 hours a day, seven days a week.

3.4.3 Operational workforce

Once fully operational it is anticipated that three to four FTE employees would be required to manage the onsite operations at the WWTP.

3.4.4 Traffic and access

Access to the WWTP would typically be via the new main access road from Fernbank Creek Road via Hastings River Drive.

A secondary all weather access road has also been included in the design for use in flood conditions.

During operation of the WWTP, several light vehicles will enter and exit the site daily, primarily for transport of operations staff and any visitors. Other heavy vehicles (including cranes) will be required at the site infrequently for maintenance purposes, and the risks associated with these activities is expected be managed on a case-by-case basis.

3.4.5 Waste management

Key waste streams that are expected to be produced during operation include dewatered sludge, recycled water, CIP waste, effluent, chemical storage packaging, general waste, wastewater, electrical and electronic waste, and lubricants, oils and chemicals.

Biosolids from the WWTP would be dewatered and transported to the Cairncross organics recycling facility for further treatment. To enable efficient transport of biosolids to the Cairncross facility, the dewatering system would target a dewatered solids concentration of 18 per cent dry solids by volume.

Captured gross residuals will be washed to reduce odour. Gross residuals refer to screenings and grit captured at the preliminary treatment stage and from waste tanker deliveries. Washed residuals will be stored onsite, before being transported offsite to PMHCs' waste management facility.

All gross solids will be collected in dedicated bins for removal offsite. The bins will be sized for a maximum of two collections per week.

All impacts were assessed as being able to be appropriately managed through the design of the scheme and implementation of appropriate waste management practices during operations. More detail is provided in Chapter 16 (Waste and chemicals management).

3.4.6 Maintenance activities

The WWTP would require ongoing maintenance activities such as regular equipment servicing, cleaning, asset condition assessments, calibration and servicing of electrical assets and online monitoring equipment as necessary. Following construction of the WWTP, a maintenance plan and asset management plan would be created for the new infrastructure to ensure it would be maintained properly to extend its life and gain the most value out of the assets.

The general approach to be adopted for the maintenance activities in operational phases is provided below:

– The permeate tank is designed to stay full unless a membrane maintenance of CIP clean is occurring.

- For grit removal and washing, stop boards would be used to manually isolate and bypass the grit tank for maintenance.
- Fine screens would enable the effective operation and maintenance of the membrane tank to prevent debris impacting on the membrane system.
- Only two screens are required for full flow operation during Stage 1, allowing the others to be offline for maintenance with the remaining drives servicing the maximum flow.
- Process sizing associated with the bioreactor adopts a normal operating sludge age of 22 days to allow stable sludge, contingency for maintenance down time and no dewatering over the weekend.
- Turndown and redundancy considerations associated with the bioreactor include liftable grids in the diffused aeration grid which would allow maintenance without taking the bioreactor offline.
- The membrane system has been designed to include reverse operation, which would allow flow through the membranes and into the membrane tanks during maintenance washing and CIP. An area designated for membrane maintenance has been provided. Drainage from this area is returned to the foul water pumping station.
    - A maintenance clean would use chlorinated permeate (sourced from the permeate storage tank), with membrane in-situ with mixed liquor (every 1-2 weeks).
    - Membrane maintenance clean would occur up to once per week and is in-situ (direct to the mixed liquor). The permeate pumps are stopped and placed into reverse drawing permeate from the permeate tank. The permeate pumps will ramp to meet a flow setpoint. Sodium hypochlorite is then dosed into the reverse flow.
- Flush points are provided for each dosing pump and dosing line to allow flushing of chemical prior to maintenance.
- Active power monitoring of drives using Next Generation Operating Systems to monitor efficiency, identify maintenance requirements and optimise energy use.

3.5 Decommissioning

The project would be decommissioned at the end of its useful life. It is noted that the design of the WWTP allows for the future expansion to an ultimate capacity of 80,000 EP and a design flow 18.5 ML/day with an ultimate design horizon of 2071 and the wastewater scheme would be required to continue to service the community until alternative arrangements are in place.

The activities involved in decommissioning would likely involve the removal of project infrastructure but would also be influenced by the intended future use of the land at that time. A detailed decommissioning plan would be prepared before any such decommissioning occurs.

4. Statutory context

This section provides a summary of the assessment and approval requirements for the project under relevant legislation. The approval pathway is summarised, and relevant planning instruments and legislations are considered.

4.1 Introduction

This section outlines the relevant statutory requirements for the project. It addresses the following:

– The legal pathway under which approval of the project is sought, why the pathway applies, and who the consent authority is.
– The relevant state approvals (outlining approvals that are not required for approved SSI and approvals that are required and that should be substantially consistent with approved SSI.
– Mandatory matters for consideration, including relevant state and local environmental planning instruments that have been considered in relation to the project.
– Relevant federal approvals.

4.2 Assessment and approval pathway

The project involves the construction and operation of a WWTP including a recycled water treatment facility at Fernbank Creek, and new sewer rising mains (SRM) and recycled water mains (RWM). Pursuant to section 5.12(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) the project is declared State significant infrastructure (SSI) under section 10 of schedule 4 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP).

As SSI, under Section 5.14 of the EP&A Act, the approval authority for SSI is the Minister for Planning. Therefore, Council, as the applicant, must obtain approval from the Minister for Planning before carrying out the project.

A referral under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was made to the Commonwealth DCCEEW. The EPBC referral determined that the project was not a controlled action and will not require approval from the Commonwealth Minister for the Environment and Water under Part 9 of the EPBC Act.

4.3 Statutory requirements for the project

Table 4-1 provides a summary of the statutory requirements of the project with reference to relevant legislation and environmental planning instruments. Further details on how the project complies with relevant legislation, including a statutory compliance table, is provided in Appendix B.

Table 4-1 Summary of statutory requirements

Category	Comment / requirement
Power to grant approval	On 1 March 2023, the NSW Minster for Planning declared the project as State significant infrastructure (SSI). The project is declared SSI in accordance with section 5.12(2) of the EP&A Act and section 10, Thrumster Wastewater Scheme, of schedule 4 of the Planning Systems SEPP. The project requires approval from the Minister for Planning under section 5.15 (Division 5.2) of the EP&A Act. The project was determined not a controlled action (refer to 'Other approvals – EPBC Act' below), therefore approval by the Commonwealth Minister for the Environment and Water under section 130(1) and section 133(1) of the EBPC Act 1999 is not required.

Category	Comment / requirement
Permissibility	State Environmental Planning Policy (Planning Systems SEPP) provides for the declaration of State significant development and State significant infrastructure including Critical state significant infrastructure. Section 2.14 of the Planning Systems SEPP provides that development specified in Schedule 4 of the policy is SSI. In accordance with section 5.12(4) of the EP&A Act, specified development on specified land can be specifically declared SSI. The development has been declared SSI and may be carried out without consent under Part 4 of the EP&A Act.
Other approvals – Approvals and legislation that does not apply to SSI	Under section 5.23(1) of the EP&A Act, the following approvals, which may otherwise be required, are not required for declared SSI: – A permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act). – An approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* (Heritage Act). – An Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* (NPW Act). – A bushfire safety authority under section 100B of the *Rural Fires Act 1997.* – A water use approval under section 89, a water management work approval under section 90, or an activity approval (other than aquifer interference approvals) under section 91 of the *Water Management Act 2000.* In addition, under section 5.23(2) of the EP&A Act, Division 8 of Part 6 of Heritage Act does not apply to prevent or interfere with the carrying out of approved SSI. Division 8 of Part 6 of the Heritage Act 1977 allows for the issuance of orders by the Minister for Environment and Heritage or the Chairperson of the Heritage Council to cease work that they believe would cause harm to a building, work, relic or place that is not on the State Heritage Register or the subject of an interim heritage order.
Other approvals – Approvals and legislation that must be applied consistently to SSI	In accordance with section 5.24 of the EP&A Act, certain approvals cannot be refused and are required to be grant in a form substantially consistent with any approval to carry out an SSI project. In context of this project, the following approvals would be required. – A consent (road occupancy licence) under section 138 of the Roads Act 1993 from the relevant road's authority for the erection of a structure, or carrying out of work in, on or over a public road, or digging up or disturbance of a surface of a road, or removing or interfering with a structure on a road. The project would require the carrying out of work on a number roads (Section 13.3). – The project is a scheduled activity listed in Schedule 1 of the *Protection of the Environment Operations Act 1997 Act* (POEO Act) and would require an environment protection licence under this schedule. Appendix B provides a more detailed overview of how the above statutory requirements have been considered for the project.
Other approvals – EPBC Act approval	In accordance with Part 3 of the EPBC Act, proposed actions that will have or are likely to have a significant impact on matters of national environmental significance (MNES) protected by the EPBC Act or the environment on Commonwealth land, or is an action by the Commonwealth, must be referred to the Commonwealth DCCEEW. An EPBC referral was submitted on 26 March 2023 (Application #2023/09582) to the DCCEW in accordance with section 68 of the EPBC for the Ministers decision whether or not the action is a controlled action for the purposes of the EPBC Act, requiring further assessment and approval. On 3 May 2024, the project was determined to not be a controlled action under Section 75 of the EPBC Act.
Other approvals – Other NSW and/or Commonwealth legislation	The project may require other approvals or to meet the requirements under other NSW and Commonwealth legislation regardless of being declared SSI. These include: – Management of contaminated land and notification to NSW Environment Protection Authority (EPA) in accordance with the *Contaminated Land Management Act 1997.* – An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act). – A consent under Section 138 of the *Roads Act 1993.* – A licence under Section 12 of the *Pipelines Act 1967.* – Approval under Section 60 of the *Local Government Act 1993.*

Category	Comment / requirement
Pre-conditions to exercising the power to grant approval	The following statutory pre-conditions are relevant to the application for approval of the project: – Section 1.3 of EP&A Act provides the objects, which are guiding principles that need to be considered by planning authorities when making decisions under the EP&A Act. Consideration of the objects of the EP&A Act is provided in Appendix B (Statutory Compliance). – Section 5.16 of the EP&A Act requires the Planning Secretary to prepare and notify the proponent of environmental assessment requirements that require the preparation of an EIS in the form prescribed by the EP&A Regulation. Appendix A and Appendix B demonstrates how the Planning Secretary's Environmental Assessment Requirements and requirements included in sections 190 and 192 of the EP&A Regulation have been addressed. – Section 5.17 of the EP&A Act provides that the proponent must submit an EIS for approval to carry out the SSI and may require the proponent to submit a response to any issues raised in submissions and a preferred infrastructure report. This EIS has been prepared to satisfy the requirements of section 5.17 of the EP&A Act. – Section 5.18 of the EP&A Act requires the Planning Secretary to provide a report for the Minister's consideration, which is to include the EIS and any preferred infrastructure report, and advice provided by public authorities, any report or advice of the Independent Planning Commission and any environmental assessment undertaken by the Planning Secretary or any other matter the Planning Secretary considers appropriate. Section 7.9 of the *Biodiversity Conservation Act 2016* (BC Act) requires that an application under Division 5.2 of the EP&A Act must be accompanied by a Biodiversity Development Assessment Report unless the proposed development is not likely to have any significant impact on biodiversity values. Section 7.14 of the BC Act provides that, when determining an application in accordance with the EP&A Act, the Minister must take into account the likely impact of a proposed development on biodiversity values as assessed in the BDAR. A BDAR has been prepared for the project and is provided in Technical Report 5 – Biodiversity Development Assessment Report. The potential biodiversity impacts are summarised in Chapter 11 (Terrestrial biodiversity).
Mandatory matters for consideration	Mandatory matters that the NSW Minister for Planning is required to consider in deciding whether to grant approval of the project include the preparation of an EIS and a submissions report (on the EIS and Amendment Report (if required)) and consideration of any recommendations from the SEARs. The EIS has reviewed relevant environmental plannings instruments to determine their applicability (refer to Appendix B (Statutory Compliance)). The detailed environmental assessment of potential impacts, considering relevant objectives, criteria and SEARs requirements, are included in Chapter 7-25.

5. Community and stakeholder consultation

This chapters summarises the community and stakeholder consultation undertaken prior to and during preparation of the EIS, and the consultation proposed to be undertaken during design and delivery of the project. A community engagement table, identifying where the main issues raised by the community during engagement have been addressed, is provided in Appendix C (Stakeholder Engagement Assessment).

5.1 Introduction

This chapter describes the stakeholder and community consultation process carried out prior to the lodgement of the EIS and the consultation activities which will continue during the assessment and development of the project. It includes issues raised and (in Appendix C (Community Engagement Table)) identifies where, if applicable, the design or work program has been amended in response to those issues.

The engagement undertaken in preparation of the EIS was based on *Undertaking Engagement Guidelines for State Significant Projects* (NSW DPHI 2022), as well as responding to the Secretary's Environmental Assessment Requirements (SEARs).

5.1.1 Consultation context

In response to SEARs, Council is required to consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.

5.1.2 Consultation strategy

A detailed and project specific Community and Stakeholder Engagement Strategy (GHD 2023) was prepared for the project with reference to *Undertaking Engagement: Guidelines for State Significant Projects* (DPIE 2021b) and guided by the Core Values and the Code of Ethics of the International Association for Public Participation (IAP2). The Strategy included a stakeholder scan to identify community members and groups, and other key stakeholders that may have an interest in or be affected by the project. As well as meeting or exceeding the requirements of the state significant engagement and IAP2 guidance, the following project specific communication and engagement objectives were identified to inform the project's approach to consultation:

- Engage early so that any concerns are understood up front and provide transparency about how these issues have been considered and addressed in the scoping report for the project.
- Inform communities and stakeholders about the project, the EIS process and opportunities to provide feedback or seek further information on the project.
- Help people understand how they can participate in the approvals process, by ensuring communication materials are clear and accessible.
- Demonstrate how community and stakeholder issues and feedback are being captured (summarised in the scoping report and the EIS that would be on public exhibition to allow the wider community to provide feedback through a formal submission process) and used to inform project development and assessment.
- Help establish the project's social licence to operate.

In order to meet these objectives the following principles were incorporated into a framework for consultation with stakeholders throughout this project:

- Involving stakeholders shows respect for them. It recognises that as recipients and 'hosts' of projects, stakeholders, including communities, have a long-term interest in the outcomes of the project.
- Using communication and consultation techniques that effectively and meaningfully engage the community and stakeholders.
- Ensuring that all stakeholders have easy access to the process and information about the project.

– Demonstrating that concerns and aspirations raised by the community and stakeholders have been considered in the concept design and review process.
– Ensuring that all information is presented in the best way for the audience to understand.

The consultation undertaken for the project included targeted stakeholder specific consultation channels including:

– Dedicated community consultation and meetings.
– Workshops for involvement of public in decision making during option evaluation, concept design and preparation of EIS.
– Letter box drops.
– Establishment of a dedicated project webpage on Council's website.
– Freecall 1800 number.
– Direct email address.

During all meetings and workshops, feedback and enquiries have been sought both directly while also offering other channels (i.e. project website, freecall number and direct email) to encourage feedback about the project.

Full details of the stakeholders engaged, how, when and where they were engaged and the results of those activities are outlined in Appendix C.

5.2 Consultation undertaken for the EIS

Table 5-1 details a list of stakeholders or stakeholder groups who have been or will be engaged with (or offered a briefing) in relation to the project.

Table 5-1 key stakeholder groups

Stakeholder group	Stakeholders
NSW Government Ministers and Local Members	– NSW Minister for Health – The Hon Ryan Park MP – NSW Minister for Water – The Hon Rose Jackson (MLC) – NSW Minister for Planning and Public Spaces – The Hon Paul Scully – NSW Member for Port Macquarie – The Hon Leslie Williams MP
NSW Government departments and agencies	– Environment and Heritage Group (Department of Planning and Environment) – National Parks and Wildlife Service – Heritage NSW – Environment Protection Authority – NSW Health – Department of Primary Industries - Fisheries – NSW Food Authority – Transport for NSW (including Roads & Waterways) – Department of Primary Industries - Agriculture – Rural Fire Service – NSW State Emergency Service – North East DECCW EPRG Regional Office – Crown Lands – North Coast Local Land Service – The Office of the Registrar
Federal, Government Ministers and Local Federal Member	– Federal Minister for the Environment – The Hon Tanya Plibersek MP – Federal Member for Cowper – Mr Pat Conaghan MP
Local Government - Port Macquarie Hastings Council	– CEO - Clare Allen – Councillors: • Mayor – Cr Peta Pinson • Cr Lisa Intemann • Cr Nik Lipovac • Cr Josh Slade

Stakeholder group	Stakeholders
	• Cr Danielle Maltman • Cr Lauren Edwards • Cr Adam Roberts
Thrumster, Fernbank Creek and Port Macquarie Community	– Thrumster and Fernbank Creek residents – Adjacent landowners such as Fernbank Creek Road and Lake Rd / Wyandra Cres Fischer St residents (around Kooloonbung Ck) – Aged care facilities nearby – Oyster Farmers and North-side progress association – Port Macquarie Racecourse – Port Macquarie Airport
Business Groups	– Port Macquarie Chamber of Commerce
Utilities/Business using the area	– Essential Energy – NBN Co – Air Services Australia
Traditional Owners	– Bunyah Local Aboriginal Land Council – Bunyah peoples – Birpai Local Aboriginal Land Council – Native Title Services Corporation – Other Registered Aboriginal Parties for the Aboriginal Heritage Assessment
Nearby businesses – wineries, crematoriums, recreational and retail	– Bunnings Warehouse – Birdon Marine – Future Innes Lake Golf Course – Port Macquarie Driving Range and Mini Golf – Grow Lush – Environmental Funerals Pty Ltd – Hopkins Consultants – Port Macquarie Race Club – Cassegrain Winery – Douglas Vale Historic Homestead & Vineyard – Hastings Regional Shooting Complex – Port Macquarie Radio Control Car Club – Hastings Valley Archery Club – Coles Lake Inness – Small Businesses along John Oxley Drive, Hastings River Drive, Widderson Street – Port Macquarie Base Hospital
Businesses – Oyster farms	– Port Macquarie Oyster Farmers Associations – Crown Oysters – Tunstead Oysters – Port Oyster Company – NSW Department of Primary Industries – NSW Shellfish Program
Community Environmental Groups	– Hastings Birdwatchers – Koala Conservation Australia (Koala Hospital) – Friends of Kooloonbung Creek Nature Park – Australian Plant Society NSW – Port Macquarie Conservation Volunteers
Rural property owners	– Racewyn Close/ Tulloch Road – Tuffins Lane – Boundary Street – Lindfield Park Road – Fernbank Creek Road

5.3 Engagement tools and activities

We identified engagement tools/activities that recognise the objectives for the project and the involvement level of stakeholders and the wider community. Table 5-2 below lists the tools that are being used be used to deliver effective, transparent, and open communication with key stakeholders and the community, using a mix of digital and traditional approaches.

Table 5-2 Engagement tools

Tool	Description and Objective
1800 number and contact@ghd.com email contact	Allows input or feedback from all stakeholders. A direct line to the project team and email contact as an alternative method of contact for anyone wanting to provide feedback or ask questions from the project team.
Briefings	State and Federal local members and local councillors are offered briefings and kept up to date with the project, so that they are able to respond to enquiries from constituents or media and are well aware of all of the project benefits. This is an opportunity to highlight the project's operational safety requirements and ensure that key 'influencers' in the region have clear channels to access information as required.
Presentations	Initial engagement to bring about early feedback to be considered during the development of the EIS will be undertaken in the form of a presentation to relevant Government Agency representatives and community groups where available. A rolling PowerPoint presentation was used during the drop-in sessions mentioned below, with copies of the presentation then saved as a PDF file for access via the project website.
Community Information Sessions	Three sets of 'drop-in' style community information sessions are being held to provide members of the community with the opportunity to attend and provide input or feedback and discuss any issues with the project team. To date two sets of drop-in sessions have been held (two sessions per time at different times of the day), on October 10 and 11, 2023, 22 May 2024. In addition, material about the project was made available at drop-in sessions organised for the Cowarra Water Supply Scheme on 16 July 2024. The sessions were held at Port Macquarie-Hastings Council Administration Centre to allow residents to call in at any time to discuss the project. Sign-in sheets to capture contact details and feedback forms to help us capture feedback are made available at the information sessions. Further drop-in sessions will be held while the EIS is on exhibition, to allow members of the community to peruse the EIS in full and ask any questions of the project team.
Fact Sheet/FAQs	Fact sheets and/or FAQs for use on the website and at community information sessions to provide the facts about the project.
Website	A webpage on Port Macquarie's Hastings Council website provides all relevant project information online (such as the project timeline, FAQs, and any other relevant information).
Social Media	Posts are shared on Port Macquarie's Hastings Council social media channels to encourage the community to attend drop-in sessions and provide feedback during the development of the EIS.
Advertising	– Advertising to promote drop-in information sessions. – Advertisements placed in Port Macquarie's newspapers inviting stakeholders to provide feedback.
Public Exhibition	The EIS will be placed on exhibition by the NSW Department of Planning to allow the community to provide submissions.

5.4 Engagement to date

5.4.1 Overview

Engagement has consisted of initial contact with key stakeholders via mail, email and phone, followed by either face-to-face or online briefings and meetings to provide detail around the project and then discuss pertinent issues or concerns, or emails or letters in reply.

The web presence has been set up and promoted through Council social media posts and is provided on project collateral such as the fact sheets provided at the drop-in sessions.

Drop-in sessions allow stakeholders to attend at a time that suits them over two, two-hour periods on one or two days. This allows stakeholders to discuss individual concerns or subjects that are of interest to them.

Specific engagement with oyster farmers, North-Side Progress Association, Friends of Kooloonbung Creek Nature Park, Hastings Birdwatchers and neighbours living close to the proposal allows them to voice their specific concerns. These local stakeholders have been proactively invited to attend meetings through mail, email and/or phone calls.

5.4.2 Early engagement

An earlier approvals process for this proposal was commenced in 2004 which included engagement with a range of stakeholders. While that proposal was not progressed at the time, it did provide a good level of local and regional knowledge around potential issues and that they could be addressed or mitigated, allowing the proposal to proceed.

Two planning focus meetings were held during this time:

Organisations Represented at Planning Focus Meeting No. 1

20 July 2004

Organisation

- Australian Plants Society
- NSW Health
- Koala Preservation Society
- NSW Quality Assurance Program
- Friends of Kooloonbung Creek
- NSW Dept of Environment and Conservation
- Residents Action Network Mid North Coast Group
- Dept of Infrastructure, Planning and Natural Resources

Organisation

- Lewis Land Group Port Macquarie
- Dept of Energy, Utilities and Sustainability
- Conservation Volunteers Australia
- Dept of Commerce
- NSW Food Authority
- Port Macquarie-Hastings Council
- NSW Farmers
- Hastings Birdwatchers Association

Interim Meeting – 20 December 2004

Council held an interim meeting on 20 December 2004 to communicate to the Planning Focus Group the need to consider a new STP site, owing to significant constraints at a proposed site. The key constraints and opportunities for each of four sites were presented and the group concurred that the Sand Plain site would be more suitable for location of the STP.

Planning Focus Group Meeting No. 2 – February 2005

The second Planning Focus Group meeting was held on Wednesday 9 February 2005. The aim of this meeting was to inform participants of a number of suggestions and options that had been developed and to obtain feedback on the advantages and disadvantages of these options.

Organisations Represented at Planning Focus Group Meeting No 2

Organisation
– Hastings Birdwatchers Association
– North Coast Health
– local oyster growers
– Port Macquarie Conservation Society
– Australian Plants Society, Mid North Coast Group NSW Health
– Koala Preservation Society
– Department of Infrastructure, Planning and Natural Resources
– Friends of Kooloonbung Creek

Organisation
– Port Macquarie-Hastings Council
– Lewis Land Group, Port Macquarie
– Port Macquarie-Hastings Council – Port Macquarie Airport
– NSW Food Authority
– NSW Farmers Association – Hastings River Oyster Branch
– Agsol
– National Parks Association
– Department of Commerce

During this time, two newsletters were also prepared to provide information to the PFG meeting attendees and to any enquirers.

5.4.3 Summary of engagement activities

To date, engagement with key stakeholders and the community has included:

- Development of a stakeholder register including all relevant community groups, agencies, residents, and businesses.
- Creation of a project webpage (Thrumster Wastewater Scheme) on the Council web site for stakeholders to refer to for general project information.
- Consultation with Port Macquarie Race Club regarding the potential location of mains within/near their property.
- Inception meetings and engagement of relevant internal stakeholders in Council.
- Engagement with DPIE, DPI and NSW EPA to provide an overview of the project and identify designated personnel for liaison associated with the project.
- Engagement (several meetings) with Oyster Farmers and North-side progress association, Friends of Kooloonbung Creek Nature Park, Hastings Birdwatchers regarding wastewater treatment plant discharge locations and potential impacts on the Hastings River estuary.
- Engagement with EPA, DPI, DPIE and DCCEEW regarding water quality modelling, environmental and ecological assessment, and discharge assessment.
- Engagement of NSW Health and DPIE through workshops regarding reuse of recycled water from the plant.
- Engagement of Rural Fire Service through workshops regarding Bushfire Hazard Assessment and defining the required Asset protection Zone.
- Liaison with the Local Aboriginal Land Councils (LALCs) was undertaken by Community Inclusion Team Leader and Major Projects Lead to share project information.
- Development of an Expression of Interest process for the potential reuse of effluent and biosolids on agricultural land located in Thrumster, Fernbank Creek, and Greater Sancrox areas.
- An industry briefing for potential local industries, contractors and suppliers for the project and fostering circular economy.
- Project information was sent out with rates notices.
- Engagement of the neighbouring landowners through information and consultation sessions regarding selection of the plant location, treatment technology, and discharge location and identification of potential concerns and addressing those concerns.

The following external stakeholders have been consulted:

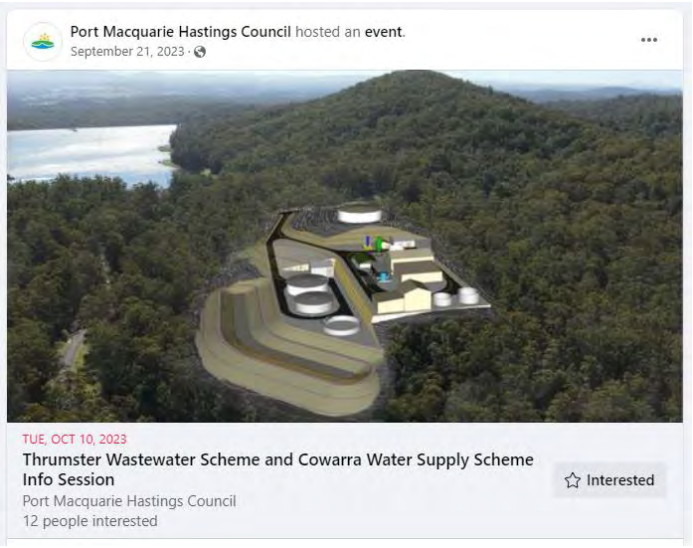
- Adjacent landowners
- General community
- Oyster Farmers and North-side progress association
- DPHI
- DCCEEW
- DPIE
- EPA
- Port Macquarie Racecourse
- Essential Energy
- LALCs
- NBN Co.
- NSW Health
- NSW Maritime
- Transport for NSW
- NSW RFS
- NSW SES
- NSW DPI

The communication engagement activities to date and purposes are summarised in Table 5-3.

Table 5-3 Summary of engagement activities

Activity	Purpose
Agency notifications – Aboriginal Cultural Heritage Assessment	Notifications on behalf of Niche Environment and Heritage were sent to groups, organisations and individuals identified as potential stakeholders for the project and were invited to register interest and share knowledge to determine the heritage significance of Aboriginal object(s) or item(s) within the project area.
Stakeholder briefings	Briefings offered to key stakeholder groups to inform on the approach to community engagement and the EIS development. Used as an opportunity to receive informal feedback and to understand sentiment.
Regulatory stakeholder and government agency meetings	Formal opportunities, with the presence of technical experts, to receive feedback on EIS topics from regulatory stakeholders and governmental agencies.
Local Aboriginal Land Councils and Aboriginal Stakeholders meetings	Regular meetings offered to address the project status, potential impacts and the progress of EIS engagement. Provides a mechanism for feedback and collaboration.
Community drop-in information sessions (face-to-face)	Two sets of two 'drop-in' style community information sessions have been held to provide members of the community with the opportunity to come along and provide input or feedback and discuss any issues with the project team. The drop-in sessions were carried out in October 2023 and May 2024. The sessions were held at the council administration building to allow residents to call in at any time over two-hour periods (both afternoon and evening) to discuss the project. Sign-in sheets to capture contact details and feedback forms to help us capture feedback are made available at the information sessions. As well, material about the project was made available at drop-in sessions organised for the Cowarra Water Supply Scheme on 16 July 2024.
Engagement with neighbours close to the site	To date two meetings have been held with a group of neighbours to discuss the project and understand concerns. These were held on 10 October 2023 and 21 May 2024. Specific engagement with near neighbours has included: – Letters notifying Fernbank Creek Road residents of upcoming consultation. – Calls to confirm date and time of a special briefing for near neighbours. – "Near neighbour" special briefing meetings and discussions. – An offer of a site visit to Morpeth WWTP (a very similar plant). – A letter from Fernbank Creek Road residents, addressed and emailed to Council's Mayor and CEO was responded to by email.
Industry briefing	An industry briefing for potential contractors and suppliers for the project was held on 24 June 2024 with 35 attendees.
Rates notice mailout	Information about the project was included in the mailout of rates notices in July 2024. The information was sent to the approximately 36,000 ratepayers across the local government area.

Activity	Purpose
Engagement with primary producers and the local community	Engagement (several meetings) with oyster farmers and North-Side Progress Association, Friends of Kooloonbung Creek Nature Park and Hastings Birdwatchers regarding wastewater treatment plant discharge locations and potential impacts on the Hastings River estuary.



Above: an event notification for the community drop-in sessions held in October 2023, and right, a screen shot from the Facebook video promoting the drop-in sessions in May 2024.

Above: The industry briefing attracted 35 attendees

5.4.3.1 Community consultation and feedback

Council is committed to genuine consultation with the local community and other stakeholders about this project. Feedback from the community has been captured and responded to prior to and during the preparation of the EIS.

The feedback has been received through Council's communication tools outlined in Table 5-2 and is detailed in Appendix C (Community Engagement Table).

5.4.3.2 Agency consultation and feedback

The project team has undertaken extensive consultation with a range of government departments and agencies to confirm regulatory requirements for the environmental assessment, gather knowledge on key issues and opportunities, and facilitate information sharing during the preparation of the EIS. Consultation that has occurred to date and the topics raised detailed in Appendix C (Community Engagement Table).

5.4.3.2.1 Site Selection Review and Workshop

Following several workshops with the regulators and local communities, a Strategic Management Plan Review Workshop was undertaken on 15 December 2023 with GHD, BECA HunterH20 and Council to return to first principles and identify any potential "blue sky options" that may not have been previously considered as part of option development. The multi-criteria assessment (MCA) was reviewed with consideration of findings from initial environmental and ecological investigations. To undertake this exercise a Geographical Information System (GIS) based multicriteria analysis took was utilised to support the workshop, known as the Infrastructure Development - Geospatial Options (InDeGO) method to quantitatively evaluate potential siting locations based upon existing available GIS data.

Through the InDeGO method, stakeholder input is gathered throughout the process and the outcome is essentially creates a heat-map of potential sites based upon a suitability rating for environmental, heritage and surrounding land use criteria.

The GIS multicriteria showed that the sand plan site (proposed WWTP site) as most suitable. The existing WWTP and adjacent site were mapped as potentially favourable however, potential unknown environmental impacts and additional time implications were present with these options. Following this workshop, Council re-affirmed its strategy to provide wastewater treatment at the existing Port Macquarie WWTP and the new WWTP at the Sand Plains site (discharge to Kooloonbung Creek).

5.4.3.3 Aboriginal heritage consultation

The project is located within the Birpai LALC boundary. Council have kept the LALC informed about the project as part of the Aboriginal Community Consultation.

Aboriginal stakeholders have been consulted with in accordance with the processes and methods outlined in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (NSW DECCW 2010), as well as additional project specific communication strategies to promote transparent and frequent two-way dialogue. A consultation log has been maintained and documents all external correspondence in relation to the Aboriginal Cultural Heritage Assessment (ACHA). As part of the ACHA (Technical Report 2 – Aboriginal Cultural Heritage Assessment), the project team has been liaising with Aboriginal organisations and/or individuals. The nine Registered Aboriginal Parties (RAPs) include locally based individuals and organisations based primarily in Port Macquarie, as well as the broader Aboriginal community with an interest in cultural heritage management. Opportunity for Aboriginal involvement in consultation for the project and to provide comments was provided throughout the ACHA, which is detailed in Chapter 8 (Aboriginal heritage) and Technical Report 2 - Aboriginal Cultural Heritage Assessment.

5.5 Future engagement

5.5.1 Engagement approach

Engagement will continue on specific issues and opportunities relevant to the project following lodgement of the EIS for exhibition, in accordance with *Undertaking Engagement Guidelines for State Significant Projects* (NSW DPHI 2022). This will include community information sessions during the EIS exhibition period to allow community members to discuss aspects of the EIS with the project team.

Council is committed to continuing to engage nearby landowners, the general community and other stakeholders throughout all project stages and to build and maintain strong relationships with the neighbours to the project.

5.5.2 Exhibition of the EIS

Community engagement will continue during public exhibition of the EIS. This community engagement will be led by DPHI. DPHI will:

– Publish the EIS online via the Major Projects Planning Portal.
– Notify the public exhibition in accordance with the requirements in the EP&A Act and the EP&A Regulation.
– In some cases, arrange for a community information session to explain the assessment and submission process and to listen to community views on the project.

Stakeholders who are interested in, or who may be potentially impacted by the project will be encouraged to make a formal submission via DPHI Major Projects Planning Portal.

The project website and enquiry lines (phone and email) will remain open during exhibition of the EIS.

5.5.2.1 Project notifications and updates

Throughout the public exhibition of the EIS, Council will continue to inform stakeholders of the opportunities to have their say on the project. During this time, Council will continue to use the following engagement channels:

– Digital EIS portal
– Stakeholder briefings
– Community information sessions
– Council webpage
– Traditional media and advertisements
– Social media

In addition, directly affected landowners will be contacted via email and/or mail to inform them of the EIS public exhibition. This will allow the community and other stakeholders to be informed about the project and the opportunity to provide a submission.

5.5.2.2 Consideration of stakeholder and community feedback

Once the EIS public exhibition period has concluded, Council will receive a copy of all community and stakeholder submissions from DPHI.

Council will prepare a submissions report that responds to comments and feedback on the EIS, which will then be made available on the DPHI website. If changes to the project are required following the EIS public exhibition period, an amendment report (or a preferred infrastructure report if the Planning Secretary requests changes to the project) may also be prepared.

5.5.3 Engagement during the construction stage

Engagement with the community and other stakeholders will continue during the construction of the project. The purpose of the ongoing engagement is to:

– Ensure a high level of process awareness remains for the community as construction progresses
– Provide opportunities for ongoing community feedback
– Ensure feedback or concerns are address in a timely manner with accurate information

Council communication tools will continue to be available, monitoring and continually updated throughout the construction stage. Impacted landowners and key stakeholders will receive information directly via channels outlined in Table 5-2.

Council will evaluate and endorse the plans in consideration of any relevant Minister's conditions of approval. The community and stakeholder engagement approach during construction will also include a feedback management procedure to manage communications with the community such as enquiries, complaints or disputes. Any feedback provided by the community will be managed with respect and be responded to efficiently and in a timely manner, with each stakeholder interaction being treated as an opportunity for a positive experience.

5.5.4 Engagement during the operation stage

Council will continue to engage with the community, relevant council and government agencies during the operation of the project in line with the conditions of approval.

The WWTP and pipelines would be inspected by Council operation staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Council's asset management team would largely manage direct engagement and relationships with key landowners and stakeholders for infrastructure maintenance purposes during operation of the project.

5.5.5 Enquires and complaints management

Enquiries will continue to be received via the project webpage on Council's website.

Council's general complaints management process would be utilised during the construction and operation of the project. This is in place now on council's Compliments and Complaints page.

The council process is in place and includes:

– Roles and responsibilities.
– Steps to receive, manage and take appropriate action in relation to community enquiries and complaints.
– Procedures to record and respond to all enquiries, complaints and contact with community members and stakeholders in the contacts database.
– An escalation procedure.

The enquiries and complaints management system includes:

– A 24-hour community line for complaints and enquiries (with voicemail capability after hours).
– A postal and email address to which complaints and enquiries may be sent.
– Publication of Council contact details in local newspapers and the project website.
– Mediation system for complaints unable to be resolved.

To enhance accessibility and responsiveness for all residents, including those from culturally and linguistically diverse backgrounds, we will implement mechanisms for inclusive communication. These include utilising the free Translation and Interpreting Services (TIS National) and adopting plain and inclusive language across all enquiry and complaint management communication channels.

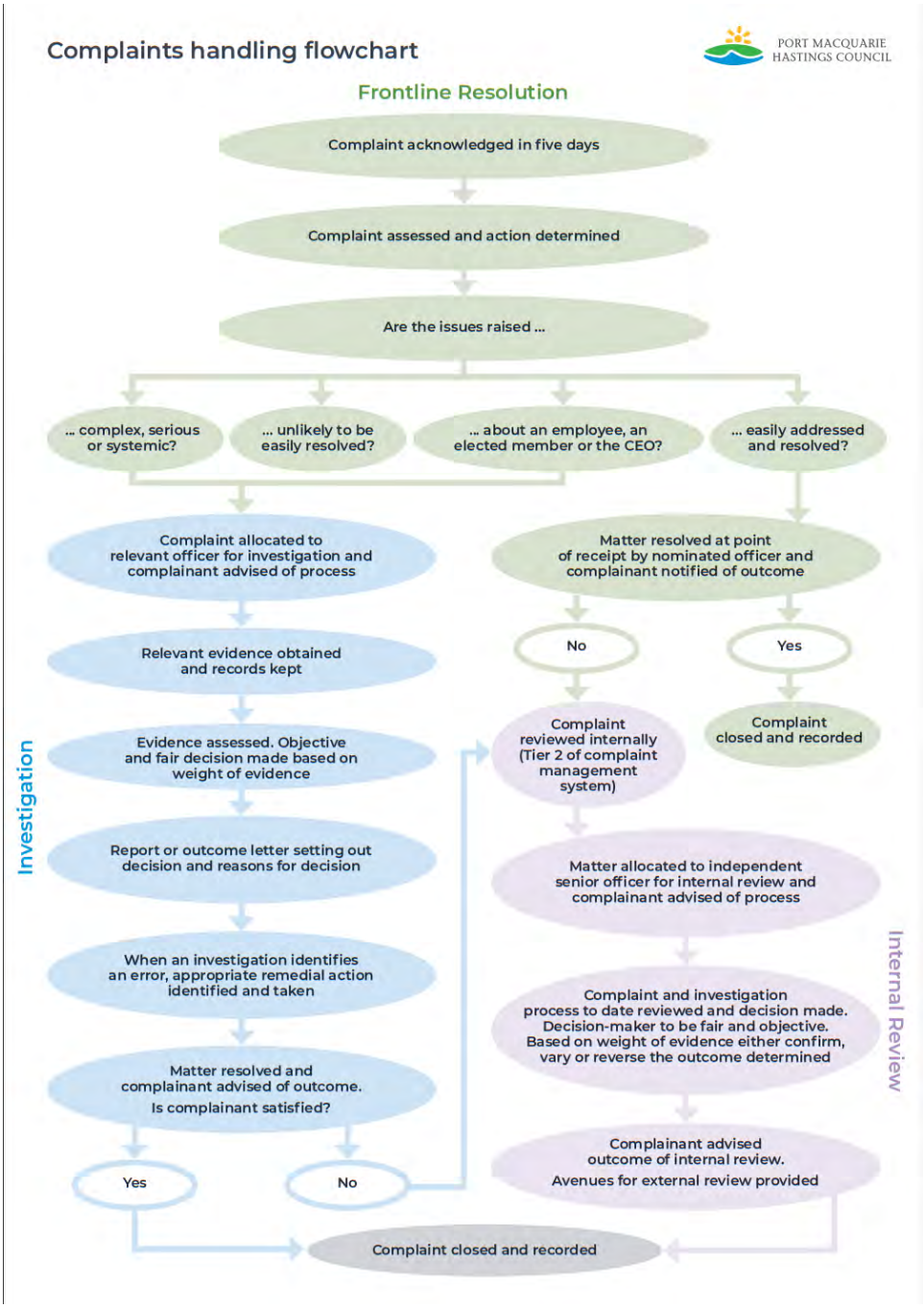


Figure 5-1 *Port Macquarie-Hastings Council Complaints Handling Flowchart*

6. Approach to impact assessment

This chapter provides a summary of the approach to the assessment of impacts adopted in this EIS. This approach has been developed in response to the need for ongoing refinement of design and construction methodology to improve environmental and performance outcomes whilst maintaining a robust assessment of potential environmental impacts for the projects. The detailed methodology for individual technical assessments is described in the technical reports and summarised in Chapter 7 to Chapter 24.

6.1 Overview

The project as presented in this EIS has been developed to avoid and minimise impacts where practicable and has been designed to a level where the potential impacts of the project can be appropriately identified and assessed. Some flexibility has been factored into the assessment as described in this EIS to allow for certain design elements and construction methodologies to be refined as part of the continued design development and construction planning process.

Council would seek to reduce environmental impacts and improve environmental outcomes through continued project design and construction methodology refinements, where appropriate. Chapter 25 (Environmental management) provides details on how the mitigation and management measures would be implemented as well as the process for dealing with any future design refinements or changes to the project.

6.2 Assessment approach

The assessment of potential environmental impacts as part of this EIS has, for the most part, been undertaken by assessing impacts on a ‘worst case’ basis. Conducting the impact assessment this way was intended to ensure that a rigorous level of assessment was undertaken, while also leaving open the possibility of further reducing impacts to sensitive receptors and the surrounding environment through the detailed design process.

The initial step of the impact assessment process involved identifying key potential environmental issues via an environmental risk assessment as part of the Scoping Report to determine potential impacts and risks that would be subject to detailed assessment as part of the EIS. The SEARs identified the following as key issues for the EIS:

– Water – quality and resource
– Water – flooding and hydrology
– Aboriginal cultural heritage
– Non-Aboriginal heritage
– Social
– Ecologically sustainable development including greenhouse gas emissions
– Biodiversity
– National Parks Estate
– Aquatic ecology
– Traffic and transport
– Air quality
– Soils and contamination
– Waste and chemicals
– Noise and vibration
– Land use and property
– Health and public safety
– Visual and design
– Crown Lands

The general requirements for the EIS as specified in the SEARs state that the EIS must be prepared in accordance with, and meet the minimum form and content requirements, as prescribed by Part 8 of the EP&A Regulation and must have regard to the State Significant infrastructure Guidelines. A checklist of how the EIS has met these requirements is provided in Appendix A Secretary's Environmental Assessment Requirements).

6.3 Impact assessment method

6.3.1 Defining the environmental baseline (existing environment)

Identification and assessment of baseline environmental values and conditions provides the foundation against which potential impacts are assessed. The approach to describing and defining the existing environment was specific to each impact assessment and was undertaken in accordance with relevant guidelines and best practice. Specific tasks included fieldwork, review of previous studies, database searches and relevant mapping.

The environment baseline (or existing environment) is described in detail in the technical reports prepared to support this EIS. A summary of the key features of the existing environment is in Chapter 3 (Project description) and the existing environment is described in greater detail in Chapter 7 to Chapter 24.

6.3.2 Assessment of potential impacts

The assessment of potential environmental impacts was based on the concept design for the project as presented in Chapter 3 (Project description). The assessment of potential environmental impacts was based on the concept design for the project as presented in Chapter 3 (Project description). The potential impacts considered by individual impact assessment include those specified by the SEARs and identified as an outcome of the environment risk assessment.

The assessment methodologies applied were specific to each key issue and defined in accordance with the requirements of the SEARs and relevant issue-specific guidelines and policies. This included consideration of the Rapid Assessment Framework, a requirement under the *Environmental Planning and Assessment Amendment Major Projects) Regulation 2021*. The Rapid Assessment Framework includes a series of guidelines, in particular the suite of State Significant Infrastructure Guidelines. For many of the key issues, the SEARs specify the guidelines that define the assessment methodologies.

Potential impacts were assessed using a (predominantly) qualitative or quantitative approach, depending on the nature of the issue and the requirements of relevant guidelines and policies. A summary of the individual assessment methodologies is provided in the Chapter 7 through to Chapter 24, with further detail in the technical reports.

6.3.3 Cumulative impacts

For an EIS, cumulative impacts can be defined as the successive, incremental, and combined effect of multiple impacts. Each of the impacts considered may in themselves be minor but could become significant when considered together. The SEARs (item B(vii)) requires, *'the likely interactions between the project any other existing, approved, proposed, reasonably foreseeable development in the vicinity of the site, include an assessment of cumulative impacts on the environment'*.

An assessment of potential cumulative impacts has been undertaken for relevant key issues in accordance with the SEARs requirements and with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW DPE 2022c). This NSW government guideline is the main tool use for assessing project-level cumulative impacts related to state significant project by setting clearing expectations and requirements.

6.3.4 Mitigation and management measures

Mitigation and management measures were identified to minimise or avoid the key potential impacts identified. The aim of these measures is to protect existing environmental values and sensitive receptors, and to achieve the objectives and requirements of relevant legislation, policies and guidelines.

The SEARs also require consideration of how residual impacts would be managed or offset. For the purpose of the EIS, residual impacts are considered to be the impacts of the project that may remain in the medium to long term, even after the implementation of the identified mitigation measures. The residual risk level of the potential impacts identified by the environmental risk assessment was assessed after mitigation and management measures were applied.

6.4 How the impact assessment results are detailed

The impact assessment results are presented in:

– Chapter 7 to Chapter 23 provides impact assessment results as they relate to the construction and operation of the project.
– Chapter 24 (Cumulative impacts) describes the potential cumulative impacts from the project and includes a discussion on residual impacts.
– Chapter 25 (Environmental management) provides a synthesis of the results of the assessment as a whole and includes a compilation of mitigation measures and assessment result that relate to the overall approach to environmental management of the project.

Table 6-1 lists where the key environmental issues as detailed in the SEARs are addressed. Further information about where individual SEARs requirements is addressed is in Appendix A (Secretary's Environmental Assessment Requirements). Chapter 7 through to Chapter 24 summarise the detailed assessment results that are in Technical Reports 1 to 19, as relevant.

Table 6-1 Addressed issues

Key environmental issue (SEARs)		Where key issues are addressed
1.	Water – quality and resource	Chapter 7 (Water quality and hydrology) Technical Report 1A – Water Resources and Flooding Assessment Technical Report 1B – Operational Water Quality Impact Assessment
2.	Water take and licensing	Chapter 7 (Water quality and hydrology) Technical Report 1A – Water Resources and Flooding Assessment
3.	Flooding and hydrology	Chapter 7 (Water quality and hydrology) Technical Report 1A – Water Resources and Flooding Assessment
4.	Aboriginal Cultural Heritage	Chapter 8 (Aboriginal cultural heritage) Technical Report 2 – Aboriginal Cultural Heritage Assessment
5.	Non-Aboriginal Heritage	Chapter 9 (Non Aboriginal heritage) Technical Report 3 – Historic Heritage Assessment
6.	Social	Chapter 10 (Social) Technical Report 4 – Social Impact Assessment
7.	Ecologically Sustainable Development	Chapter 23 Technical Report 16 – Ecologically Sustainable Development Assessment
8.	Biodiversity	Chapter 11 (Biodiversity) Technical Report 5 – Biodiversity Development Assessment Report
9.	National Parks Estate	Chapter 18 (Land Use) Appendix B-4-11
10.	Aquatic Ecology	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
11.	Traffic and Transport	Chapter 13 (Traffic and transport) Technical Report 7 – Traffic and Transport Assessment
12.	Air Quality	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment

Key environmental issue (SEARs)		Where key issues are addressed
13	Soils and Contamination	Chapter 15 (Soils and contamination) Technical Report 9 – Soils and Contamination Investigation
14.	Waste and chemicals	Chapter 16 (Waste and chemicals management) Technical Report 10 – Waste and Chemicals Assessment
15.	Noise and vibration	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
16.	Land use and property	Chapter 18 (Land use and property)
17.	Health and public safety	Chapter 19 (Hazard and risk) Technical Report 12 –Health Impact Assessment Technical Report 14 – Bushfire Risk Assessment
18.	Visual and design	Chapter 20 (Landscape character and visual amenity) Technical Report 13 – Landscape Chapter and Visual Amenity Impact Assessment
19.	Crown Lands	Chapter 18 (Land use and property)

7. Water quality and hydrology

The proposed wastewater scheme will include the Thrumster Wastewater Treatment Plant (WWTP) as well as associated infrastructure including biosolids handling, tertiary treatment for recycled water, transfer pipelines and release infrastructure.

This chapter includes a summary of the water quality modelling assessment and the geomorphology assessment relating to the construction and operation of the Thrumster WWTP. More detailed assessments on geomorphology and construction water quality are provided in Technical Report 1A – Water Resources and Flooding, and Technical Report 1B – Technical Report 1B – Operational Water Quality Impact Assessment.

Although the Thrumster WWTP has been designed to be expandable to a future ultimate capacity of 80,000 EP (18.4 ML/day ADWF), the water quality modelling and this water quality assessment are only representative of conditions up to the capacity of 40,000 EP (9.2 ML/day).

7.1 Assessment approach

7.1.1 Legislation and policy context

Key national and state legislation, guidelines and policies considered as part of the Water Resources and Quality (WRQA) assessment included:

- *Environmental Planning and Assessment Act 1979*
- *Protection of the Environment Operations Act 1997*
- *Water Management Act 2000*
- *Local Government Act 1993*
- *State Environmental Planning Policy (Planning Systems) 2021*
- *State Environmental Planning Policy (Resilience and Hazards) 2021*
- NSW Aquifer Interference Policy
- Port Macquarie-Hastings Council *Flood Policy 2018*
- *Port-Macquarie Hastings Local Environmental Plan 2011*
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000; ANZG 2018)
- Approved Methods for Sampling and Analysis of Water Pollutants in NSW (NSW EPA 2022c)
- Managing Urban Stormwater, Soils and Construction, Volume 1 (Landcom 2004)
- NSW Oyster Industry Sustainable Aquaculture Strategy 2021
- NSW Healthy Estuaries for Healthy Oyster Guideline 2017
- NSW Flood Risk Management Manual (DPE, 2023)
- Australian Rainfall and Runoff (ARR, 2019)
- AUS-SPEC Development Design Specification – D7 Stormwater Management

7.2 Methodology

7.2.1 Overview

Detailed methodologies is provided in Technical Report 1A – Water Resources and Flooding, and Technical Report 1B – Technical Report 1B – Operational Water Quality Impact Assessment. The key tasks undertaken for the water quality and hydrological assessment included:

- Reviewing legislation, guidelines and policies.
- Development of the concept and design of the project included consideration of water related impacts and where applicable, in-built measures were facilitated.

– Based on the nature of the proposed works, surrounding environment, and relevant legislation; potential risks for assessment were identified with relation to the following areas:
    - Surface water quality, during both construction and operation
    - Geomorphological impact
    - Flooding
    - Construction phase pipeline installation
    - Groundwater impacts during construction due to pipeline installation
– The above risks were assessed firstly through identification of potential direct sources of the above impacts, followed by identification of the potential location and magnitude of impact, as well as the relevant potentially affected receptors.
– Where in-built measure alone was considered insufficient to manage predicted impacts, additional mitigation measures were developed to address any potential impacts.

Assessing residual impact following implementation of mitigation measures.

The operational water quality assessment is based on the outcomes of WQRM (Technical Report 1B – Operational Water Quality Impact Assessment) (Intrawater, 2024) for the key parameters of concern related to WWTP effluent discharge including total nitrogen, total phosphorus, Enterococci (as a representative pathogenic indicator), inorganic nitrogen (including ammonia and nitrate), inorganic phosphorus and chlorophyll-a. Changes to salinity were also modelled as the Thrumster WWTP would discharge to tidally influenced waterways.

Where relevant, water quality has been assessed against appropriate default guideline values for environmental values including aquatic ecosystem protection, human health (primary / secondary recreation or consumption of aquatic foods). Full detail of the water quality modelling outcomes is provided in Technical Report 1B – Operational Water Quality Impact Assessment.

The modelling has been supplemented by qualitative assessment of other parameters of secondary concern, or those that have interrelationships with the key parameters of concern including water temperature, biological oxygen demand (BOD), dissolved oxygen and pH.

7.2.2 Definitions

7.2.2.1 Treatment capacity and discharges

PFTF is the maximum flow that receives treatment through the bioreactor process without significantly compromising effluent quality. The basis of design adopts a Peak Full Treatment Flow (PFTF) of 4x ADWF which was selected to reduce the storm storage pond size and reduce emergency overflow frequency. The design capacity (i.e. the PFTF) discharge equates to EP of 40,000 and expected to be reached by 2039 or later based upon residential and industrial growth projections in the outer suburbs of Port Macquarie.

When inflows exceed 4x ADWF, water would bypass the secondary treatment and discharge to the storm storage pond (see Section 3.3.1 WWTP). Water in the storm storage pond would be returned to the process for full treatment through the MBR when inflows again drop below 4x ADWF.

Under rare circumstances when inflows exceed the 4x ADWF for an extended period and water volume in the storm storage pond exceeds the storage capacity of 25 ML, water would discharge via the emergency discharge point to a swale running through the adjoining wetland into Partridge Creek. Modelling for the 40,000 EP design predicted four overflow events during the 12 year period modelled (Beca HunterH20, 2024).

7.2.2.2 Discharge water quality

The quality of the treated effluent has been estimated through modelling undertaken by Beca HunterH20. The expected median values for the treated effluent are presented in Table 7-1 and represent the typical quality the plant is expected to achieve throughout the operation of the scheme. The 90th percentile values for total ammonia and nitrate are also shown. These values were used as the basis for the WQRM modelling presented in Technical Report 1B – Operational Water Quality Impact Assessment to ensure a conservative assessment.

The Kooloonbung Creek effluent quality in Table 7-1 is reflective of discharges up to 4 x ADWF, which is the maximum flow that can be treated through the bioreactor process without significantly compromising effluent quality. The Partridge Creek overflow in Table 7-1 is generally of poorer quality (compared to Kooloonbung Creek discharges), due to the bypassing of secondary treatment, but would only apply during the rare (approximately four in twelve years) wet weather events where inflows are greater than the treatment capacity and exceed the 25 ML storage capacity. The WQRM identified that, based on historical rainfall records, only two major overflow events would have occurred in recent years (2011 to 2022), involving cumulative rainfalls of between 400 and 500 mm over periods of eight to nine consecutive days. This is shown in greater detail in Technical Report 1B – Operational Water Quality Impact Assessment.

Dilution factors and mixing zones for the Kooloonbung Creek discharge are discussed in Section 7.5.4 and Technical Report 1B – Operational Water Quality Impact Assessment. The overflows from the storage pond the wetland on Partridge Creek would only occur during periods of intensive rainfall (4x ADWF for an extended period), when there would be substantial dilution in Patridge Creek.

Table 7-1 Assumed treated wastewater quality for the Thrumster WWTP discharge

Parameter	Units	Kooloonbung Creek discharge	Partridge Creek overflow^
Total nitrogen	mg/L	6.0	7.1 to 12.7
Total ammonia	mg/L	0.2 (1.6*)	5.4 to 9.6
Oxidised nitrogen	mg/L	4.5	0.0 to 0.2
Nitrate	mg/L	(5.0*)	
Organic nitrogen	mg/L	1.3	1.7 to 3.1
Total phosphorus	mg/L	0.52	1.25 to 2.25
Filterable reactive phosphorus	mg/L	0.50	0.90 to 1.50
Organic phosphorus	mg/L	0.02	0.35 to 0.65
Organic carbon	mg/L	10.6	23 to 42
pH	pH units	6.5 to 8.5	6.5 to 8.5
BOD	mg/L	<5.0	40 to 70
Dissolved oxygen	mg/L	6.0	5.0 to 5.2
Enterococci	cfu/100mL	100	30,000 to 50,000

Notes: Values are medians.

90^{th} percentile values are shown in brackets for total ammonia and nitrate.

*90^{th} percentile values provided for total ammonia and nitrate only.

^Partridge Creek discharge minimum and maximum concentrations predicted from retention in the storm storage pond, the minimum equating to higher dilution, the maximum to lower dilution.

7.2.3 Water Quality Response Model

The Water Quality Response Model (WQRM) developed by Intrawater (2024); Technical Report 1B – Operational Water Quality Impact Assessment) involved consideration of scenarios that might reflect conditions under operation of the scheme over time, including expected changes in catchment conditions such as land use, population growth, and climate change. The modelling scenarios were as follows:

– **Baseline scenario:** Represents current (circa 2023/24) conditions (including current Port Macquarie WWTP discharges).
– **Background scenario:** Represents catchment and climatic conditions expected in a future time horizon (circa 2058) without the inclusion of the releases from the Thrumster Wastewater Scheme.
– **Impact scenario:** Represents catchment and climatic conditions expected a future time horizon (circa 2058) with the inclusion of the releases from the Thrumster Wastewater Scheme.

Each scenario was simulated under three independent rainfall years, representative of lower, average and higher annual precipitation as follows:

– 1st May 2015 to 30th June 2016 – a representative average rainfall year
– 1st July 2018 to 30th June 2019 – a representative lower rainfall year
– 1st July 2021 to 30th June 2022 – a representative higher rainfall year

Modelling of these different conditions provided an understanding of how rainfall conditions affect impacts from the proposed treated wastewater releases. Intuitively, the influence of the proposed discharges to receiving waters would be expected to be higher during periods of lower precipitation when there is lower dilution. The level of tidal influence is another factor that may influence the influence of the proposed discharges under to scheme to the receiving waters, as increased tidal flushing would reduce the influence of effluent discharge on water quality.

Climate change was considered in the WQRM as follows:

– Catchment inflows and water quality updated to represent climate change modifications to rainfall and evaporation.
– Sea level rise to represent climate change effects.
– Temperature rises in oceanic conditions as well as inflows from the catchment.

The WQRM was calibrated and validated against hydrodynamic and water quality monitoring data recorded at various locations throughout the Hastings River, Kooloonbung Creek, Fernbank Creek, Partridge Creek and other major tributaries.

The expected discharge volumes vary with expected population growth forecasts. The ‘future operation’ of the Thrumster WWTP was considered in the WQRM to be at a ADWF of 9.2 ML/day in 2058. Prior to reaching these operating levels, the extent of the impacts on the receiving water, whether they be beneficial or detrimental, are likely to be proportionally reduced, based on the predicted sea level rise (with climate change) which would be expected to increase tidal flushing. The Thrumster WWTP design assumed an ADWF of 6.0 ML/day at commissioning of the WWTP (approximately 2027), compared to the 9.2 ML/day at design flows by 2039 or later based upon residential and industrial growth projections.

The discharge rates modelled in the WQRM include no allowance for beneficial reuse. The modelling therefore represents a worse-case scenario in terms of ADWF, where no percentage of the WWTP effluent is supplied for recycling purposes.

The full detail on the modelling methods, assumptions and constraints is outlined in Technical Report 1B – Operational Water Quality Impact Assessment.

7.3 Existing environment

This section presents a summary of the existing condition of the receiving environments that will potentially be influenced by the project.

7.3.1 Hydrology and hydrogeology

The main water bodies in proximity to the WWTP and recycled water facility include the Hastings River, Partridge Creek, Fernbank Creek, while the proposed discharge point is to Kooloonbung Creek which flows to the lower Hastings River estuary.

The Hastings estuary has a riverine form with a distance of 32 kilometres (Technical Report 1B – Operational Water Quality Impact Assessment) from the river mouth to its tidal limit and occupies a total area of 14 km^2 (Umwelt, 2001). The river system has a catchment area of 3,595 km^2 and extends approximately 100 kilometres inland from the coast, through to the Cottan-Bimbang National Park.

The Hastings catchment is bounded by the neighbouring catchments of the Macleay River to the north and the Manning River to the south. At the river mouth, the entrance of the estuary has been constrained by training walls since early in the 20th century, adding to its high hydraulic efficiency (Umwelt, 2001).

Kooloonbung Creek is tidal up to approximately 900 metres upstream of the proposed Thrumster WWTP discharge point (i.e. Lake Road), with tidal influence dissipating in the wetlands around this area. The weir near the Gordon Street bridge may also affect the extent of tidal influence in Kooloonbung Creek.

There are areas of high potential aquatic groundwater dependent ecosystems (GDEs) within five kilometres of the project as well as areas of low, moderate and high potential terrestrial GDEs, based on regional assessments, and there are three registered groundwater bores within a 1.5 kilometres radius of the WWTP and recycled water facility footprints.

Further detail can be found in Technical Report 1A – Water Resources and Flooding Assessment.

7.3.2 Flooding

The WWTP and recycled water facility footprints as well as portions of the associated sewerage and recycled water pipelines are situated in flood prone land. The key sources available, and associated flood levels are listed in Table 7-2. This EIS has adopted the latest flood modelling undertaken for the Hibbard Precinct Flood Study (Advisian 2019), with exception of the PMF/Extreme flood, where the flood level from the Hastings River Flood Study (Patterson Britton & Partners Pty Ltd, 2006).

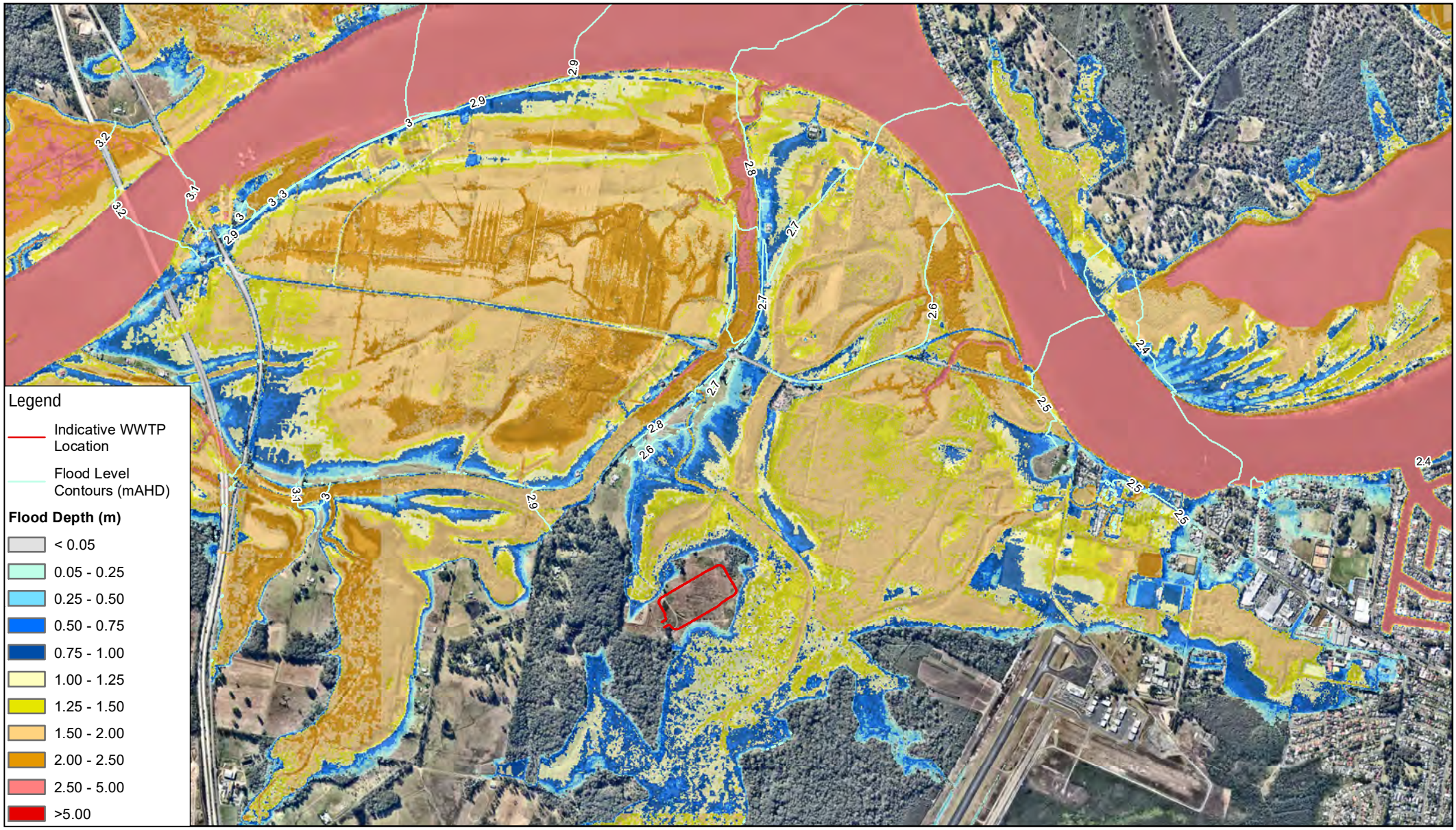
Table 7-2 Flood levels at the proposed WWTP and access roads site from various sources

ARI (year)	AEP (%)	Hastings River Flood Study (2006)	Hibbard Precinct Flood Study (2019)	Council's Geocortex Webmapping system	Draft Hastings River Flood Study Extension (Worley Consulting 2024)
		mAHD			
20	5%	2.67	2.54	2.67	2.29
50	2%				2.62
100	1%	3.43	3.38	3.34	3.04
200	0.50%		3.71		3.37
500	0.20%*		4.07	4.04	3.81
2000	0.05%				4.46
750000 (PMF/ Extreme)	0.00013%	6.67	7.63 (6.68)**	6.67	7.63

* This event is simulated as the 1% AEP event plus climate change

** During the course of the present assessment, Worley found an error with the PMF simulation undertaken for the Hibbard Precinct Flood Study. This value represents the corrected PMF flood level issued on 12/07/2024.

A series of flood maps for existing conditions at the site, based on the results from the Hibbard Precinct Flood Study (Advisian 2019) flood models have been provided in Technical Report 1A – Water Resources and Flooding.



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Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme

Existing Conditions
Flood Depth and Level

5% AEP

Project No. 12611129
Revision No. A
Date 16 July 2024

Figure 7.1

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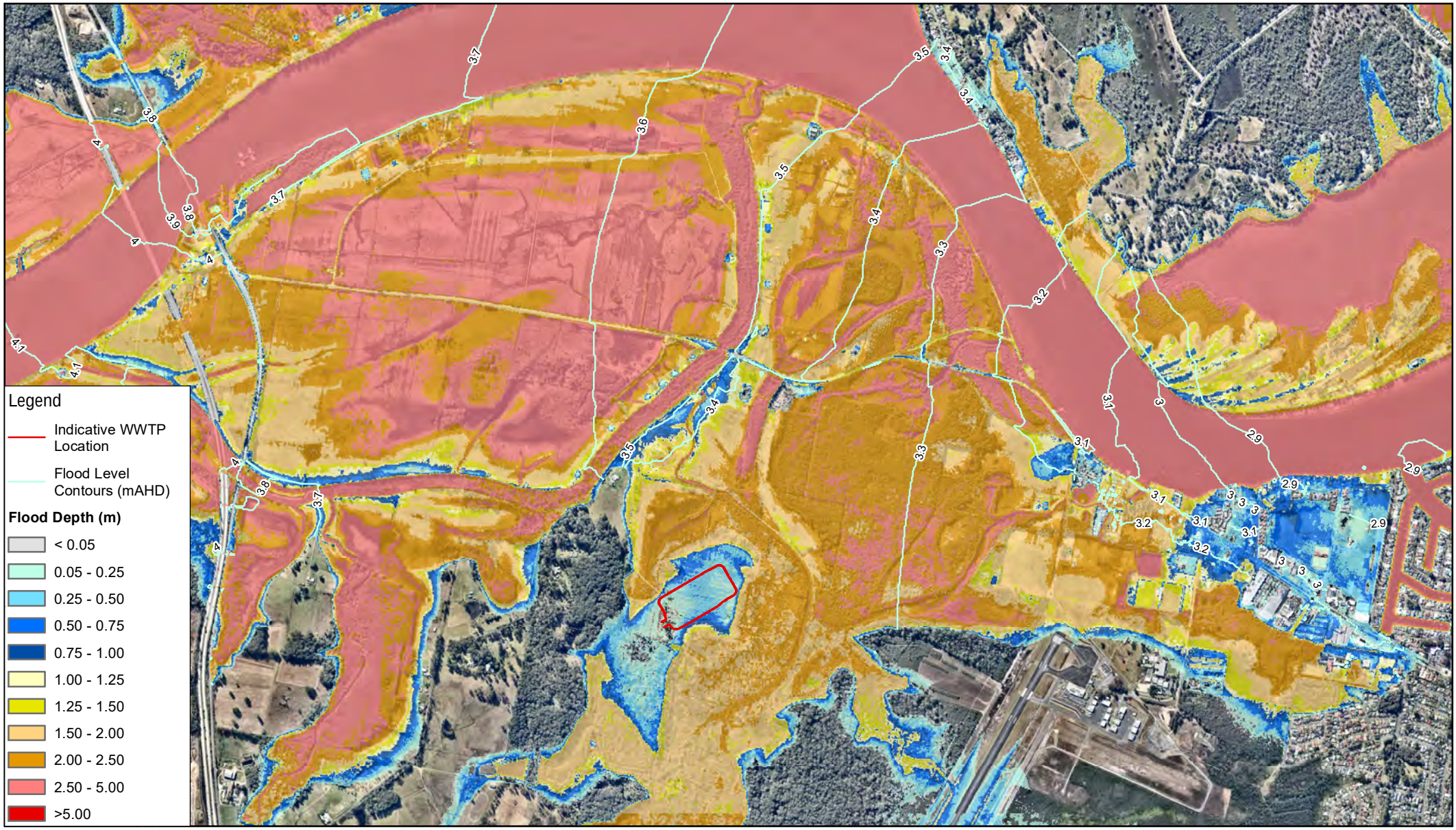
Data source: NearMap, Aerial Imagery, 2024. Created by: sydhydro



Paper Size ISO A4

0 250 500 750

Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme

Existing Conditions
Flood Depth and Level

1% AEP

Project No. 12611129
Revision No. A
Date 16 July 2024

Figure 7.2

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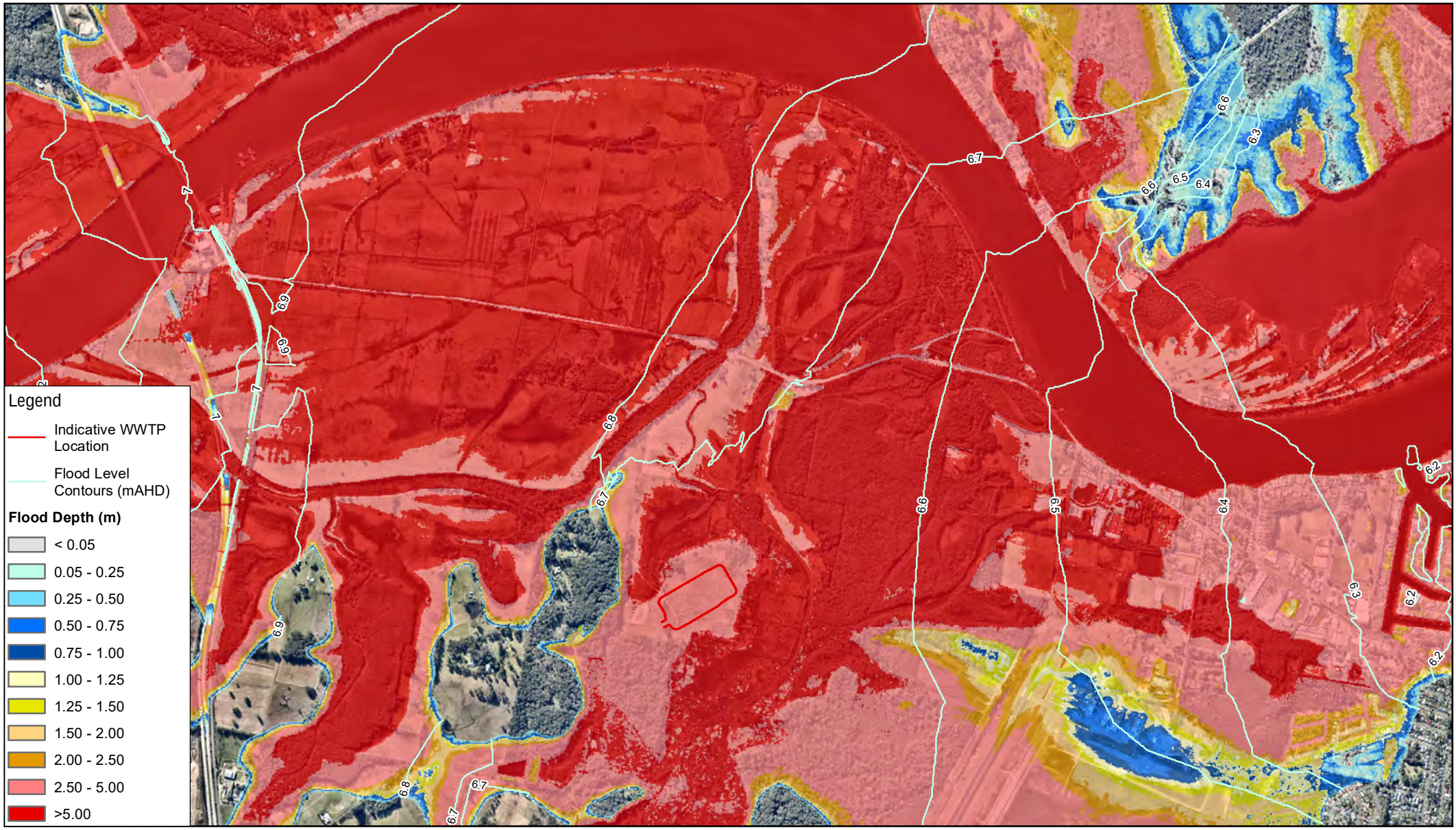
Data source: NearMap, Aerial Imagery, 2024. Created by: sydhydro



Paper Size ISO A4

0 250 500 750

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme

Existing Conditions
Flood Depth and Level

PMF or Extreme - 2006 Study

Project No. 12611129
Revision No. A
Date 16 July 2024

Figure 7.3

Data source: NearMap, Aerial Imagery, 2024. Created by: sydhydro

7.3.2.1 Flood depth and levels

Under the 5% AEP flood the site (the location of the WWTP and access roads) is located on a portion of the Hastings River floodplain that is not inundated by flood waters however is surrounded by backwater flooding from the Hastings River, the alignment of the northern access road would be inundated to depths of approximately 0.6 m, however the eastern access road would remain flood free. Parts of Fernbank Creek Road and Hastings River Drive would be inundated by flood waters. At the site flood levels remain reasonably static with little hydraulic grade.

In the 1% flood the location of the site would start being inundated to depths of around 0.5 metres and the location of both access roads alignments would experience backwater flooding from the Hastings River. At the site flood levels remain reasonably static with little hydraulic grade, demonstrating slow flow velocities and the backwater flooding in this part of the floodplain.

In the 0.5% and 0.2% flood, which is adopted as a proxy for future climate, flood depths in the floodplain at the site increase by a further approximately 0.3 metres to 0.4 metres and 0.6 metres to 0.7 metres respectively, compared to the 1% AEP flood events.

Under the PMF/Extreme flood depths were simulated to be around 3.8 and 4.8 metres deep depending on which flood study result is adopted.

7.3.2.2 Flood Velocities

Flood velocities at the location of the proposed WWTP are slow flowing, generally less than 0.3m/s. Velocities are slightly elevated in the extreme flood at approximately 0.6 m/s. These velocities are expected under back flooding conditions in a large floodplain.

The alignment of the northern access road passes through some areas of elevated flood velocities (approximately 1 m/s) near Fernbank Creek Road, closer to the Hastings River. In the PMF/Extreme event velocities increase to 1.8 m/s.

7.3.2.3 Flood Hazard

The combination of flood depth and slow-moving flood velocity over a range of events result in a low to medium flood hazard at the location of the site. The northern access road alignment traverses some areas of high and very high hazard, while the western access road generally traverses low hazard zone, with a small section of medium hazard.

7.3.3 Soils and geology

The WWTP and recycled water facility footprint and pipelines are underlain by Coastal deposits (dune facies), Alluvial floodplain, and Alluvial backswamp surface geology and lie within the Korogoro and Christmas Creek soil landscapes. Soils are typically not prone to erosion due to the low relief and waterlogging. The proposed pipelines pass through a number of different geological environments and soil landscapes. The different geological units identified within the project footprint, and each pipeline segment are summarised in Chapter 15 (Soils and contamination).

Some low – high probability acid sulfate soils are encountered throughout the WWTP and recycled water facility footprint as well as segments of the pipeline. The pipeline routes also pass through dispersible, sodic and moderately reactive soils. Further details are discussed in Chapter 15 (Soils and contamination).

7.3.4 Geomorphology

The sewer and recycled water mains intersect the southern reach of Partridge Creek. Overall, this creek is in moderate – good condition based on the NSW River Styles and River Condition Index assessment criteria. The pipelines also cross several first-order and second-order waterways.

The WWTP and recycled water facility footprints intersect the northern and southern reach of Partridge Creek. Overall, the northern and southern reaches of Partridge Creek are in moderate – good condition based on the NSW River Styles and River Condition Index assessment criteria. The pipelines do not intersect any major creeks but cross a number of first-order and second-order waterways.

7.3.5 Environmental values and objectives

Relevant waterway objectives for the Hastings River estuary and tributaries have been developed in accordance with the *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (OEH, 2017). The values and uses adopted for this assessment for the Hastings River and tributaries are provided by the NSW Water Quality and River Flow Objectives – Camden Haven and Hastings Rivers (DPE 2006). The environmental objectives in accordance with DPE (2006), relevant to human health include:

– Visual amenity
– Primary contact recreation
– Secondary contact recreation
– Aquatic foods (cooked) and commercial shellfish production

The water quality guideline values used to identify risks to the above human health environmental objectives include:

– Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
– Aquatic Foods (cooked) (as applied to aquaculture activities) (DPE 2006)

The relevant aquatic ecosystem protection values include:

– Stressor default guideline values (ANZECC 2000) for lowland freshwater rivers, estuaries and marine waters.
– Toxicant default guideline values (ANZG 2018) for freshwater and marine waters for:
    - Protection of 95 percent of species (relevant for slightly to moderately disturbed waters)
    - Protection of 90 percent of species (relevant for highly disturbed waters)

Kooloonbung Creek is tidal up to approximately 900 metres upstream of the proposed Thrumster WWTP discharge point (i.e. Lake Road), with tidal influence dissipating in the wetlands around this area. Therefore, the proposed discharge point is within the extent of tidal influence. The weir near the Gordon Street bridge may also affect the extent of tidal influence in Kooloonbung Creek. Therefore, aquatic ecosystem default guideline values for freshwater and estuarine waters have been included. As the tidal influence would vary based on tide conditions and rainfall, freshwater and estuarine default guideline values may apply to the same sites around the extent of tidal influence (e.g. Kooloonbung Ck U/S of Lake Road (KCS04) and Partridge Creek site Upstream of weir). The salinity measure has been used to determine which guideline value is applicable.

7.3.6 Water quality

Historically, the Hastings Estuary Management Plan (Umwelt, 2001) reported that water quality in the main estuary was generally very good and complied with ANZECC guidelines for protection of aquatic ecosystems in most conditions. However, water quality of all parts of the estuary was reported to decline during rainfall events, largely as a result of run-off from predominantly agricultural upstream land-use.

The Hastings Estuary Management Plan also noted that the water quality of the estuary was found to comply with the guidelines for primary contact recreation (swimming) near the mouth and at Pelican Island. Water quality at Wauchope however did not always comply with the primary contact guidelines after rain and Kooloonbung Creek complied with secondary contact recreation, but not primary contact recreation.

Monthly water quality sampling data are available at select monitoring locations on Fernbank Creek, Partridge Creek Kooloonbung Creek and the Hastings River are summarised in Table 7-3 and shown on Figure 7-4.

Table 7-3 Summary of monitoring data. Sites are in order upstream to downstream.

Creek	Monitoring locations	Sampling period	Frequency
Partridge Creek	Upstream of weir	6 March 2023 to 28 May 2024	Monthly
	Downstream of weir		
Fernbank Creek	Junction of Fern & Part		
	Outlet to hastings		
Kooloonbung Creek	Kooloonbung Ck upstream (U/S) of Lake Road (KCS04)	7 January 2023 to 20 September 2023	Monthly
	Kooloonbung Ck WWTP Discharge (KSC17)		
	Kooloonbung Ck at Walk Bridge (KCS05)		
	Wrights Creek at Lake Road (KCS 08)		
	Kooloonbung Ck William St Bridge (KSC06)		
	Kooloonbung Ck HRiver entrance at Wharf (KSC07)		
Wrights Creek	Wrights Creek at Lake Road (KCS08)		
Hastings River	HRiver at Public Wharf at Town Green (KSC10)		
	HRiver Settlement Point at PWD Station (KSC09)		

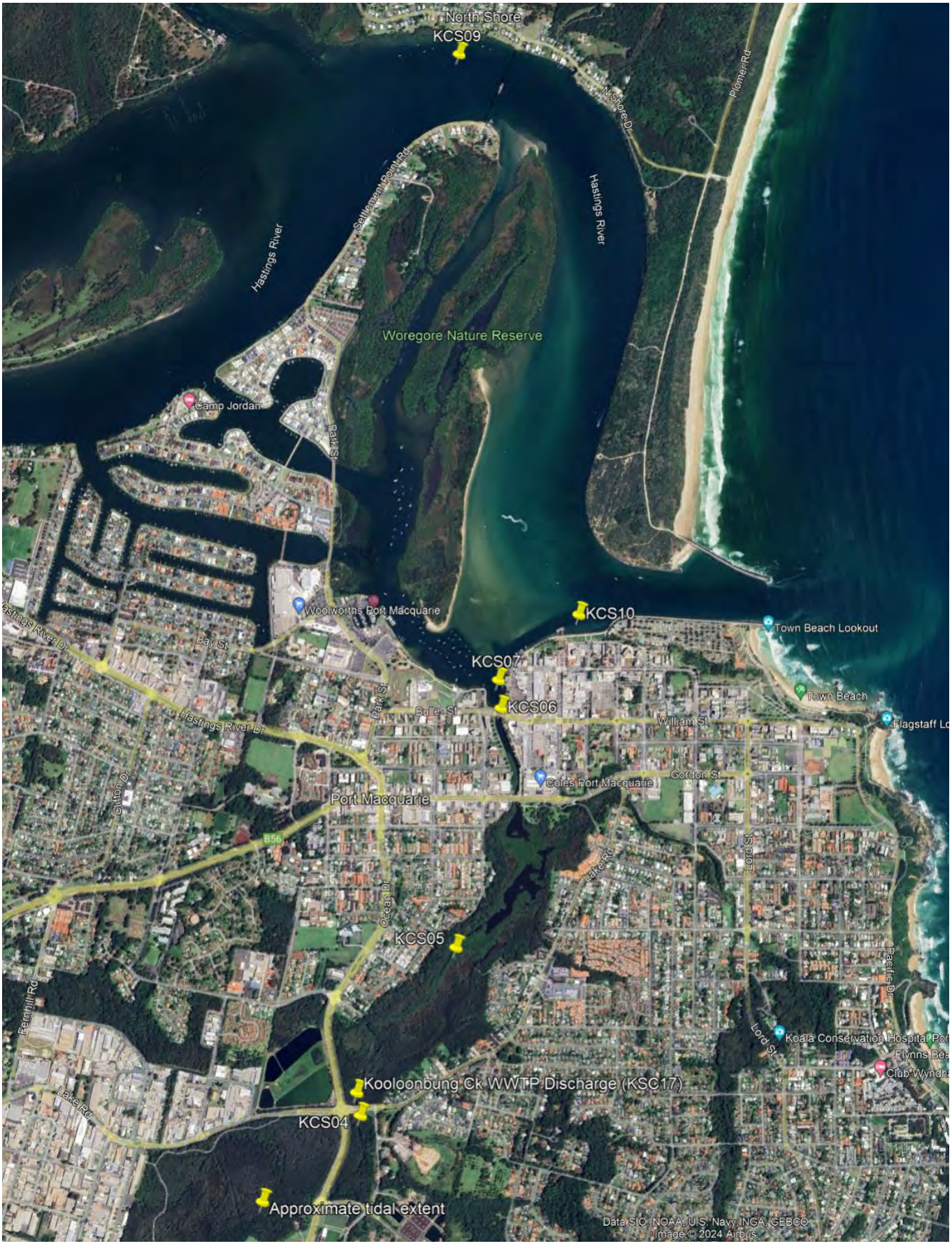


Figure 7-4 Surface water monitoring locations

Technical Report 1B – Operational Water Quality Impact Assessment provides a review of existing water quality in the receiving water catchment with a comparison to relevant WQOs with key aspects presented below along with interpretation of data from Council's monitoring program.

A statistical summary of available water quality data for Kooloonbung Creek, Partridge Creek and Fernbank Creek is provided and compared to water quality guideline values relevant to human health and aquatic ecosystems in Technical Report 1A – Water Resources and Flooding Assessment.

The results of the analysis are considered in the sections below.

7.3.6.1 Salinity

Salinities are observed to increase along Kooloonbung Creek and Partridge / Fernbank Creeks with distance downstream towards the Hastings River. Salinity in Partridge Creek and Fernbank Creek indicates that upstream of the weir, conditions are generally consistent with a freshwater environment, while salinity downstream of the weir indicates estuarine conditions, with some exceptions.

Salinity immediately downstream of the Port Macquarie WWTP discharge point (site KCS17) was low, despite being within the extent of tidal influence, due to the discharge of low salinity water from Port Macquarie WWTP. Salinities at the William Street Bridge site downstream are representative of estuarine or marine conditions, coupled with some influence from the stormwater inflows and effluent discharges which become more prevalent during and following rainfall events. Upstream of Lake Road, and the Port Macquarie WWTP discharge, salinities are largely fresh to brackish in nature with some higher salinities recorded during periods of lower rainfall and higher spring tidal ranges as shown on

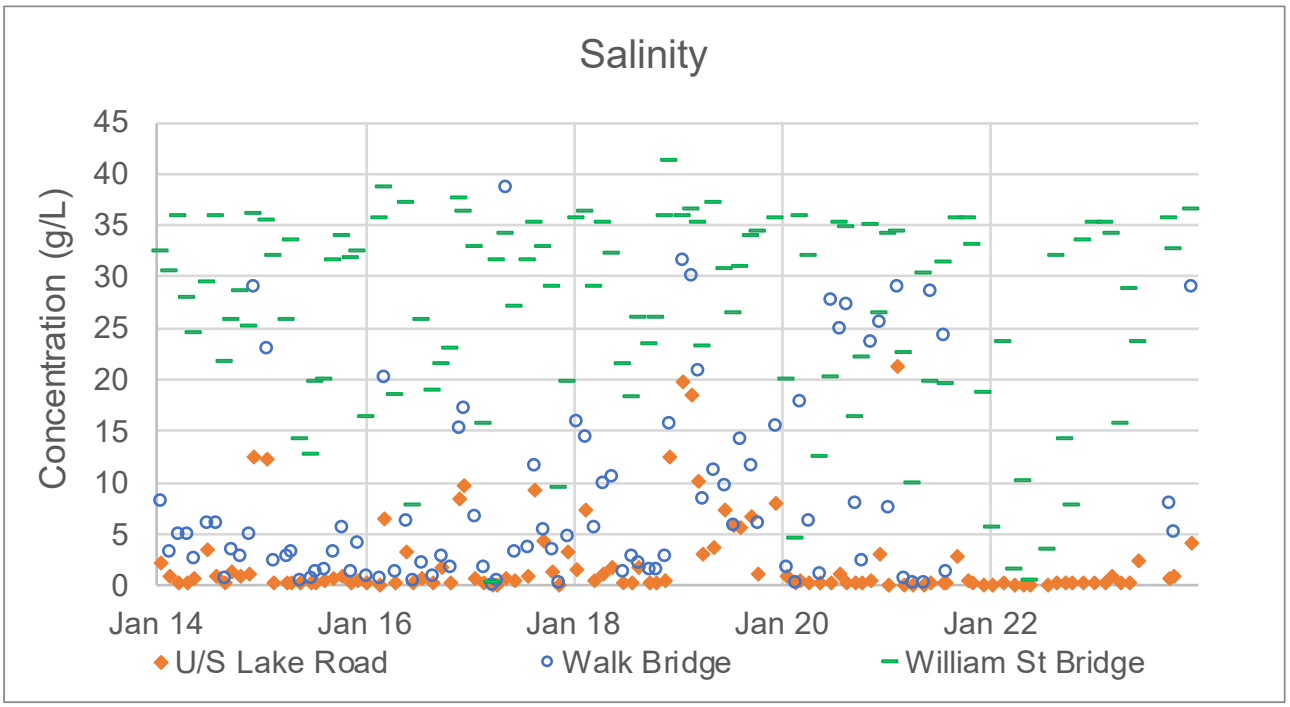


Figure 7-5 Kooloonbung Creek monitoring data – Salinity (2014-23).

Note: U/S Lake Road is KCS04, Walk Bridge is KCS05 and William St Bridge = KCS06.

7.3.6.2 pH

Within Partridge Creek to the junction with Fernbank Creek, pH has been observed below the lower guideline values for Aquatic Foods (cooked) (as applied to aquaculture activities), primary recreation and aquatic ecosystem protection, with more frequent exceedances in upper Partridge Creek. These acidic conditions are due to the acid sulfate soils (ASS) in the area, which have been actively managed by Council since 2001 with introduction of a hydraulic gate. The sub-catchments of Partridge Creek and Fernbank Creek are examples of a high-risk ASS area which have been managed through the installation of embankments and the development of wetlands within the floodplain area. In Kooloonbung Creek, pH was within the guideline values and between 7.25 (5th percentile) and 7.68 (95th percentile), increasing in a downstream direction as salinity increases.

7.3.6.3 Dissolved Oxygen

Dissolved oxygen concentrations (mg/L) were above the minimum recommended in the Aquatic Foods (cooked) guideline values (aquaculture activities) throughout the Kooloonbung Creek and Hastings River sites, except at the Kooloonbung Creek site upstream of the Port Macquarie WWTP discharge point where some low dissolved oxygen was observed. The constant flow from the Port Macquarie WWTP discharge has likely contributed to the dissolved oxygen concentrations, while the Hastings River sites are in well-flushed areas of the estuary. Dissolved oxygen was generally lower at the Partridge and Fernbank Creek sites, with the median value falling below the Aquatic Foods (cooked) guideline value (aquaculture activities) at all sites except Fernbank Creek at the outlet with the Hastings River. When comparing dissolved oxygen percent saturation to the stressor default guideline value for aquatic ecosystem protection, there was a similar level of impairment observed in upper reaches of Kooloonbung, Partridge and Fernbank Creek, with few exceedances observed at the better flushed sites in the lower estuary and Hastings River.

7.3.6.4 Turbidity

Turbidity frequently exceeded the stressor default guideline value for aquatic ecosystem protection in Partridge Creek, downstream of the weir, but was otherwise generally within the guideline values at all other sites. Total suspended solids frequently exceeded the Aquatic Foods (cooked) guideline value (aquaculture activities) in Fernbank Creek at the confluence with the Hastings River, indicating some risk to the oyster leases downstream, under existing conditions. Total suspended solids concentrations in Kooloonbung Creek were generally very low.

7.3.6.5 Metals

Aluminium concentrations exceeded the Aquatic Foods (cooked) guideline values (aquaculture activities) in Kooloonbung Creek, Fernbank and Partridge Creek, though no oyster leases are mapped to occur in these waterways.

7.3.6.6 Nutrients

The Hastings River estuary typically has elevated nitrogen and phosphorus levels Intrawater, 2024). Nitrogen tends to be related to surface runoff and therefore associated with high flow conditions, while phosphorus is biologically generated within the system and associated with low flows. In line with findings from Ryder et al (2012), phosphorus concentrations appear more consistent throughout the whole catchment relative to the nitrogen analysis, suggesting catchment-wide sources of phosphorus are present. Longer-term data (Intrawater, 2024) indicates that rainfall and increased catchment loads influence nutrient concentrations in the Hastings River, with lower concentrations recorded during lower rainfall periods. Concentrations of total nitrogen and total phosphorus at the Hastings River sites were generally within the guideline values but there were some minor exceedances for inorganic phosphorus.

Analysis of Council monitoring data in Kooloonbung Creek by Intrawater (2024) is presented in Figure 7-6 and Figure 7-7.

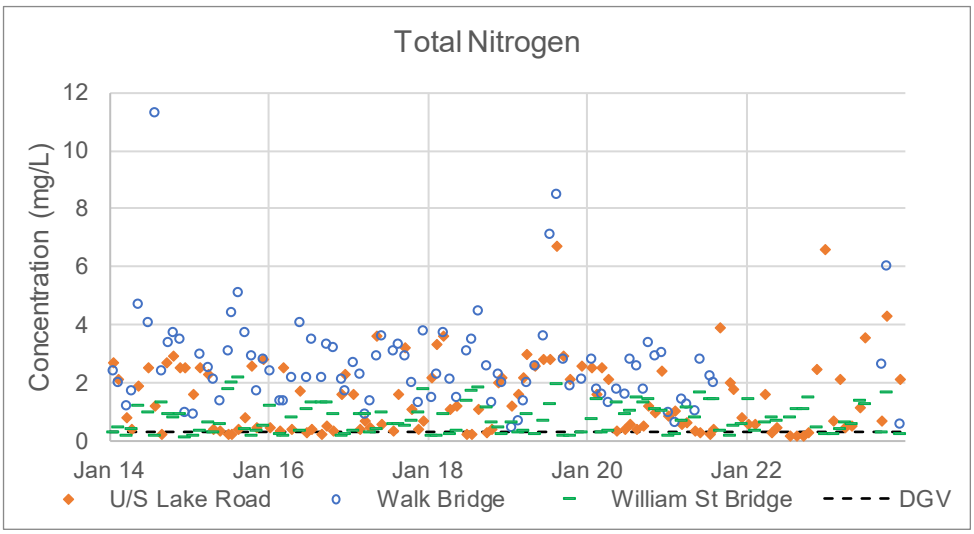


Figure 7-6 Kooloonbung Creek monitoring data – Total Nitrogen (2014-23)

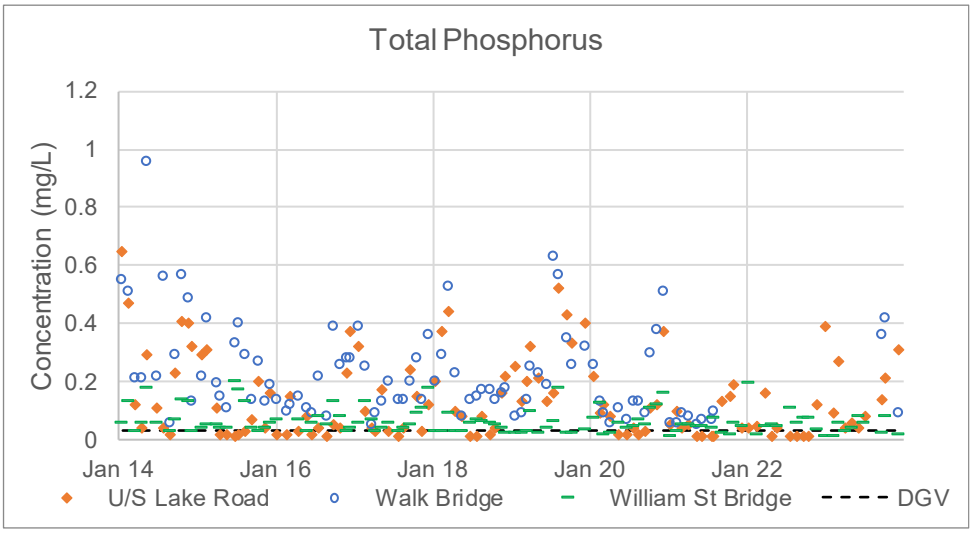


Figure 7-7 Kooloonbung Creek monitoring data – Total Phosphorus (2014-23)

The analysis of the trends indicate nutrient concentrations within the creek are influenced by the high nutrient loads being released from the Port Macquarie WWTP storage lagoons as well as, to a lesser degree, the runoff from the surrounding urbanised catchment.

Due to its location downstream of the lagoon releases and with less influence from estuarine waters, the nutrient levels are highest at the Walk Bridge site. Downstream, impacts reduce at the mouth of the creek near the Willam Street Bridge due to the greater influence of estuarine waters, however this is also likely to be affected by the state of tide when sampling is undertaken.

Upstream of Lake Road, nutrient levels are still elevated but to a lesser degree, indicating that impacts from the lagoon releases extend upstream of the release point but are less dominant, which would be affected by tidal ranges and rainfall.

Against the long-term median concentrations analysed, all sites within Kooloonbung Creek were non-compliant with the water quality objectives for all the nitrogen and phosphorus indicators analysed.

7.3.6.7 Toxicants and pathogens

Nitrate and ammonia concentrations in Kooloonbung Creek and the Hastings River were generally below Aquatic Foods (cooked) guideline values (aquaculture activities), and toxicant guideline values for protection of 95 percent of marine species (at pH 8.0), except for immediately downstream of the Port Macquarie WWTP discharge. Ammonia concentrations frequently exceeded the Aquatic Foods (cooked) guideline values (aquaculture activities) in Partridge Creek downstream of the weir but were generally below the guideline value at other Partridge and Fernbank Creek sites and at the Hastings River sites. There were no exceedances of the Aquatic Foods (cooked) guideline values (aquaculture activities) for nitrate at Partridge and Fernbank Creek sites.

Enterococci concentrations frequently exceeded the Aquatic Foods (cooked) guideline values (aquaculture activities) in Partridge Creek downstream of the weir and Fernbank Creek, including the site at the outlet of the Hastings River. While Enterococci were not measured at sites in Kooloonbung Creek, Technical Report 1B – Operational Water Quality Impact Assessment identified that the concentrations of Thermotolerant Coliforms in Kooloonbung Creek frequently exceeded the guideline values, as far downstream as the William Street bridge site as shown on Figure 7-8.

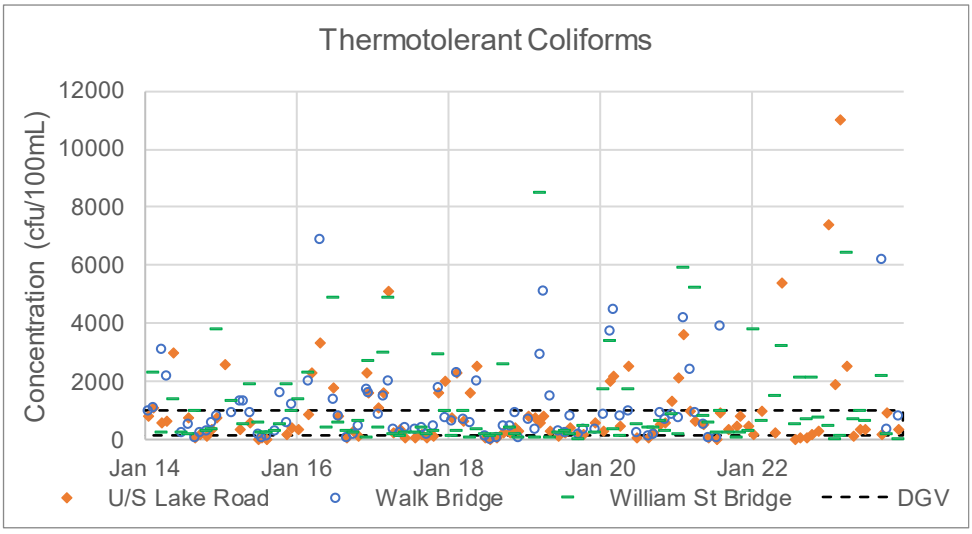


Figure 7-8 ***Kooloonbung Creek monitoring data – Thermotolerant/Faecal (2014-23)***

Chlorophyll-a concentrations commonly exceeded the stressor aquatic ecosystem protection guideline values in Kooloonbung Creek at sites closest upstream and downstream of the Port Macquarie WWTP, indicating elevated algal loads at these locations. Chlorophyll-a concentrations were also frequently elevated in Partridge Creek upstream of the weir, and occasionally at other Partridge and Fernbank Creek sites and the Hastings River. Though, generally, the chlorophyll-a concentrations at the Kooloonbung Ck William Street Bridge site, and downstream Hastings River sites were very low.

7.3.6.8 Temperature

The water temperature recorded in Kooloonbung Creek and the Hastings River under the existing conditions, suggests that water temperature between March and September 2023 was generally higher at the Kooloonbung Creek WWTP site compared to the site upstream of the Port Macquarie WWTP discharge point (Kooloonbung Ck U/S of Lake Road) or the Wrights Creek site upstream of the confluence with Kooloonbung Creek (Wrights Creek at Lake Rd), which are representative of river flows with reduced tidal influence (i.e. largely freshwater conditions; Figure 7-9). Water temperature at the latter two sites varied by approximately five to eight degrees, between the warmest (February / March) and coldest (June) periods. There is a stronger tidal influence on the sites further downstream in Kooloonbung Creek and the Hastings River which explains the more consistent temperatures (only three to four degrees variation) observed at these sites across the March and September 2023 period. The generally higher water temperature at Kooloonbung Creek WWTP Discharge is likely due to a combined influence of elevated temperature in the Port Macquarie WWTP effluent and the increased tidal influence compared to sites Kooloonbung Ck U/S of Lake Road and Wrights Creek at Lake Rd.

The water temperature at Kooloonbung Ck William St Bridge, located approximately 120 metres upstream of the confluence with the Hastings River, appeared generally elevated in February, March and September 2023, compared to sites further into the Hastings River, suggesting that there is some influence on water temperature from the Port Macquarie WWTP effluent near the Kooloonbung Creek outlet during the warmer months.

The water temperature recorded in Kooloonbung Creek and the Hastings River under the existing conditions, suggests that water temperature between March and September 2023 was generally higher at the Kooloonbung Creek WWTP site compared to the site upstream of the Port Macquarie WWTP discharge point (Kooloonbung Ck U/S of Lake Road) or the Wrights Creek site upstream of the confluence with Kooloonbung Creek (Wrights Creek at Lake Rd), which are representative of river flows with reduced tidal influence (i.e. largely freshwater conditions; Figure 7-9). Water temperature at the latter two sites varied by approximately five to eight degrees, between the warmest (February / March) and coldest (June) periods. There is a stronger tidal influence on the sites further downstream in Kooloonbung Creek and the Hastings River which explains the more consistent temperatures (only three to four degrees variation) observed at these sites across the March and September 2023 period. The generally higher water temperature at Kooloonbung Creek WWTP Discharge is likely due to a combined influence of elevated temperature in the Port Macquarie WWTP effluent and the increased tidal influence compared to sites Kooloonbung Ck U/S of Lake Road and Wrights Creek at Lake Rd.

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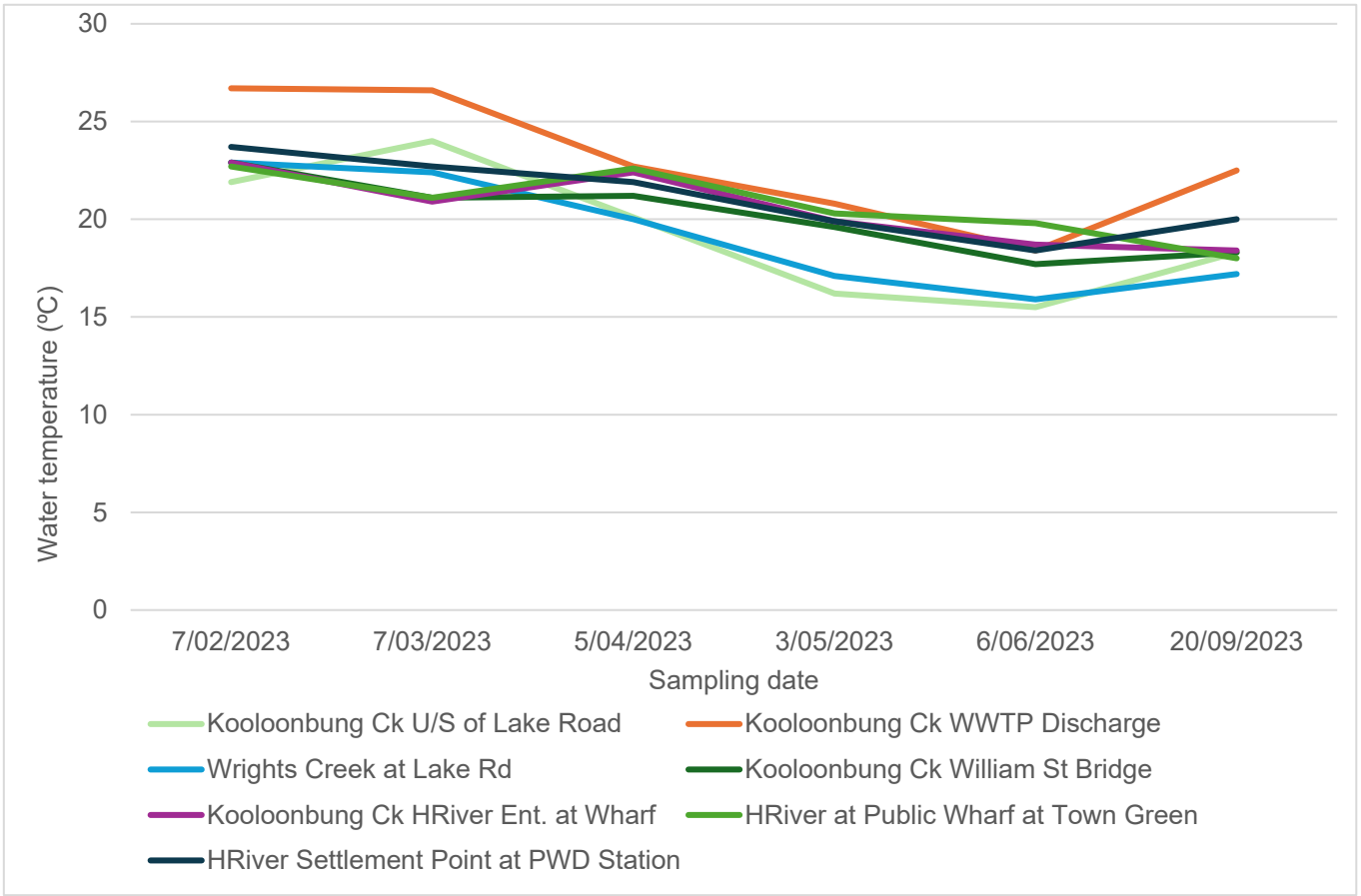


Figure 7-9 ***Water temperature measured in Kooloonbung Creek and the Hastings River between March 2023 and September 2024***

7.4 Construction impacts

7.4.1 Flooding

The proposed WWTP, recycled water facility, access roads and pipeline routes interface with flooding on the following basis:

– The construction and operational site footprint is located within an identified Flood Planning Area, which is impacted by flooding under existing conditions for a range of events above the 5% AEP level. The site footprint is located in flood storage and flood fringe areas of the floodplain and in areas of low and medium flood hazard.
– The construction and operational site access road alignments traverse the Flood Planning Area. In addition, the access roads bisect flood storage and flood fringe areas of the floodplain and in areas of low and medium flood hazard. The northern access road near Fernbank Creek Road partly traverses a floodway area and is located in a high flood hazard area.
– The pipelines and ancillary infrastructure will pass through Flood Planning Area and will be installed by horizontal directional drilling or trenching.

Appropriate construction planning will be required to ensure appropriate safety and environmental management measures are available if a flood event occurs during the construction program. The degree of impact to flood behaviour during construction will depend upon how close to the final design is achieved which is discussed in Section 7.5.1.

Flood Planning Levels identified in the Port Macquarie-Hastings Council *Flood Policy* (2018) would be adopted to set proposed pad levels for the WWTP provide a flood evacuation route via the alternative access to the WWTP. The relevant flood planning levels for the WWTP are included in Table 7-4.

Table 7-4 Thrumster WWTP Concept Design Report (90% stage) flood design requirements

Design Requirements	Flood Planning Level Category	Treatment Plant Location
Minimum pad construction level	FPL3	4.6m AHD
Critical infrastructure level	FPL4	6.7m AHD

The two-tiered pad design would provide opportunity to locate commercial and industrial facilities above the 1% AEP flood level including climate change and 0.5 metre freeboard critical infrastructure will be located on the second tier of the pad which is located above the Probable Maximum Flood as defined by the 2006 flood study. Additionally, pipe infrastructure would be located below ground and would be suitably designed to manage impacts during flood conditions.

7.4.2 Geomorphology

Construction impacts to geomorphology, including erosion of waterway banks, may arise from pipe installation, including trenching or HDD of waterways. Whilst geomorphic impacts from the pipelines are generally anticipated to be temporary, primarily associated with the construction phase, and local in nature, construction of pipeline waterway crossings of waterways can result in adverse impacts, depending on watercourse characteristics and flow conditions at the time of construction. Potential adverse impacts include sedimentation (see Section 7.4.3), flow rate change, recharge disruption and pollution / contamination.

Pipelines would be designed in accordance with IECA's 'Land-based pipeline construction' guideline (IECA, 2015) and APGA's 'Code of Environmental Practice – Onshore Pipelines' guideline (APGA, 2017) to minimise geomorphological impacts. Pipeline design will also consider appropriate pipeline depths and construction methodologies to reduce the risk of scour and other geomorphological impacts during waterway crossings. Pipe infrastructure would also be located below ground and trenched or, preferably horizontal-directional-drilled (HDD) for services, waterway crossings and other environmentally sensitive areas, as HDD would result in lesser impact compared to trenching. Only first and second-order streams are intersected during the pipeline construction which generally have low ecological value relative to higher order streams (e.g. third order and higher that are considered to provide key fish habitat).

Overall, the geomorphology assessment identified that with implementation of the mitigation measures, the Project pipelines are anticipated to result in negligible adverse geomorphological impacts during construction. More detail on the geomorphological assessment is provided in Technical Report 1A - Water Resources and Flooding Assessment.

7.4.3 Erosion, sedimentation and soils

Potential activities that could result in erosion and sedimentation include earthworks and excavations for the construction of pipelines, footings for wastewater treatment infrastructure and construction of the emergency discharge storage pond. Once disturbed, this sediment is prone to being mobilised into downstream waterways primarily from rainfall-derived runoff. Material generated by pipeline trenching or HDD activities may also result in erosion, which if not managed appropriately, could impact the downstream water quality by increasing turbidity (and suspended solids) and salinity. Sedimentation of waterways can also occur as the eroded soils settle in waterways, blanketing the river bed in silt. These potential impacts to water quality and waterway condition can pose a risk to flora and fauna.

These potential impacts can be appropriately managed through the implementation of appropriate strategies, in accordance with the Managing Urban Stormwater: Soils and Construction - Volume 1 (Landcom, 2004), informally known as the ‘Blue Book’. A Construction Environmental Management Plan (CEMP), a Soil and Water Management Plan (SWMP) and an Erosion and Sediment Control Plan (ESCP) will be developed prior to construction, in accordance with the Blue Book. This includes the staging of the WWTP and pipeline construction works into manageable portions (refer Section 3.3). Staging of construction works limits the area of disturbance and thereby assists in the management of erosion and sedimentation risk. Other key control measures that will reduce the potential for erosion include minimising the extent of vegetation and soil disturbance at drainage line and waterway crossings and re-establishing vegetation cover as soon as is practicable along the pipeline corridor. The project works also include the collection of onsite runoff in established surface water drains which would be directed to appropriately sized sediment basins. With the implementation of these and the additional control measures outlined in Technical Report 1A - Water Resources and Flooding Assessment, the project is anticipated to have negligible adverse impacts on erosion and sedimentation.

Monitoring of key water quality parameters in waterways adjacent to disturbance areas, prior to and during construction (see Section 7.6.1) will allow for early detection of water quality risks or the need for additional erosion and sediment controls during construction. On this basis, significant impacts to the water quality of Partridge Creek and other waterways are not expected during construction of the Thrumster WWTP or associated infrastructure. More details on the construction water quality assessment is provided in Technical Report 1A - Water Resources and Flooding Assessment.

7.4.4 Handling of high-risk materials with water quality risks

The handling of materials hazardous to downstream waterways (excluding those associated with erosion and sedimentation) is required to facilitate construction of the project. Potential activities where handling of hazardous materials could occur may include the accidental spills of stored materials e.g., fuels (diesel).

The potential impact associated with the handling of these components includes the potential mobilisation into downstream waterways either via direct flow of the material itself, or through washing from either rainfall derived runoff, or from applied water (e.g., during dust suppression). If mobilised into downstream waterways, impacts to both flora and fauna are likely and would vary in terms of persistence and severity.

The risk of handling these materials is typical of works of this nature and control measures are well established, such as bunding, safely storing hazardous materials, and visual inspection of the works area and waterways and are commonly employed during implementation of CEMPs and SWMPs which are stipulated as required mitigation in Section 15.5. On this basis, with the specified future development of required mitigation and plans the project is anticipated to result in negligible water quality impacts due to handling of high-risk materials during construction.

7.4.5 Acid sulfate soils

As outlined in Section 15, soils and contamination, there are areas of both high and low probability of ASS along segments of the pipeline route. The sub-catchments of Partridge Creek and Fernbank Creek are examples of a high-risk ASS area. The exposure of ASS to oxygen during ground disturbance can lead to the generation of sulfuric acid, which could influence surrounding soils and plants and, if the exposed ASS enter waterways, this could make the water more acidic (i.e. lower the pH). As detailed in Section 15, it is considered that the potential impacts associated with ASS can be managed through the implementation of HDD in areas of high ASS probability in conjunction with other the mitigation measures. Therefore, the risk of changes to water quality in natural waterways or wetlands due to construction of the services for the Thrumster WWTP are considered to be low. More detail on acid sulfate soils is provided in Technical Report 9 – Soils and Contamination Preliminary Site Investigation.

7.4.6 Groundwater

The proposed pipeline alignment crosses several mapped waterways (Figure 3-2) and accordingly intercepts some areas of alluvium and coastal sands (see Technical Report 1A - Water Resources and Flooding Assessment), where shallow groundwater could be found.

Bores installed within coastal sands generally have shallower groundwater levels, with standing water levels (SWLs) typically less than 3.5 metres below ground level (BGL). Analysis of SWLs and the water bearing zones (WBZs) of the remaining groundwater bores found that groundwater in alluvium and fractured rock materials is typically encountered deeper than 10 metres BGL. Most of the proposed pipeline is expected to be constructed via trenching, with the depth of trenching to be determined during detailed design and construction phase. Whilst pipeline segments in proximity to sensitive areas and waterways are proposed to be HDD, trenching is proposed through some potentially shallow groundwater areas (coastal areas). In these areas, there is a risk of the pipeline trenching intercepting the groundwater table, and therefore dewatering may be required during the construction process.

The closest monitoring bore, MB5, to the Stormwater storage pond has groundwater elevation ranging from 0.99 metres AHD to 1.67 metres AHD, which is around the base of the emergency Stormwater Storage Pond at one metres Australian Height Datum (AHD). There is a potential risk that the WWTP construction would intercept the groundwater table, and therefore dewatering at the WWTP may be required during the construction process.

Temporary dewatering and construction activities that interfere with aquifers are generally identified as aquifer interference activities in accordance with the WM Act and NSW Aquifer Interference Policy. If more than three megalitres of groundwater is to be taken as part of the aquifer interference activity, then a Water Access Licence (WAL) under the WM Act is also required under clause 7 of Schedule 4 *Water Management (General) Regulation 2018.* The project is expected to result in dewatering of more than 3 ML during construction activities for establishment of the WWTP and pipeline infrastructure in areas of high groundwater level and a WAL is therefore expected to be required to account for water take from the aquifer interference activities.

It is anticipated that mitigation measures will be required to be put in place to minimise the possibility of groundwater interception during pipeline installation. A trigger action response plan (TARP) approach will be put in place, as per Section 7.6 to minimise and respond to any possible groundwater interception such that impacts to existing groundwater are minimised. With the implementation of a TARP approach, the potential impacts would be within the Level 1 minimal impact considerations for water supply works in the NSW Aquifer Interference Policy. Technical Report 1A - Water Resources and Flooding Assessment provides more detail on potential impacts to groundwater during construction.

7.4.6.1 Impacts to GDEs

The return effluent pipeline alignment passes through high priority groundwater dependent ecosystems (GDEs) surrounding Port Macquarie Airport. These high priority GDEs are listed in the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. Additionally, there is a high priority alluvial GDE located within 40 metres of the Recycled Water pipeline. However, these sensitive areas are typically proposed to be constructed using HDD. Therefore, groundwater dewatering is not required impacts to these GDEs are not anticipated during construction of the pipelines.

Additionally, high priority wetland GDEs documented within the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources and high priority alluvial GDEs documented within the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources overlap. These overlapped high priority GDEs are within 40 metres of the end of the Return Effluent pipeline, associated with Kooloonbung Creek. However, minimal groundwater extraction will be required during the pipeline trenching process given the anticipated groundwater levels, and therefore, it is not anticipated to impact the GDEs.

There are also high priority GDEs approximately 600 metres from the Thrumster WWTP footprint. There is potential that groundwater may be intercepted during construction of the Emergency Storage Pond. Estimates of groundwater inflow indicate that the radius of groundwater drawdown due to construction dewatering extend up to 48.8 metres. Therefore, construction of the WWTP will not impact on the high priority GDEs.

Therefore, the potential impacts are considered to be within the Level 1 minimal impact criteria for high priority GDEs and culturally significant sites as per the NSW AIP.

7.4.6.2 Impacts to neighbouring landholder bores

There are a number of existing landholder bores within 1.5 kilometres of the WWTP.

There are 93 registered landholder bores in proximity to the pipeline, located at varying distances from the pipeline route. Most of the registered water supply bores are distanced from the pipeline, and therefore, the majority of the pipeline route is not anticipated to intercept groundwater. HDD is generally proposed in coastal sands and alluvium areas where shallow groundwater is most likely to be present. However, two water supply bores are located less than 100 metres from the sewer rising main (58 metres north) and Return Effluent pipelines (57 metres east). Minimal groundwater is anticipated to be extracted during the trenching of the pipelines given the depth to groundwater along the trench alignments. Therefore, the proposed activity is unlikely to cause drawdown at any of the registered water supply bores.

There are three water supply bores in proximity to the WWTP and recycled water facility footprints, approximately 500 metres from the western site boundary. There is a potential that these water supply bores may be intercepted during the construction of the Emergency Storage Pond. Estimates of groundwater inflow indicate that the radius of groundwater drawdown due to construction dewatering extends up to 48.8 metres. Therefore, the construction of the WWTP will not impact nearby water supply bores.

Therefore, potential impacts are within the Level 1 minimal impact considerations for water supply works, as outlined in the NSW AIP.

7.4.6.3 Impacts to groundwater quality

There are no proposed discharges during construction and on this basis the construction of the project is not anticipated to cause any significant change to groundwater quality.

The general construction phase surface water quality risks discussed in Section 7.4.3 to Section 7.4.5 are relevant to groundwater, such as from handling of materials and disturbance of ASS. The water quality measures proposed would also provide a secondary benefit to groundwater management and on this basis, the potential impact of the project is within the Level 1 minimal impact considerations for water quality in the NSW Aquifer Interference Policy.

7.5 Operational impacts

7.5.1 Flooding

7.5.1.1 Flood impact

Flood impact mapping is provided in Technical Report 1A – Water Resources and Flooding Assessment, assessing the potential impact on flooding due to the filling associated with the provision of the project. The maps show:

– In the 5% AEP event there is minor (up to 20 mm) increases in flood level in a small localised area where the main access road meets Fernbank Creek Road.

– In the 1% AEP event minor flood impacts (up to 10 mm) are noted north of the site, between the site and Fernbank Creek. The reason for this is that the fill pad and access road results in a minor obstruction of the slow moving flood waters in this part of the floodplain.
– In modelled events less frequent than the 1% AEP flood event, the results show that impact in the broader floodplain are less than 10 mm. The scale of the 10mm impact simulated in a wide floodplain is within the modelling accuracy.
– In the 1% AEP flood event the results show that the impact on flood velocities are less than 0.1 m/s.

The Port Macquarie-Hastings Council Flood Policy 2018 requires:

– For commercial and industrial development: , the applicant is required to demonstrate that the impact on peak 1% AEP flood levels is less than 10 mm, and on peak 1% AEP Flood velocities is less than 0.1m/sec, at the property boundary.
– For critical facilities: All Development must ensure flood flows and/or flood levels will not be detrimentally affected with respect to flood risk to neighbouring properties.

The assessment has shown that these requirements are satisfied.

7.5.1.2 Site access and evacuation

Figure 7-10 shows that in the 1% AEP flood event, there is approximately 10 hours before the alternative access road is cut-off by flood waters.

The Port Macquarie-Hastings Council Flood Policy 2018 requires:

– For commercial and industrial development: a minimum of eight hours Effective Warning Time must be available to a particular site.
– For critical facilities: Safe and Reliable Evacuation must be provided from the site to land above the PMF, preferably to an approved Flood Evacuation Centre.

The assessment has shown that these requirements are satisfied for commercial and industrial development. For critical facilities, the upper tier of the site is located at approximately the 1 in 110 000AEP event, which is considered a suitably rare event for evacuation purposes.

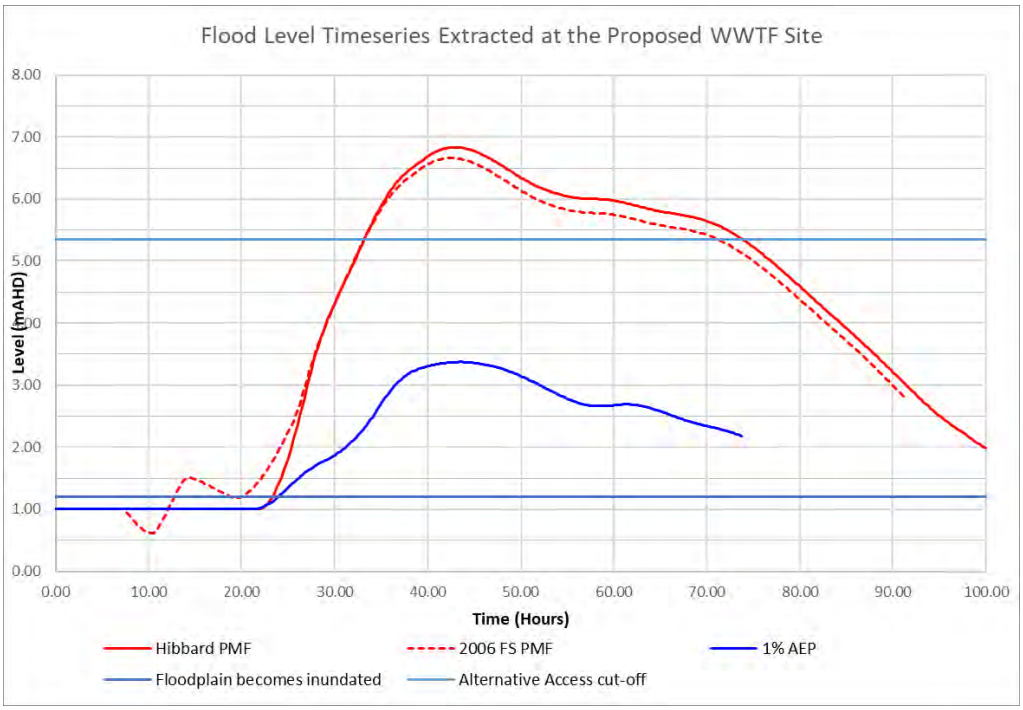


Figure 7-10 Flood Rise Times

7.5.2 Geomorphology

The geomorphology assessment identified that the Project pipelines are anticipated to result in negligible adverse geomorphological impacts during operation of the WWTP, with implementation of the SWMP and ESCP (see Section 7.6.

During the operational phase of the project, geomorphological impacts are possible from return treated effluent discharge to Kooloonbung Creek and emergency discharges to Partridge Creek. Other impacts along the buried pipelines are unlikely to occur, assuming adoption of the above industry-standard construction techniques, as discussed in Section 7.4.2.

Environmental considerations associated with treated effluent discharge into Kooloonbung Creek are as follows:

– The Kooloonbung Creek system is adapted to discharges from the Port Macquarie WWTP. The proposed operations plan involves a slow increase of treated effluent discharge, allowing the lagoon / wetlands area to adapt to the new regime. It is anticipated that the discharge volume increase would be absorbed within the wetlands area. However, the response of the dense existing vegetation is uncertain.
– Adaptation could involve die-off of riparian vegetation within the increased wetted perimeter and increased bank saturation / instability. Any eroded sediment would be transported into the Hastings River. However, the area of impact is anticipated to be small and mitigated by the gradual increase in discharge, resulting in a negligible overall impact to the condition of Kooloonbung Creek and downstream receptors.

Environmental considerations associated with emergency discharges into the unnamed tributary of Partridge Creek include:

– The potential for minor worsening of the existing minor bank erosion within the tributary and Partridge Creek downstream of the confluence. However, emergency discharges would occur infrequently, during major flood events, and are unlikely to exacerbate flood flow erosivity.

An Operation Environment Management Plan (OEMP) will be developed prior to operation to stipulate ongoing inspection requirements of pipeline corridors after rainfall and flood events to identify any areas of erosion, down-system sedimentation, and poor vegetation establishment.

Refer to Technical Report 1A - Water Resources and Flooding Assessment for more details on geomorphological risks and management measures.

7.5.3 Chemical storage and contamination risk

The Thrumster WWTP has been designed so as to minimise the risk of chemical contamination from chemical storage and operations, as follows:

– A bulk chemical system control strategy has been developed within the design for management of chemicals within the WWTP processes. These include:
  - Alarming and control systems for chemical storage tanks with radar level element and visual level to control dosing pump activities.
  - Refilling of chemical storage tanks occurs via tanker contained within a road bund. The tanker uses its own pump to refill tanks. Chemical storage tank level elements have visual and audible alarms with automatic pump cutoff if chemical storage tank levels reach full.
  - Controlled automatic alum and sodium hydroxide dosing, with operational timer for wet weather events. The dosing pipework would have double containment to prevent spills. A level switch located in the low point of the containment line is to indicate a leak. If the level switches are activated, an alarm is generated, and the dosing pumps will fail and latch.
  - All booster pumping stations for onsite service water will operate to achieve a pressure setpoint in the water header.
  - The recycled water system includes use of a chlorination system and chlorine contact water. The recycled water system will start and stop based on the level in the chlorine contact tank. A delay will be inbuilt to allow the UV system to complete its warmup before recycled water production starts. The recycled water system feed pumps will not start until raised by the chlorine contact tank/storage reservoir and after UV system warm up is complete.

– All associated storages required during the operation of the Thrumster WWTP and recycled water facility would be bunded and contained/roofed per Australian Standards to maintain separation from site stormwater.
– An operational stage stormwater treatment train will be developed to minimise impacts associated with the development of the impervious areas across the site.

These mitigation measures will minimise potential chemical contamination impacts to the natural environment, including waterways and wetlands during operation or the WWTP Thrumster WWTP and recycled water facility.

7.5.3.1 Water quality – discharges to Kooloonbung Creek

The WQRM results indicate that the impacts on water quality in Kooloonbung Creek are comparatively limited in nature relative to the background and baseline scenarios that simulate the current and forecast impacts from the releases from the Port Macquarie WWTP.

This means that the expected changes to water quality in Kooloonbung Creek due to the introduction Thrumster WWTP discharges are generally minor relative to the influence of the current Port Macquarie WWTP and catchment inflows under existing and future projections. This is because of the advanced treatment at the Thrumster WWTP relative to the existing Port Macquarie WWTP and the modelled increased flushing over time with sea level rise.

The full details on the outcomes of water quality modelling are outlined in Technical Report 1B – Operational Water Quality Impact Assessment.

Nutrients

Relative to the Baseline scenario, the Background scenario results demonstrate increased ambient nutrient concentrations upstream of the proposed Thrumster WWTP discharge point, coupled with a general reduction in nutrient levels in the creek downstream through to the creek's confluence with the Hastings River. These changes in median profiles are expected to be a result of increases in sea level and flushing as well as changes in land use and runoff in the contributing sub-catchments.

Annual median total nitrogen concentrations in Kooloonbung Creek, downstream of the discharge point are predicted to be similar to the Baseline (2023/24) conditions, except for one area, approximately 800 metres to 1600 metres downstream of the discharge point (around the junction of Wrights Creek), where increased nitrogen concentrations are predicted under the Impact scenario. This means that annual median total nitrogen concentrations would not be expected to change considerably from existing conditions, assuming the modelled sea level rise and increased flushing as shown on Figure 7-11.

Increased nutrient loads would be expected to discharge to Kooloonbung Creek over time due to the increased discharge volumes as the population increased. However, the proposed Thrumster WWTP discharge would maintain total nitrogen at similar to the existing median concentrations, with the elevated discharge volumes being offset by the improved effluent quality in comparison to the Port Macquarie WWTP and increased tidal flushing.

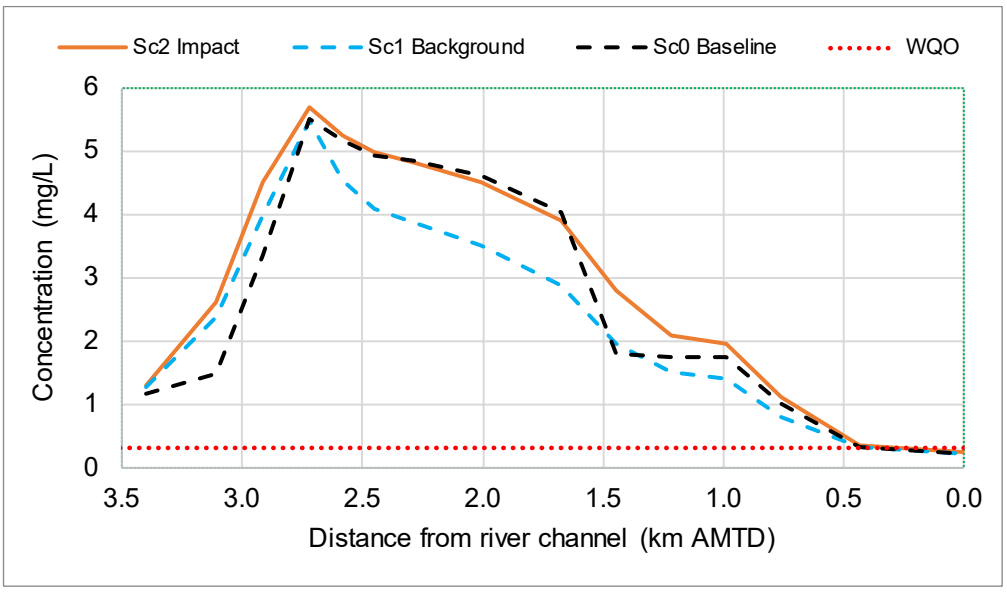


Figure 7-11 Predicted annual median concentration of Total Nitrogen (average rainfall year)

Modelling shows that the annual median total phosphorus concentrations would be generally lower under the proposed scheme compared to the Baseline (2023/24) conditions, depending on the distance from the discharge point as shown on Figure 7-12. From approximately one kilometre downstream of the confluence of Kooloonbung Creek with the Hastings River, there is no expected change in annual median total phosphorus concentration under the Impact scenario, compared to the Baseline scenario. The Impact scenario considers greater dilution from tidal flushing, and, therefore, the Thrumster WWTP discharge may result in increased concentrations over time, if sea level rise is less than expected.

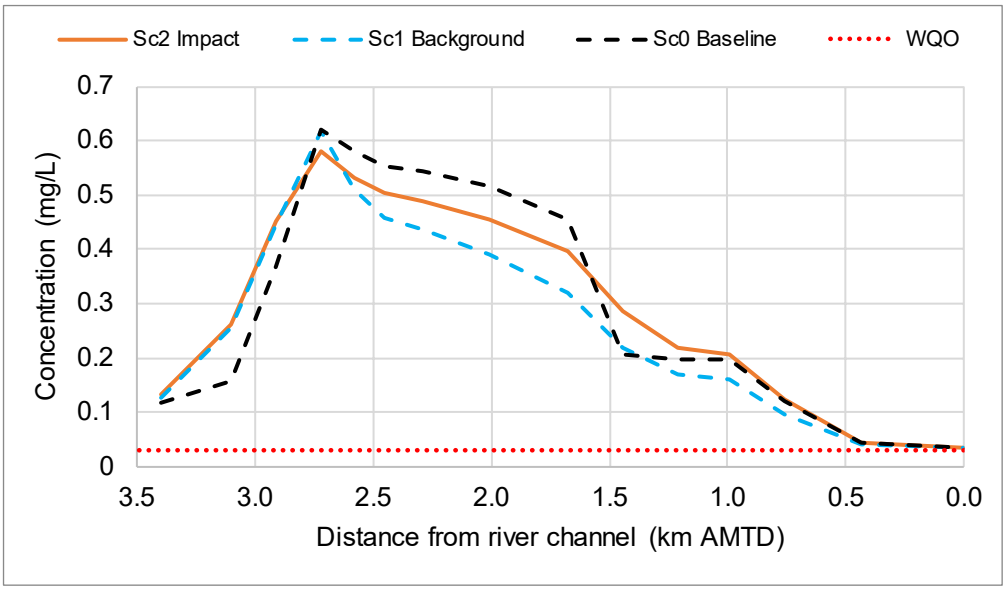


Figure 7-12 Predicted annual median concentration of Total Phosphorous (average rainfall year)

When comparing the Background scenario to the Impact scenario, there are predicted increased annual median nutrient concentrations under the Impact scenario, which is a function of the increased loads associated with the addition of flows from the Thrumster sewerage scheme.

The increased nutrient concentrations during an average rainfall year were modelled to influence a small area of the Hastings River in vicinity of the Kooloonbung Creek confluence, extending north into Pelican Bay, which is the site of some oyster leases as shown on Figure 7-13. Just offshore of the public wharf at the Town Green, annual median concentrations under the Impact scenario were predicted to be elevated within the following ranges:

– Total Nitrogen: 0.020 to 0.035 mg/L

– Inorganic Nitrogen: 0.015 to 0.030 mg/L
– Total Phosphorus: 0.002 to 0.003 mg/L

This would be a substantial increase when compared to the stressor default guideline values for aquatic ecosystem protection.

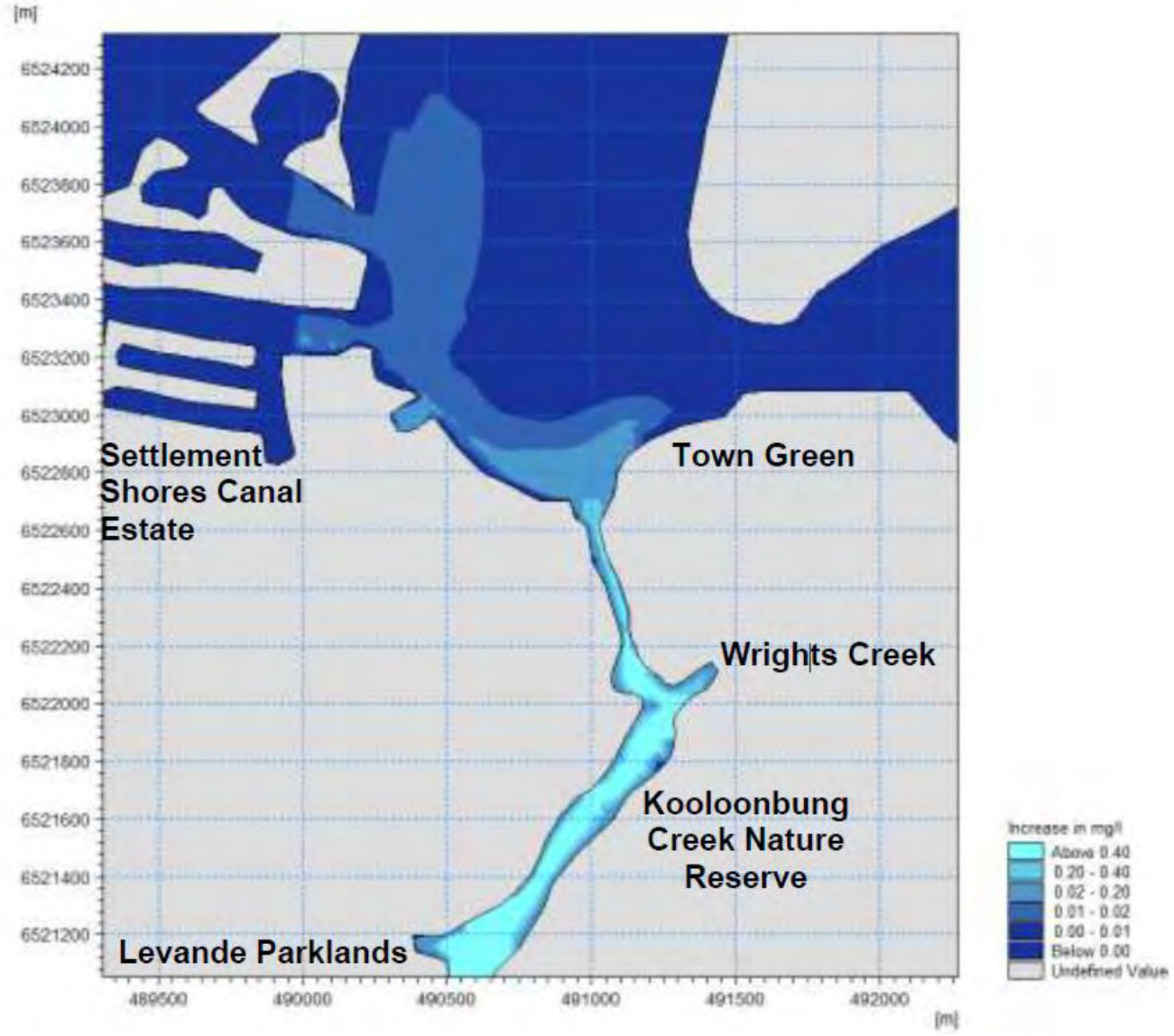


Figure 7-13 ***Predicted change in annual median Total Nitrogen concentrations – Impact scenario relative to background (average rainfall year***

There was predicted to be no measurable change in the annual median values of any the nitrogen or phosphorus indicators analysed in the main channel of the Hastings River. This was consistent with the WRL (2023) modelling of sewage overflows which indicated that the sand bar opposite the Kooloonbung Creek outlet limits the influence of Kooloonbung Creek discharges on water quality in the main Hastings River channel.

The following values represent the maximum levels of change from the annual median analysis in the main Hastings River channel, including areas of Big Bay and Limeburners Creek where most of the oyster leases are located:

– Total and Inorganic Nitrogen: < 0.005 mg/L
– Total and Inorganic Phosphorus: < 0.0005 mg/L

Across all the scenario conditions simulated, concentrations of all nutrient indicators within Kooloonbung Creek remain elevated and in excess of the applicable water quality guideline values. Concentrations remain elevated until within approximately 500 metres of the confluence of Kooloonbung Creek with the Hastings River.

Downstream of this point, tidal flushing from the river provides dilution and dispersion of the effluent dominated creek water.

Algal blooms

Increased nutrient loads can increase the likelihood of algal blooms, or nuisance plant growth. However, if the nutrient concentrations stay similar in Kooloonbung Creek and the Hastings River, due to the predicted increased tidal flushing over time, there may not be an increased risk of algal blooms or other associated factors.

Chlorophyll-a

Chlorophyll-a is a required resource for photosynthesis of cyanobacteria (i.e. blue-green algae), green algae and other photosynthetic organisms, and is commonly used in catchment health programs, such as the Northern Rivers Region Ecohealth Program to assess the potential for algal blooms. The WQRM has identified potential improvements (reductions) in Chlorophyll-a in Kooloonbung Creek over time (based on annual median chlorophyll-a in a lower rainfall year), even under the Background future scenario, due to greater tidal flushing from increased sea level rise (due to climate change). The project is expected to result in further reduction in chlorophyll-a concentrations, due to the additional discharge of treated effluent from Thrumster WWTP as shown on Figure 7-14.

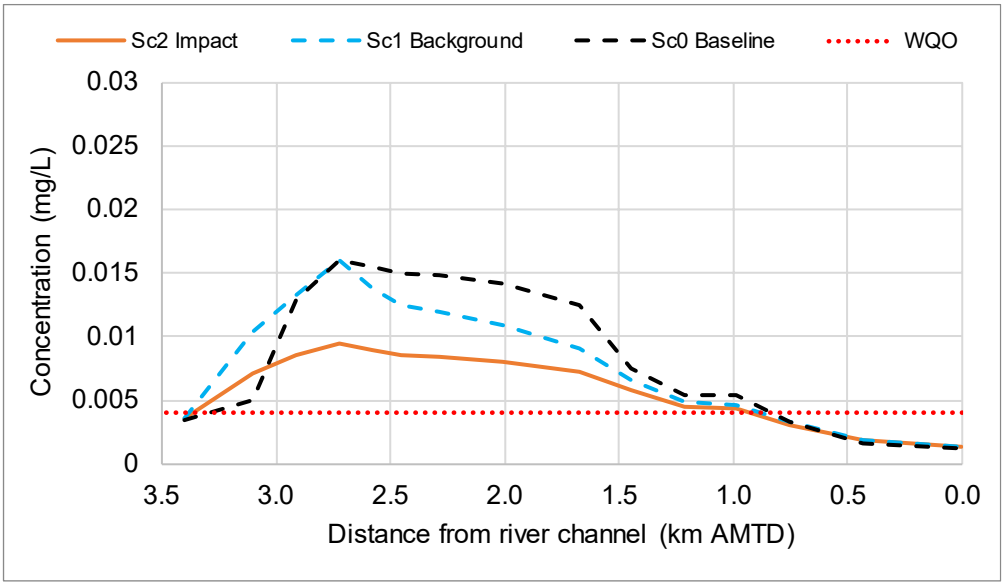


Figure 7-14 Predicted annual median concentrations of Chlorophyll a (lower rainfall year)

From analysis of the annual median results along the main Hastings River channel and also at sites near the entrance of Kooloonbung Creek, there is predicted to be limited or no measurable increase in Chlorophyll-a concentrations within the river due to the introduction of the Thrumster WWTP releases.

Biochemical oxygen demand and dissolved oxygen

Biochemical oxygen demand (BOD) is a measure of the combined biological and chemical demand on dissolved oxygen in a system (ANZECC 2000). The BOD in a system can be from oxygen consumption due to microbial activity or algal growth, both of which can be elevated in nutrient rich environments.

There is the potential for an increase in BOD, and a corresponding reduction in dissolved oxygen, due to increasing nutrient loads from the Thrumster WWTP as the population increases towards 40,000 people. However, there is not expected to be a substantial change in nutrient concentrations from existing conditions in Kooloonbung Creek and the Hastings River. Therefore, it is unlikely that the Thrumster Wastewater Scheme would result in increased BOD, in the Hastings River.

Salinity

Kooloonbung Creek is naturally tidal, with the tidal influence extending to approximately 900 metres upstream of the discharge point. The salinity at sites close to the proposed WWTP discharge point was generally consistent with freshwater rather than brackish water definitions. Salinity increases with distance downstream towards the confluence with the Hastings River as shown on Figure 7-15.

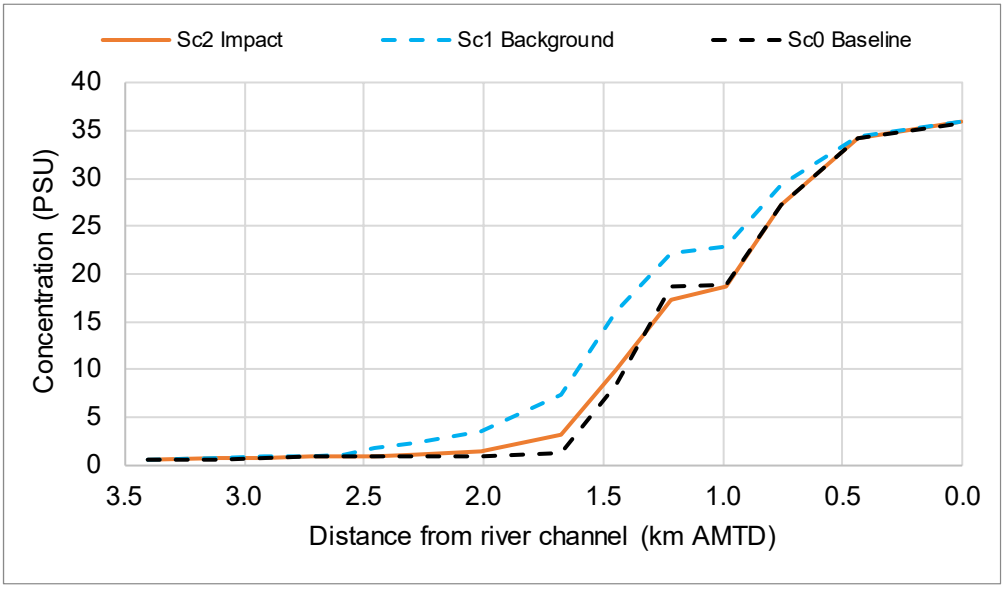


Figure 7-15 Predicted annual median concentrations of Salinity (average rainfall year)

While salinity in the creek would be influenced by tidal regime and rainfall, and runoff from the urbanised catchment, it will also be highly affected by the low saline releases from the existing the Port Macquarie WWTP. The proposed discharge from the Thrumster WWTP will increase the volume of low salinity discharge to Kooloonbung Creek and, therefore, may influence the extent of tidal influence in this waterway.

The WQRM identified that under baseline conditions, salinity in Kooloonbung Creek is expected to generally increase over time (under high, low and average rainfall years), based on the expected sea level rise and increased tidal flushing.

The discharge from the Thrumster WWTP is predicted to offset this sea level rise in Kooloonbung Creek, with modelling identifying salinities under the Impact scenario, very similar to the Baseline (2023/24) scenario, due to the increased volume of low salinity inflows. If the sea level rise is not as great as allowed for in future background and baseline scenarios, the salinity of Kooloonbung Creek may decrease over time as the volume of freshwater inflows increases in comparison to tidal influence.

In the Hastings River, the WQRM identified negligible changes to salinity due to the proposed Thrumster WWTP discharge, with potential for a small decrease in salinity in the Hastings River near the confluence with Kooloonbung Creek based upon timing of sea level rise in comparison to effluent flow projections.

Water temperature

Water temperature outside of the natural range for a waterway can negatively influence the development of aquatic biota, or interfere in biological processes, such as temperature-based cues for spawning or migration of fish. The Policy and guidelines for fish habitat conservation and management (DPI 2013) identifies that a discharge that alters the water temperature of a natural waterway by more than two degrees may be a barrier to fish passage, meaning that fish experiencing an area of water that is warmer or colder than expected may avoid the area.

Water temperature may also influence the success of oyster leases as the Aquatic Foods (cooked) (as applied to aquaculture activities) guideline values suggest 20 to 28°C in warm water and 15 to 20ºC in cold water for aquaculture. Water temperature is relevant to swimming and other direct contact with the water, with primary recreation guideline values of 15 - 35 °C.

The proposed Thrumster WWTP discharge will increase the volume of treated effluent discharge to Kooloonbung Creek over time towards design flow of 9.2 ML/day ADWF. The proposed Thrumster WWTP treatment process minimises opportunities for temperature transfer so the effluent temperature is likely to be similar to inflow temperatures. Based on the elevated water temperature observed in Kooloonbung Creek downstream of the existing Port Macquarie WWTP discharge point, it is likely that there will be a similar temperature range associated with the Thrumster WWTP in Kooloonbung Creek. Based on the observed temperature range in proximity to the Port Macquarie WWTP (approximately 18.4 to 24.7 ºC), there wouldn't be any negative impact relating to primary recreation or aquaculture in the Hastings River. There may be some potential influence to aquatic ecology.

pH

In Kooloonbung Creek under existing conditions, pH was circumneutral (around 7 pH units) and within the guideline values for aquatic ecosystem protection, primary recreation and aquatic foods (cooked – for aquaculture) (as applied to aquaculture activities) at all Kooloonbung Creek and Hastings River sites. The pH of the effluent is likely to be between a medium range of 6.5 and 8.5 (Table 7-1), which, may represent an increase or decrease from the existing conditions at times during Thrumster WWTP conditions, but would largely maintain pH in Kooloonbung Creek, within the relevant guideline values.

Toxicants of concern

Ammonia and nitrate were identified as the toxicants of potential concern related to the proposed Thrumster WWTP. As summarised in Table 7-6, it was determined that based on the expected Thrumster WWTP effluent concentrations for total ammonia and nitrate, a dilution factor of 1.4 would be required for the concentrations in Kooloonbung Creek to achieve the tDGV for protection of 95 percent of aquatic species (freshwater), while no dilution was required to meet the tDGV for protection of 90 percent of aquatic species (freshwater). The approximate distance from the proposed Thrumster WWTP when the dilution requirement is achieved (i.e. the boundary of the mixing zone) for achievement of 95 percent protection values for total ammonia and nitrate is 200 metres upstream and 800 metres downstream. Therefore, the concentrations of potential toxicants total ammonia and nitrate would be expected to be below the default guideline value for protection of 95 percent of aquatic species (freshwater), at the confluence between Kooloonbung Creek and the Hastings River, despite modelling of maximum effluent ammonia and nitrate concentrations. Therefore, the risk of toxicity from ammonia and nitrate on oyster leases in the Hastings River would be expected to be low, based on the assumed sea level rise and increased tidal flushing. More detailed analysis of the dilution factors and mixing zones is provided in Technical Report 1B – Operational Water Quality Impact Assessment.

The ecotoxicity of ammonia is influenced by pH and water temperature. A range of default guideline values are provided in ANZG (2018) based on varying pH, indicating that ammonia toxicity generally increases with increasing pH. The tDGV for ammonia provided in Table 7-5 is based on an assumed pH of 8.0. From a pH of 6.0 to 8.0, the estuarine / marine default guideline value was higher than the freshwater default guideline value, while for pH between 8.0 and 9.0, the estuarine / marine default guideline value was lower than the freshwater default guideline value. As discharge quality is expected to be within 6.5 and 8.5, and existing Kooloonbung Creek pH was also generally within this range (see **Error! Reference source not found.**), the identified tDGVs for total ammonia may underestimate potential toxicity at pH between 8.0 and 8.5. At a pH of 8.5, the default guideline value for protection of 95 percent of aquatic species is 0.4 mg/L for freshwater species and 0.35 mg/L for estuarine / marine species, and the assumed background concentrations considered in the dilution assessment are below these guideline values. Therefore, assuming the background conditions can be achieved as modelled, there would be a low risk of toxicity from ammonia and nitrate, outside of the mixing zone, including the Hastings River, although, the concentrations are likely to increase compared to the existing concentrations.

Table 7-5 Dilution requirements for Kooloonbung Creek discharges for toxicants

Parameter	Percent species protection	tDGV (mg/L) at pH 8.0	Effluent quality (mg/L)	Assumed background (mg/L)	Dilution requirement	Estimated mixing zone (km)^	
						Upstream	Downstream
Total ammonia	95%	0.91*	1.6	0.130	1.4	0.2	0.8
	90%	1.2	1.2	0.130	1.0	No mixing zone required	

Parameter	Percent species protection	tDGV (mg/L) at pH 8.0	Effluent quality (mg/L)	Assumed background (mg/L)	Dilution requirement	Estimated mixing zone (km)^	
						Upstream	Downstream
Nitrate	95%	3.5	5.0	0.325	1.4	0.2	0.8
	90%	5.6	4.8	0.325	0.9	No mixing zone required	

* Default guideline value for total ammonia in marine waters at pH 8.0 (see Technical Report 1B - Operational Water Quality Assessment for more detail)

^ Approximate distance downstream of the proposed Thrumster WWTP when the dilution requirement is achieved

Metals have not been identified as water quality parameters of concern relating to the proposed Thrumster WWTP, as the inflows to the Thrumster WWTP will be largely from residential sources, with a small industrial load contribution (mainly from warehouses) (Beca HunterH20, 2024). Further, the membrane bioreactor (MBR) included in the treatment process is expected to remove metals with high efficiency and biological treatment of phosphorus is also expected to limit the need for alum dosing (Technical Report 1B – Operational Water Quality Impact Assessment). If heavy industry occurs in the catchment in the future this could potentially increase the risk of elevated metals in the effluent, depending on the nature of the non-residential activities. Additional risks of metal toxicity due to changes in the waste customers over time, would be identified through implementation of routine water quality monitoring upstream and downstream of the proposed discharge point on Kooloonbung Creek, as discussed in Section 7.6.1.

There is no expected chlorine toxicity risk associated with the proposed Thrumster WWTP because effluent from the Thrumster and the Port Macquarie WWTPs are not chlorinated prior to discharge to the receiving environment.

Bacteriological

Enterococci was included in the WQRM as a representative pathogenic indicator. The modelling identified that, across the low, moderate and high rainfall periods simulated, the introduction of discharges from the Thrumster WWTP is predicted to be a negligible change to Enterococci concentrations in Kooloonbung Creek. This is due to the advanced treatment in the Thrumster WWTP and low levels of pathogenic content expected within the treated effluent, combined with modelled increased tidal flushing in the future. With the MBR treatment, the Enterococci concentrations in the Thrumster WWTP effluent would be expected to be much lower than the median effluent of 100 cfu/mL assumed in the WQRM (see Table 7-1), under most circumstances. Therefore, Enterococci concentrations in Kooloonbung Creek may be lower than existing concentrations.

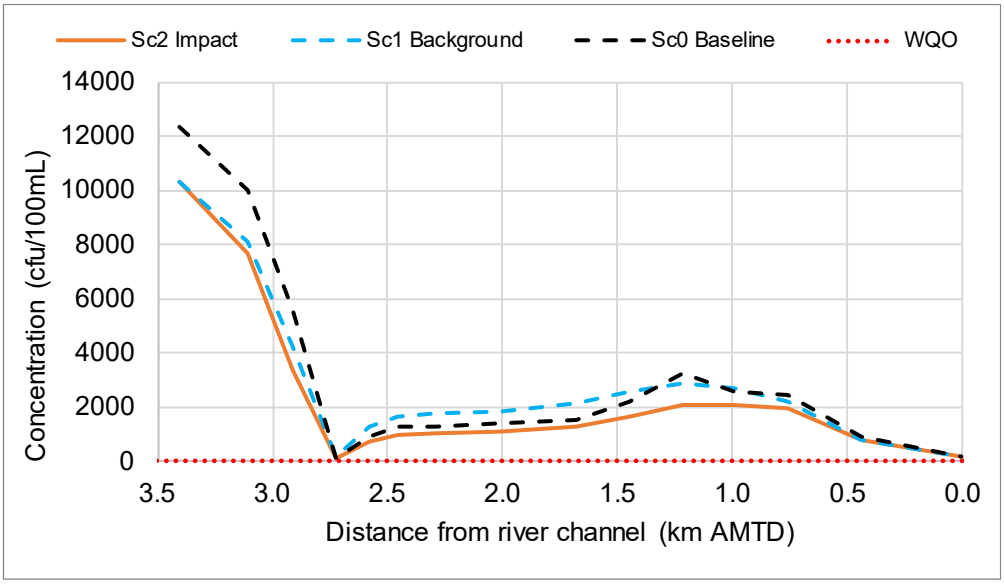


Figure 7-16 Predicted annual median concentrations of Enterococci (higher rainfall year)

The daily discharge is proposed into Kooloonbung Creek which is away from the oyster harvesting areas in Big Bay and Limeburners Creek, reducing the risk of bacteriological impacts to oyster leases during normal operations, compared to some of the discharge scenarios considered. There is the potential for diluted effluent to influence areas in vicinity of the Kooloonbung Creek confluence (e.g. Pelican Bay), during an incoming tide, although, modelling indicated that Enterococci concentrations in the main Hastings River channel are likely to be lower than the existing conditions, despite increased discharge volumes, due to the predicted low Enterococci counts in the treated effluent. The highest level of impact was predicted in the higher rainfall year and comprised of both elevations and reductions. The levels of impact (≤ ±60 cfu/100mL) was considered within the levels of model uncertainty.

Under the modelled Thrumster WWTP discharge conditions, the Enterococci concentrations in Kooloonbung Creek and the Hastings River near the confluence of Kooloonbung Creek, may still exceed the default guideline values for primary recreation and Aquatic Foods (cooked) - as applied to aquaculture activities and recreation, due to high ambient concentrations from the Port Macquarie WWTP and other catchment sources. Although, the predicted decreased counts in the Thrumster WWTP discharge would likely reduce the risks for human health in this area.

7.5.3.2 Storm storage pond discharge to Partridge Creek

The WQRM identified that, during controlled storm pond overflows, which were predicted to occur approximately four times in the 12 rainfall years modelled (Beca HunterH20, 2024), the water quality of Partridge Creek would worsen compared to existing conditions, due to the bypassing of secondary treatment at the Thrumster WWTP. During these rare periods of storm storage overflow, there would likely be increased concentrations of total nitrogen, inorganic nitrogen, total phosphorus and inorganic phosphorus, chlorophyll-a and higher Enterococci counts in Partridge Creek and Fernbank Creek. Due to the significant flushing in the creek, water quality will return to background levels following cessation of the releases to Partridge Creek. Figure 7-7 provides an indication of the increased nutrient concentrations that would be observed in Partridge Creek during a bypass event.

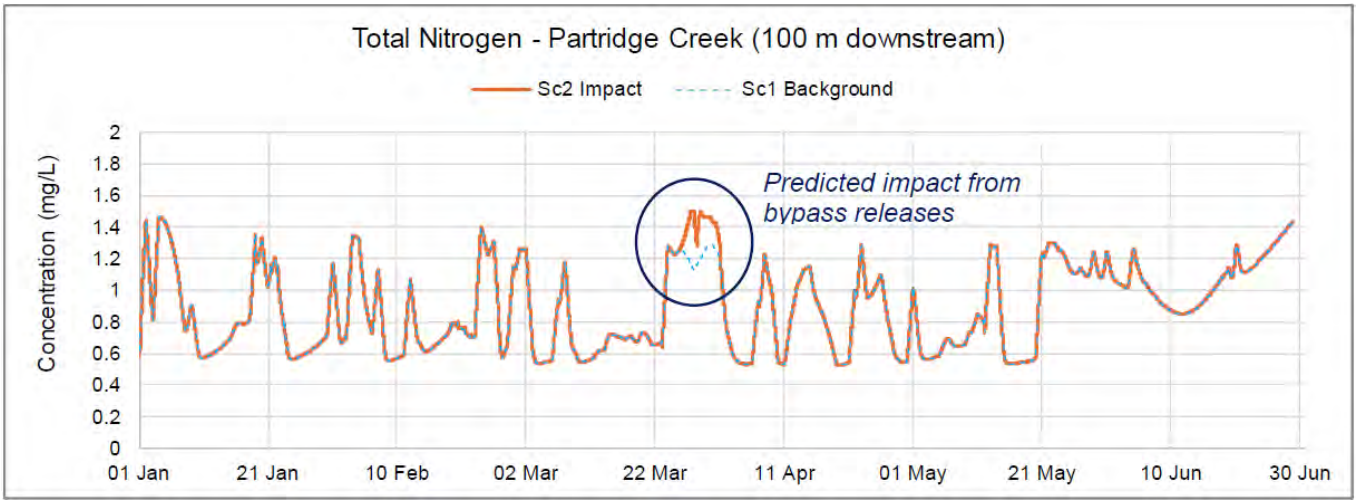


Figure 7-7 Predicted total nitrogen concentrations 100 m downstream of the hydraulic gate

The impacts were predicted to reduce with distance travelled downstream in the creek due to dilution presented by inflows to Fernbank Creek and also the Hastings River. The impacts are predicted to be assimilated and immeasurable by the time the flows reach the main channel of the river. The following values represent the peak increases in concentration predicted within the creek during the bypass event:

- Total Nitrogen: ~0.37 mg/L increase relative to background conditions
- Inorganic Nitrogen: ~0.30 mg/L increase relative to background conditions
- Total Phosphorus: ~0.07 mg/L increase relative to background conditions
- Inorganic Phosphorus: ~0.05 mg/L increase relative to background conditions
- Enterococci: ~750 cfu/100mL increase relative to background conditions

As the inflows to the Thrumster WWTP will be largely from residential sources, and the overflows to Partridge Creek will only occur rarely during periods of intensive rainfall and high dilution, the risk of metal toxicity relating to the Thrumster WWTP storm storage pond overflows is considered to be low.

While there would be an increased risk of ecotoxicity from elevated ammonia and nitrate concentrations in Partridge Creek and Fernbank Creek during the rare overflow events, given the short-term nature of these events, and substantial dilution that would occur at the time of the overflows, there is not expected to be an enduring water quality impact in Partridge or Fernbank Creek or the associated wetlands. The WQRM indicated that due to the relatively high levels of predicted dilution, there is a low level of potential bacteriological influence on oyster leases in Limeburners Creek and Big Bay in the Hastings River during storm storage pond overflow events to Partridge Creek.

7.5.3.3 Local stormwater

Local stormwater consists of water derived from rainfall on the project itself, as opposed to effluent water which is produced from the WWTP and recycled water facility. Potential water quality risks occurring during the operational phase with regard to local stormwater include the risks associated with chemical storage and handling at the site and increase in impervious area.

As discussed in Section 5, as an in-built mitigation measure to reduce operational surface water quality risk, chemicals and associated storages required during the WWTP and recycled water facility operation would be bunded and contained/roofed per Australian Standards to maintain separation from site stormwater.

Notwithstanding the above, handling of materials that pose enhanced water quality risks will occur, although infrequently, during the site's operation poses a water quality risk to downstream waterways. These potential risks include:

– Potential risks associated with the handling of fuels and chemicals used in the WWTP and recycled water system (such as chlorine, sodium hydroxide, alum and polymer).
– Leakage from site infrastructure such as chemicals from the various storage facilities and stages of the WWTP process, and leaks from the mechanical solids dewatering infrastructure.

The potential impacts associated with handling and managing these materials may result in potential mobilisation of materials into downstream waterways either via direct flow of the material itself or through washing from with rainfall derived runoff. Once mobilised into downstream waterways, impacts to both flora and fauna could occur and would vary in terms of persistence and severity.

Typical control measures such as bunding, safely storing hazardous materials and visual inspection of the works area and waterways are commonly employed during implementation of an Operation Environment Management Plan (OEMP) with these stipulated as required mitigation in Section 7.6. Other management plans such as a Pollution Incidence Response Management Plan (PIRMPs) can also be utilised to manage these impacts.

The proposal involves a significant increase in impervious areas compared to existing conditions which could lead to an increase in contaminants associated with movements on the site.

As mentioned in Section 8.3, Council use AUS-SPEC planning, design, and construction for civil engineering works associated with subdivisions and development. The specification identifies stormwater treatment pollutant load requirements that are to be met when designing stormwater treatment measures, in order to be compliant with the specification. The specification outlines that the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) is a water quality model that is acceptable for the purposes of demonstrating compliance with the specification. Therefore, an operational stage stormwater treatment train, developed in accordance with AUS-SPEC would be included within the final design as an in-built mitigation measure for stormwater runoff quality.

For the various pipeline infrastructure, potential operational phase water quality impacts would be associated with maintenance activities and system malfunctions such as leaks or bursts. These incidents are expected to be temporary and local in nature, however, depending on the pipeline type may vary in impact based on water quality and response times. Leaks or bursts may occur in areas adjacent to waterways. (as identified in Section 8.3). It is expected that leak detection and emergency shut off valves would be included in pump stations to minimise these impacts. The management of any emergency leaks or bursts would also be addressed in an OEMP and PIRMP (refer Section 7.6).

With implementation of these measures, the Project is not anticipated to result in unacceptable impacts with relation to storm water quality risks during operation.

7.5.4 Groundwater

Groundwater impacts during operation phases are summarised below:

– It is anticipated that the pipeline would pose a negligible impact on groundwater flow paths post construction.
– The Emergency Storage Pond will be lined with a HDPE liner. Therefore, there will not be any groundwater inflows into the Emergency Storage Pond following construction and no groundwater drawdown due to the operation of the project.
– Impacts to groundwater quality associated with the discharge of treated effluent to Kooloonbung Creek and emergency discharge to Partridge Creek are expected to be similar to or less than the impacts to surface water quality, as discussed in Section 7.5.3.1 and Technical Report 1B – Operational Water Quality Impact Assessment.
    - Modelling by Intrawater (2024) predicted that impacts from discharge of treated effluent to Kooloonbung Creek are limited in nature compared to baseline modelling that simulates the current and forecast releases from the Port Macquarie WWTP. Discharge of treated effluent are not anticipated to result in notable impacts to groundwater receptors.
    - Emergency discharges will only occur under extreme and prolonged rainfall conditions, when flood flows are anticipated to be occurring in Partridge Creek and the Hastings River. Modelling suggests that any water quality impacts would be temporary in nature and considering this dilution, emergency overflows of treated effluent are not anticipated to result in notable impacts to groundwater receptors.
– Other materials (as discussed in Section 7.5.3) that pose a specific water quality risk would be stored in a bunded area. Any spills would be managed per the Soil and Water Management Plan outlined in Section 7.4.3. Therefore, the operation of the project will not impact on the viability of any groundwater receptors including groundwater dependent ecosystem and landholder bores.

Based on the above, impacts to groundwater during operation of the project are not anticipated.

7.6 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise soil and contamination impacts of the project are detailed in Table 7-6. The mitigation measures are discussed in more detail in Technical Report 1A - Water Resources and Flooding Assessment and Technical Report 1B – Operational Water Quality Impact Assessment.

Table 7-6 Soil and contamination impact mitigation and management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
WQ1	Surface water, geomorphology	Implementation of a CEMP, a SWMP, an Acid Sulfate Soils Management Plan, and an ESCP in accordance with the Blue Book. This includes the staging of the WWTP, recycled water facility and pipeline construction into manageable portions.	Council / contractor	Pre-construction
WQ2	Soil and Water	During construction, collection of onsite runoff in established surface water drains and sediment basins.	Council/ contractor	Pre-construction and construction
WQ3	Surface water	A Pollution Incidence Response Management Plan (PIRMP) would be implemented to manage operational impacts, including the management of emergency leaks and bursts.	Contractor	Construction

ID	Impact	Environmental safeguard	Responsibility	Timing
WQ4	Water quality	Baseline water quality monitoring will be undertaken targeting parameters related to potential erosion and sedimentation during construction. Matching datasets would be collected during and following construction and compared to the baseline data. See Section 7.6.1 for more details.	Council/ contractor	Pre-construction, construction and post-construction
WQ5	Water quality	Water quality monitoring will continue to be undertaken by Council in receiving waters as outlined in Section 7.6.1.	Council	Operation
WQ6	Water quality	Identify opportunities for reuse of recycled water, which would reduce the volume of effluent discharged to the receiving waters.	Council	Anytime
WQ7	Flooding	A Flood Management Plan (FMP) to be developed as part of the SWMP or CEMP.	Council / contractor	Pre-construction
WQ8	Flooding	Flood proofing to be provided for all parts of the building up to FPL4. Preferably, this is to be achieved by filling the portion of the site containing the critical infrastructure; however, alternative methods may also be considered. These may include raise areas internal to building, bunding or local raising.	Council / contractor	Construction and Operation
WQ9	Flooding	Flood Proofing to be provided to all aspects of the proposed development up to FPL3.	Council / contractor	Construction and Operation
WQ10	Flooding	Compile a site Flood Emergence Response Plan which documents the responsible staff, flood characteristics, flood warnings, flood response including evacuation, emergency contacts, and flood recovery.	Council / contractor	Operation
WQ11	Geomorphology	An OEMP is also required to stipulate ongoing inspection requirements of pipeline corridors / discharge points after rainfall and flood events to identify any areas of erosion, off-site sedimentation, and poor vegetation establishment.	Council / contractor	Operation
WQ12	Groundwater	A trigger action response plan (TARP) approach will be implemented to minimise and respond to any groundwater interception such that impacts to existing groundwater are minimised.	Council / contractor	Pre-construction and Construction
WQ13	Groundwater	A trigger action response plan (TARP) approach will be implemented to minimise and respond to any groundwater interception such that impacts to existing groundwater are minimised. The Emergency Storage Pond will be constructed with an impermeable HDPE liner.	Council / contractor	Construction
WQ14	Groundwater	Implementation of an Operation Environment Management Plan which includes the implementation of typical control measures such as bunding, safely storing hazardous materials, and visual inspection of the works area and waterways, as well as pipeline maintenance. A Pollution Incidence Response Management Plan can also be utilized to manage operational impacts.	Council / contractor	Operation

7.6.1 Monitoring

Ongoing water quality monitoring would be undertaken to identify changes to water quality after commencement of discharges from the Thrumster WWTP. The proposed water quality monitoring program would include:

– Routine monitoring upstream and downstream of the permanent discharge point on Kooloonbung Creek.
– Event-based monitoring of the storm storage pond during periods when water is bypassing the secondary treatment (i.e. flow greater than 4x ADWF).

The proposed water quality sampling would focus on the parameters of concern identified in relation to the Thrumster WWTP, including nutrients, salinity, dissolved oxygen, BOD, pH, water temperature and bacteriological. Given the potential for an increase in non-residential customers for the Thrumster WWTP over time, it is recommended that biannual monitoring for metals is undertaken on the Thrumster WWTP effluent to evaluate potential risks to aquatic ecosystems. If elevated metals concentrations (in excess of the ANZG (2018) aquatic ecosystem protection values) are observed over time as the treatment capacity increases, it would be appropriate to commence receiving water monitoring of metals.

PMHC has participated in the Northern Rivers Region Ecohealth Program developed by the Northern Rivers Catchment Management Authority and partner agencies.

The construction phase water quality monitoring program would be confirmed at a later stage and may include:

– The collection of baseline monitoring data from upstream and downstream waterways in proximity to the project by Council staff on a fortnightly basis for approximately six months prior to construction works commencing. The monitoring suite could include field parameters such as turbidity, electrical conductivity and pH, as well as total suspended solids, total dissolved solids and oil and grease.
– Surface water quality monitoring monthly and during specified wet weather events during construction and post-construction. The monitoring suite would be the same as the baseline data set to allow for identification of changes due to construction activities.

8. Aboriginal heritage

This chapter provides a detailed summary of the assessment of potential impacts on Aboriginal heritage as a result of the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures.
The full assessment is provided in Technical Report 2 – Aboriginal Cultural Heritage Assessment.

8.1 Assessment approach

8.1.1 Legislation and policy context

The following Commonwealth and NSW legislation, and guidelines that informed the preparation of the Aboriginal ACHA by Niche Environment and Heritage included:

– *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including the National Heritage List (NHL) and the Commonwealth Heritage List (CHL).
– *Native Title Act 1993.*
– *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*
– *Native Title Act 1993.*
– *NSW Environment Planning and Assessment Act 1979.*
– *NSW Heritage Act 1977.*
– *Aboriginal Land Rights Act 1983.*
– *Port Macquarie-Hastings Local Environmental Plan 2011.*

8.1.2 Methodology

This section summarises the tasks undertaken as part of the ACHA methodology. Further details are presented in Technical Report 2 – Aboriginal Cultural Heritage Assessment. The key tasks for the ACHA included:

– A desktop assessment of the existing environment, including environmental context, heritage searches, and consideration of archaeological context.
– Preparing an Aboriginal archaeological predictive model based on past assessments in the project area or in proximity to the project area.
– Field surveys undertaken between 9 to 11 April 2024.
– Analysis of results of desktop studies and field surveys to determine the potential impacts to Aboriginal archaeology.
– Provision of mitigation measures to minimise and avoid impacts to items of Aboriginal heritage significance.

Further details on core methods adopted in the ACHA are included below. In addition, the assessment was undertaken in accordance with the SEARs, as well as the following codes and guidelines:

– *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011).
– *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a).
– *Aboriginal Cultural Heritage Consultation Requirements for Proponents (Part 6 National Parks and Wildlife Act, 1974)* (DECCW 2010b).
– The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia International Council on Monuments and Sites [ICOMOS], 2013).

Aboriginal cultural heritage consultation process

Consultation with the Aboriginal community, including appropriate RAPs, was carried out in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (NSW DECCW 2010b) as part of the ACHA. A summary of the consultation undertaken is included below in Table 8-1.

Table 8-1 ACHA Aboriginal Consultation stages

Consultation Stage	Details
Stage 1 Notification of project proposal and registration of interest	– A notification letter was distributed to all relevant organisations, including the Native Title Tribunal, Heritage NSW, Council, and the relevant LALCs. – From the responses received, 14 individuals and organisations were identified as potential knowledge holders for the project area. A notification letter was then distributed to all relevant organisations on 29 August 2023. – A newspaper advertisement was placed in Port Macquarie News on 1 September 2023, including a close date on 15 September 2023. – Stage 1 enquiries resulted in the registration of nine relevant RAPs which was then notified to Heritage NSW and the Bunyah and Birpai LALCs on 13 February 2024.
Stages 2 and 3 Presentation of project information, assessment methodology and gathering information about the cultural significance of the project area	– Project information and draft methodology was provided to the RAPs identified in Stage 1 on 12 March 2024, with a closing date on 11 April 2024 (to meet the minimum 28-day review period). – A number of RAPs provided feedback on the project information and assessment methodology. Their comments and/or reviews are provided in Technical Report 2 – Aboriginal Cultural Heritage Assessment. – A cultural heritage survey was completed with representatives of the Birpai LALC and Birpai Traditional Owners Indigenous Corporation between 9 to 11 April 2024. Throughout the field assessment process, representatives provided comments regarding the cultural values of the project area. The swamp landscapes were pointed out as significant for their provision of resources and comments were made regarding the avoidance of impacts within and east of the proposed laydown area.
Stage 4 Review of draft ACHA	– The draft ACHA has been provided to all nine RAPs for their review and comment. The ACHA has been updated to incorporate their comments.

Field survey

A field survey was undertaken between 9 to 11 April 2024 in accordance with the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (NSW DECCW 2010a). The purpose of the field survey was to assist in the identification of cultural heritage values and to record a representative sample of the material traces and evidence of Aboriginal land use, including those which although may not be visible, have a likelihood of occurrence under the ground surface. For the survey, the project area was divided into 14 Survey Units to examine the landforms of each Unit more closely.

8.2 Existing environment

8.2.1 Aboriginal heritage context

The project area is located within the boundaries of the Birpai LALC. Parts of the project area are located in the suburb of Fernbank Creek, the city of Port Macquarie and the eastern section of the Hastings River. The project area is located within the land of the Birpai People of the Birpai Nation. Past Aboriginal land use of the project area can be re-traced using previously recorded archaeological resources, historical observations of early settlers and surveyors, and contemporary comments from Aboriginal people (though the inherent bias present in historical European observations must be recognised).

The project area is situated within the floodplains and intercoastal zone of the Port Macquarie Hastings region with sections located 3.5 kilometres from the Port Macquarie CBD. Seasonal land use systems were generally followed by food resources along the coast. Aboriginal people in the region are known to have made and used items made from various wood and bark. Such items rarely last, however scarred trees can provide an indication of the types of trees wood and bark were obtained from and the types of uses. Due to the abundance of permanent water sources in the immediate area, there would have been plentiful resources to sustain multiple campsites.

It is likely that the project area may have been visited and traversed for the purposes of hunting and gathering marine and estuarine resources for food and other uses. Movement within the landscape would likely have been associated with the seasonal availability of targeted species.

A review of Aboriginal archaeological studies prepared for areas within and surrounding the project footprint provides context on past Aboriginal land use. Few Archaeological investigations have been undertaken for the project area and Port Macquarie-Hastings LGA. The investigations available for the area are at a regional scale and focused on coastal zones. However, sites identified within the surrounding region through previous studies include:

– Clybucca-Stuarts Point midden complex (AHIMS ID #21-6-0140) approximately 100 kilometres north, contains a series of extensive and well-preserved midden deposits.
– Eight stone artefact scatters and two isolated artefacts found at Rainbow Beach, Bonny Hills, approximately 24 kilometres southwest.
– Lighthouse Beach (AHIMS ID# 30-6-0245) at Lake Cathie, approximately 12 kilometres west of the southernmost part of the project area, containing a midden and PAD.
– 144 stone artefacts and two new sites with artefact deposits at the salvage site for the Oxley Highway to Kempsey Upgrade (GHD 2010) project, approximately within 10 kilometres of the project area.

8.2.2 Cultural heritage sites and objects

An extensive search of the AHIMS database revealed a total of 82 Aboriginal cultural heritage sites and one declared Aboriginal place have been previously recorded within the project area.

Of these 82 sites recorded, four were recorded within the project area and one along the border of the project area (refer to Figure 5 in Technical Report 2 – Aboriginal Cultural Heritage Assessment). A summary of the AHIMS sites in proximity to the project area, included those located within or on the project area boundary, are detailed in Table 8-2. The most common Aboriginal cultural heritage site type is isolated finds, with the next most common being open campsites (Technical Report 2 – Aboriginal Cultural Heritage Assessment).

No AHIPs have been registered over the project area or immediate surrounds. The closest AHIP identified was AHIP #4931 for the Visitor Infrastructure Upgrade at Sea Acres National Park. This AHIP was issued in 2022 to the NSW National Parks and Wildlife Service for Movement only of certain Aboriginal objects, and harm to certain Aboriginal objects through the proposed works. Sea Acres National Park is 2.5 kilometres west of the most western extent of the project area.

Of the 82 sites, one was listed as restricted. This means that the details of the sites are not provided at the time of the AHIMS search. Following further correspondence and information exchange, it was confirmed by AHIMS with a map visual that the restricted site would not be impacted by any of the proposed works within the project area (a redacted version of the correspondence is provided in Technical Report 2 – Aboriginal Cultural Heritage Assessment). Section 8.3 details the potential impacts associated with the construction of the project on AHIMS sites.

Table 8-2 AHIMS sites located within proximity to the project and on the project border

AHIMS ID	Site name	Site context	Site status	Approximate distance from project area	Site features
30-3-0205	Wattoo 2	Open site	Valid	On the project area boundary	Isolated Find; Artefact

AHIMS ID	Site name	Site context	Site status	Approximate distance from project area	Site features
30-3-0121	Partridge Creek Swamp	Open site	Valid	AHIMS recorded location 75m north of project area, however, review of site card places it within the project area (see Technical Report 2 – Aboriginal Cultural Heritage Assessment)	Stone Quarry; Artefact
30-3-0321	E1	Open site	Valid	Within project area	Isolated Find; Artefact: 1
30-3-0390	Thrumster PAD 1	Open site	Valid	Within project area	PAD
30-3-0405	Thrumster Sewerage 1	Open site	Valid	AHIMS location records the site within project area however the site actually occurs 200 m to the south	Artefact Scatter; Artefact:36

In addition to AHIMS, searches of the other relevant registers and databases revealed that no Aboriginal heritage items are located wholly within the project area, however, one historic heritage item intersects the proposed route and a second is in close proximity to the project area (refer to Section 9.2).

Field survey results

The field survey program undertaken within the project area included an inspection of previously identified Aboriginal cultural heritage sites (detailed in Section 8.2.2) as well as a systematic survey of sensitive landforms. The extent of Thrumster PAD 1 (AHIMS ID# 30-3-0390) (see Table 8-2) was reassessed during the site inspection and identified to extend within the project area as detailed below.

In respect to Aboriginal cultural heritage identified during the survey, no previously unrecorded Aboriginal cultural heritage sites or objects were identified during the survey. Ground truthing of the AHIMS sites was undertaken with no surface artefacts, previously unidentified artefacts or subsurface potential identified during the survey.

The isolated find associated with the site had been recorded in the site card as being previously collected. The isolated artefact associated with E1 (AHIMS ID# 30-3-0321) could not be ground-truthed due to access issues. The details for these sites are included in Technical Report 2– Aboriginal Cultural Heritage Assessment.

The survey program investigated a range of landforms including areas of wetlands, flats, floodplains, minor rises, undulating plains and swamps. The flats and floodplains surveyed in the western portion of the project area were found to be the least disturbed, with extensive grass and other vegetation covering the ground surface. Their proximity to an extensive area of wetlands/swamps confirmed that the area was likely utilised for resource-gathering activities and potentially for intermittent occupation within more protected areas (including rises).

8.2.3 Predictive model

The predictive modelling developed for the ACHA was compiled using past assessments which have occurred within the project area or in proximity to the project area. Past Aboriginal land use is indicated by the historical documents presented and results of previous archaeological work that has occurred within the region.

Within the project area, limited historical disturbance outside of infrastructure development such as vehicle tracks has occurred, however, few Archaeological assessments have been conducted within the project area itself. Assessments conducted by OzArk (2005), ERM (2008) and Davies (2008) are directly associated with the project area. Based on survey work, landform review and historic disturbances, and past land use, it was determined that there was low to no archaeological potential within 'the sand plain' site (OzArk 2005). It was highlighted in the report that 'the sand plain' is located within a drained, swamp/wetland environment, with there being a limited potential for Aboriginal occupation to have occurred, and more potential in locations with higher elevation (OzArk, 2005:29).

The results of previous archaeological investigations indicate that there are landforms present within the project area and in direct association, which have the potential to contain a range of resources, that would have been exploited by Aboriginal people in the past. They indicate a potential for Aboriginal cultural heritage sites to be present. While the majority of the project area is located within road corridors and disturbed contexts, the landforms present across the project area indicate that in areas of low or limited impact, there is potential for Aboriginal objects to be present. Several Aboriginal cultural heritage sites have been identified within proximity to the project area (see Table 8-2, and Technical Report 2 – Aboriginal Cultural Heritage Assessment for further detail), including PADs, isolated finds, and Artefact Scatters, with one Aboriginal cultural heritage site located within the project area. There was an identified potential for such sites to be present within the project area, with Aboriginal cultural heritage sites being present in similar landforms and soil profiles having been identified.

8.3 Potential impacts

8.3.1 Construction

The results of the AHIMS search, desktop assessment and archaeological field inspection, undertaken as part of the Aboriginal heritage assessment, determined that:

– Avoidance and in-situ conservation with mitigating no-go zones would occur at two sites.
– Harm caused by mitigating circumstances such as collection or salvage would occur at two Aboriginal cultural heritage sites.
– Due to previous salvage, one site is no longer valid and should have its status changed to destroyed.

A summary of the impacts associated with the construction of the project is provided in Table 8-3 below.

Table 8-3 Location of the Aboriginal cultural heritage sites on the border of the project area

AHIMS ID/Site name	Site features	Portion of the site to be impacted	Consequence of impact
Watoo 2 (30-3-0205)	Isolated Find; Artefact	None	None
Partridge Creek Swamp (30-3-0121)	Stone Quarry; Artefact	Total (site is situated wholly within proposed drill PAD)	None. The isolated artefact has previously been collected and the existence of a quarry has been previously shown to not occur at the site.
E1 (30-3-0321)	Isolated Find; Artefact	Total (site is situated wholly within proposed drill PAD)	Total loss of value
Thrumster PAD 1 (30-3-0390)	PAD	Partial (site is partially situated within the proposed WWTP and associated laydown area)	Partial loss of value

The artefacts associated with Thrumster Sewerage 1 (AHIMS ID# 30-3-0405) appear to have been collected during a previous test excavation of Thrumster PAD 1 (AHIMS ID# 30-3-0390). The PAD extent associated with this AHIMS site extends north of an area previously tested by ERM (2008). As this area has not been previously tested and impacts are projected, subsurface testing is required to determine the nature and extent of the PAD to confirm proposed impacts to this site.

To mitigate potential impacts to Thrumster PAD 1 (AHIMS ID# 30-3-0390), which might affect a previously identified impact area at the WWTP site by ERM (2008), it is proposed to conduct a targeted test excavation program. This program would focus on areas of potential impact associated with the WWTP and Laydown Area (refer to Figure 7 in Technical Report 2 – Aboriginal Cultural Heritage Assessment) in order gain a clearer understanding of the deposit's nature. Thrumster PAD 1 (AHIMS ID# 30-3-0390) is assessed to have low to moderate scientific significance.

However, mitigation of harm in the form of avoidance of impacts to Thrumster PAD 1 (AHIMS ID# 30-3-0390) is not considered possible due to flooding issues and design constraints for the development. The design proposed for the WWTP and ancillary infrastructure would intercept a portion of the PAD area.

Exclusion zones are proposed to be used for sites Wattoo 2 (AHIMS ID# 30-3-0205) and E1 (AHIMS ID# 30-3-0321) with these areas integrated into the project design. Where these exclusion zones can be accommodated into the final design stage of the project, impacts to two isolated artefact sites Wattoo 2 (AHIMS ID# 30-3-0205) and E1 (AHIMS ID# 30-3-0321) can be avoided. Where avoidance is not feasible, however, community collection of the associated isolated finds is deemed an appropriate mitigation measure given the low scientific significance and the highly dispersed nature of the isolated finds which are identified in areas of known disturbance.

Patridge Creek Swamp (AHIMS ID# 30-3-0121) has been determined to have been previously disturbed and therefore no additional impacts to the site would occur.

Management measures are warranted to mitigate the potential impacts to the Aboriginal sites and values that would result from the proposed activities. Management and mitigation measures are required to ensure continued compliance with the NPW Act and are further discussed in Table 8-4.

8.3.2 Operation

No impacts to Aboriginal heritage are anticipated during the operation of the project. Mitigation and management risk measures detailed in Section 8.4 apply to the operational aspects of the project in addition to construction safeguards.

8.3.3 Assessment of significance

An assessment of significance and heritage values for individual Aboriginal sites within the project area (see Table 8-2) was undertaken. These significance assessments were prepared in consideration of comments received from the RAPs during the consultation process and the interrelationships between the cultural and spiritual values with the natural landscape. No responses on the cultural significance of the individual sites were received from the RAPs.

A statement of significance for the project area as a whole is included in this section. A summarised assessment of significance and outline of the criteria of assessment is provided in Technical Report 2 – Aboriginal Cultural Heritage Assessment.

8.3.3.1 Social value

The project area was deemed to have low to moderate social/cultural value. Four Aboriginal cultural heritage sites were identified in close proximity or within the proposed disturbance footprint comprising two isolated artefacts, one artefact scatter and one PAD (see Table 8-2).

One isolated artefact occurs directly adjacent to the Subject Area within a disturbed context. The artefact scatter and PAD are both considered part of a broader continuous Aboriginal cultural heritage site with low-intensity artefact discard patterns previously recorded in the form of surface and subsurface artefacts.

A PAD identified during the site inspection associated with Thrumster PAD 1 (AHIMS ID# 30-3-0390) occurs within a culturally sensitive landform on raised, level ground adjacent to an area of extensive wetlands associated with a range of resources to support Aboriginal occupation and use.

The presence of known sites including the broad PAD area has particular importance in representing a tangible link for the Aboriginal community to the activities and occupation areas associated with previous occupation and use of the area.

The isolated artefact recorded at Patridge Creek Swamp (AHIMS ID# 30-3-0121) has limited social/cultural value due to its disturbed context and remoteness from other cultural features. The isolated artefact has previously been collected from the site.

The isolated artefact recorded at E1 (AHIMS ID# 30-3-0321) has limited social/cultural value due to its disturbed context and remoteness from other cultural features however it does still provide a tangible link to previous Aboriginal community use of the surrounding area.

8.3.3.2 Aesthetic value

The project area was found to have low aesthetic value as it contains no rare or outstanding landforms or features.

8.3.3.3 Historic value

The project area was found to have low historical value. No tangible or intangible historic values were identified within the proposed project footprint during the desktop assessment or survey.

8.3.3.4 Scientific (archaeological) value

Thrumster PAD 1 (AHIMS ID# 30-3-0390) has previously been subject to a test excavation which recovered a low-density artefact scatter (ERM 2008). Following the test excavation program, the site has been reassessed by ERM (2008) to have low research potential as the low artefact count was regarded as offering limited potential to answer future research questions.

Nonetheless, two works components (the WWTP and adjacent laydown area) occur within an archaeologically sensitive landform feature (a low-rise overlooking wetlands and Partridge Creek) with potential to contain more intensive evidence of prior occupation and use than has been observed in the previous subsurface investigation.

Beyond this area, the scientific/research value of the project area is considered to be low (including in respect to E1 [AHIMS ID# 30-3-0321]) given the extent of previous disturbance and the potential to contain only sporadic evidence of prior patterns of Aboriginal occupation and use.

8.4 Mitigation and management measures

Proposed mitigation measures to protect Aboriginal heritage are provided in Table 8-4. Mitigation and management measures have been prepared in consideration of the results of archaeological investigations, and comments received from the RAPs during the consultation process.

Table 8-4 Aboriginal heritage impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
(Specific to AHIMS sites located on project border)				
General measures				
AH1	Consultation with RAPs	The Proponent should continue to consult with the RAPs in regard to the project in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010*. Consultation may include, but is not limited to: – Finalisation of ACHA – Participation in the proposed test excavation/ community collection program – Determination of the long-term management of recovered artefacts under a care and control agreement – Project updates – Unexpected finds Project updates should be sent to all RAPs every six months at a minimum to ensure the consultation associated with this ACHA remains active.	Council/ Contractor	Pre-construction/ construction post construction

ID	Impact	Environmental safeguard	Responsibility	Timing
AH2	Preparation of an Aboriginal Cultural Heritage Management Plan	The Proponent should develop an Aboriginal Cultural Heritage Management Plan (ACHMP) for the project that includes: – The outcomes of the ACHA. – Measures agreed with the Traditional Owners for the protection and management of both tangible and intangible cultural heritage values and mitigation of impacts. – Agreed protocols for the identification, protection and management of any cultural heritage values discovered during the project. – Delivery of cultural awareness training to project staff and contractors to ensure that CHMP measures are implemented. RAPs should be included within the development of the ACHMP.	Council	Pre-construction
AH3	Buffer zones	No-go buffer zone extending 10 m must be established through temporary fencing around E1 (AHIMS ID# 30-3-0321) and a 5 m no go buffer zone established through temporary fencing around Wattoo 2 (AHIMS ID# 30-3-0205) prior to the commencement of works to ensure avoidance and prevention of any indirect impacts during works. If potential impacts to the sites cannot be avoided, the sites should be subject to community collection prior to the commencement of works and would require a subsequent ASIRF submission to update the site status in AHIMS.	Contractor	Pre-construction
AH4	Impacts to identified AHIM sites within, or in proximity, to the project area	An area of PAD associated with Thrumster PAD 1 (AHIMS ID# 30-3-0390) has been identified within the proposed WWTP and associated laydown area. A test excavation of the PAD identified in Figure 7 in Technical Report 2 - Aboriginal Cultural Heritage Assessment should be undertaken to determine the nature and extent of the PAD. The test excavation program should be undertaken prior to any proposed impacts. The Test Excavation Methodology has been prepared, and a copy of this, as reviewed by the RAPs is provided in Appendix 5 of the Technical Report 2 - Aboriginal Cultural Heritage Assessment. A program of community collection is also required at the site to recover surface artefacts present and should be undertaken prior to the proposed impacts.	Council	Pre-construction
AH5		The long-term management of any surface or subsurface artefacts salvaged during the test excavation of Thrumster PAD 1 (AHIMS ID# 30-3-0390) should be formalised in a care and control agreement as determined by the RAPs. Where requested by the RAPs, the feasibility of on-Country reburial of artefacts within a conservation area should be considered by the Proponent.	Council	Construction/ Post-construction
AH6		The desktop assessment of Thrumster Sewerage 1 (AHIMS ID# 30-3-0405) and Partridge Creek Swamp (AHIMS ID# 30-3-0121) have determined that artefacts associated with both sites have previously been salvaged/collected. Aboriginal Site Impact Recording Forms should be submitted to provide details of the ACHA findings and to update the site status of both sites.	Council	Pre-construction

ID	Impact	Environmental safeguard	Responsibility	Timing
AH7	Staff induction	All workers and contractors associated with the works within the project area should be inducted, so they are made aware of their obligations under the SEARs prior to, during and after works.	Contractor	Construction
AH8	Confidentiality	The Proponent should not publicise the location of Aboriginal cultural heritage sites or other cultural information without prior consent from the Aboriginal community. This includes the public distribution of any mapping, AHIMS data and/or cultural information contained within this report.	Council	Pre-construction/ construction
AH9	Unexpected finds	In the event of unexpected finds, notification is required under section 89A of the NPW Act. During construction, all work in the area must cease immediately and: – The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. – Contact Niche immediately. No further action is to be undertaken until archaeologists have assessed the finds.	Contractor	Construction
AH10	Human remains	In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact must cease immediately and: – The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. – The NSW Police must be contacted immediately. – No further action is to be undertaken until the NSW Police provide written notification. – If the skeletal remains are identified as Aboriginal, the Proponent or their agent must contact: • Heritage NSW's Enviroline on 131 555 and representatives of the RAPs. • No works are to continue until Heritage NSW provides written notification.	Contractor	Construction

9. Non-Aboriginal heritage

This chapter provides a detailed summary of the assessment of potential non-Aboriginal heritage impacts as a result of the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures.
The full assessment is provided in Technical Report 3 - Historical Heritage Assessment.

9.1 Assessment approach

9.1.1 Legislation and policy context

The management and conservation of historical heritage and archaeological sites is subject to a range of statutory provisions at federal, state and local levels including:

– *Environment Protection and Biodiversity Conservation Act 1999*
– *Heritage Act 1997*
– *Environmental Planning and Assessment Act 1979*
– *Port Macquarie Local Environmental Plan 2011*

The assessment of potential impacts on non-Aboriginal heritage was also developed in accordance with the following guidelines:

– The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013 (the Burra Charter) (Australia ICOMOS, 2013).
– Assessing Heritage Significance (DPE 2023).
– Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch DPE 2009).
– Material Threshold Policy (Heritage NSW 2022).

9.1.2 Methodology

The HHA included:

– Undertaking a desktop assessment including analysis of environmental context, historical context and searches of the following public heritage databases on 11 December 2023:
  - NSW Heritage State Heritage Register (SHR) and State Heritage Inventory (SHI).
  - *Port Macquarie Local Environmental Plan 2011.*
  - Port Macquarie Hastings Development Control Plan 2021.
  - Commonwealth heritage registers including the Australian Heritage Database, Commonwealth Heritage List, and former Register of the National Estate (RNE).
  - Previous historical heritage studies and reports.
– Conducting a walkover and site inspection of the project area on 5 December 2023.
– Analysing results of desktop and field surveys.
– Providing mitigation measures and recommendations.

The HHA is presented in full in Technical Report 3 – Historical Heritage Assessment.

9.2 Existing environment

9.2.1 Historic context

The project area is predominantly within the traditional lands of the Birpai People of the Birpai Nation (Mathews 2005). Birpai lands extend from the Hastings River through the Rollands Plains to the Manning and west to Wauchope (Ramsland 2001: 16). Today the project area is situated within the boundaries of the Birpai LALC.

The known period of Aboriginal occupation is 5,000-6,000 years, with the Birpai people accessing a wide range of habitats including the coastal band of rocky shores, beaches and sand dunes, estuaries, wetlands, rivers and forests. Evidence of the long Birpai connection to the land is evident in sites such shell middens, burial sites, fish traps, camp sites, axe grinding sites and stone quarries.

The first published observations of the region by Europeans comes from the journal of surveyor General John Oxley, whose exploration party traversed the Hastings River Valley from 1818. The first settlement in the area was in 1821 located about two kilometres from the project area in an area known as Town Green, at the end of present-day Clarence Street.

By 1826, the penal settlement was earning expenditure through the exportation of timber, the cultivation of sugar cane and tobacco and other agricultural activities. Port Macquarie was also used as a depot for convict invalids until 1847 (Connah, 1998; Annable et al, 2003).

Prior to the 1870s, access to settlements on the mid-north coast of New South Wales were restricted largely to river traffic. A resurgence of population growth occurred in the 1880s, but this tapered off during the 1890s depression (Higginbotham 1994). Dairying had been a major industry in the region in the late nineteenth century and remained so well into the 1940s when timber and beef came to dominate production. During the late 19th and early 20th century, Port Macquarie emerged as a recreational but seasonal destination, which laid the foundation for later growth. In 1915 the North Coast Railway reached Wauchope, opening the district and permitting the transport of produce to Sydney without reliance on shipping from Port Macquarie.

9.2.2 Listed heritage items

Searches of several heritage databases were conducted to determine if heritage items were located within the project area. The results of the database searches are presented in Table 9-1 and shown in Figure 3 of Technical Report 3 – Historical Heritage Assessment.

Table 9-1 Non-Aboriginal heritage database searches

Database	Results
National Heritage List	None within project area
Commonwealth Heritage List	None within project area
State Heritage Inventory	– None within the project area – Item number 00997 Lake Innes House ruins and environs is located one km south of the project area
Section 170 Heritage and Conservation Registers	None within the project area
Port Macquarie Local Environmental Plan 2011	The following items listed under Schedule 5 of the LEP were identified within two km of the project area: – AH03 PAHS Thrumster Knoll – one km west and south of several sections of the project area. – I1062 Hamilton House (former school) and the Manor house – 500 m north of the project area. – I030 Cemetery – one km north of project area. – I019 Hibbard Slipway – one km north of project area. – I075 Douglas Vale dwelling house and grounds – 100 m west of project area. – I082 The Cross navigational marker – 500 m north of project area.

Database	Results
	– I007 Grantham dwelling house – 100 m south-east of project area. – I076 Cemetery – 280 m east of project area.
Register of National Estate (RNE)	– RNE #14557 - Lake Innes Nature Reserve and Adjacent Areas, Oxley Highway, Port Macquarie is located one km southeast of the subject area. – RNE #101340 – Port Macquarie Rifle Range, Lady Nelson Drive, Port Macquarie eastern extent is within and immediately adjacent to the subject area.

9.2.3 Site inspection results

The site inspection did not identify any surface evidence of subsurface deposits. Any remaining evidence of previous phases of occupation has likely been obscured by more recent additions such as landscaping of road verges.

The site inspection conducted separated the project area into 14 separate units, whereby the survey method for each unit included long linear parallel transects aligned to the proposed components via a pedestrian survey. Each survey unit is defined and shown in Technical Report 3 – Historical Heritage Assessment.

The site inspection identified a range of landforms present within the project area including areas of wetlands, flats, floodplains, minor rises, undulating plains and swamps. The flats and floodplains surveyed in the western portion of the project were found to have been subjected to the least historic era disturbance, with extensive grass and other vegetation covering the ground surface.

The only historic heritage identified in the site inspection was one potential historic heritage item within the project area consisting of an unoccupied and/or abandoned dwelling and farm shedding located near the proposed WWTP site. The built items are constructed from weatherboard, timber and corrugated metal sheeting. The items identified likely date to the early to mid-20th Century (1920-1940) and can be directly associated with the farmland on which they are located. There is no immediate association physical or social that can be attributed to a significant person or group of persons; however, the presence of the structures may have some potential to contribute to the understanding of the regions pastoral and agricultural history.

While the project area transects the northernmost extent of the former RNE listed Port Macquarie Rifle Range, no relics or built heritage items related to the historic period were noted within the project area during the site inspection.

The majority of the project alignment follows existing vehicle tracks, road verges, previously installed infrastructure, unsealed roads and electrical corridors. Large tracts of land surrounding the project area have been cleared in the more than 200 years since colonial settlement of the area. While the project area does contain some elements of remanent natural landscape, these are readily identified elsewhere within the Port Macquarie-Hastings region that would contribute to the natural history of the area.

9.2.4 Summary of archaeological profile

Archaeological potential is defined as the likelihood that an area may contain physical evidence related to earlier phases of occupation, activity and/or development.

The HCA identified historical phases applicable to the project area and its surrounds and analysed their archaeological potential. This analysis is presented below in Table 9-2.

Table 9-2 Archaeological potential of identified historic phases

Historical Phase	Analysis of Archaeological Potential Associated with Historical Phase
Phase 1: Pre-colonial Aboriginal Landscape	**Moderate**- The corresponding Aboriginal Cultural Heritage Assessment for the project addresses pre-historic period Aboriginal cultural heritage identified within the project area.

Historical Phase	Analysis of Archaeological Potential Associated with Historical Phase
Phase 2: Exploration and Settlement (1818 – 1860)	**Low** – land clearance and ground disturbance throughout the project area suggests there is a very limited potential for archaeological evidence from this historical phase to be present. Any remaining archaeological evidence for this phase of development would be limited to relics associated forestry and farming practices.
Phase 3: Cedar Cutters, forestry and growth (1861 – 1900)	**Low** – The project area is largely located within cleared areas containing sealed roads, access and walking tracks, electrical transmission corridors, subsurface utilities and residential development. Any remaining archaeological evidence would be limited to items associated with farming practices and/or road construction.
Phase 4: (1901 - present)	**Moderate** – Century developments within the project area include residential development, farming practices, road construction and installation of utilities. While farming practices and development (including the construction of farm dwellings, outbuildings and sheds) occur throughout this and all preceding phases, the majority of developments have occurred after 1940. While some evidence regarding farm practices may remain, any remaining archaeological evidence is likely to be associated with post 1940 events.

There have been no previous historical archaeological investigations undertaken within the project area.

Historic values relating to Aboriginal heritage were not identified within the project area however it is likely that the project area and the surrounding landscape would have been visited many times by the Aboriginal community. The corresponding ACHA for the project addresses the Phase 1, Pre -colonial Aboriginal landscape (Technical Report 2 – Aboriginal Cultural Heritage Assessment).

Continual residential and commercial developments throughout the 20th and 21st centuries are likely to have removed and or destroyed any archaeological evidence within the project area that relates to Phase 2 and Phase 3 (refer to Table 9-2). There is however some potential for deposits related to the earlier Phase 4 era to be present.

9.2.5 Statement of significance

The project area represents a landscape shaped by rural and residential development. While no features directly associated with historical events were identified, the project area does possess contributory heritage value due to its location within the wider Port Macquarie-Hastings landscape.

While a small portion of the project area transects the Port Macquarie Rifle Range (see Table 9-1) and has some limited association with Australian volunteer military training history, no features that would indicate direct social association or associations with historical figures is apparent. The project area does not contain any specific elements that would be considered important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement. Nor does it contain uncommon, rare, or endangered cultural or natural history, as defined by the guidelines.

The project area overall demonstrates a low potential to contain archaeological resources that would contribute further to our understanding of heritage values in the region.

As such, the project area as a whole, is not considered to be of heritage significance as defined by Assessing Heritage Significance: Guidelines for assessing places and objects against the Heritage Council of NSW criteria (DPE 2023).

9.3 Potential impacts

As there are no listed heritage items within the project area, there would be no impacts to World, National, Commonwealth, State or locally listed heritage as a result of the construction or operation of project.

The project area is located within and immediately adjacent to the eastern extent of the Port Macquarie Rifle Range. As the range is located partially within the project area, potential impacts to its heritage significance have been considered and assessed.

Known and potential impacts on heritage items can be quantified under three main categories: direct impact, indirect impact and no impact. These kinds of impacts are dependent on the project, the nature of the heritage item and its associated curtilage.

9.3.1 Direct impacts

Direct impacts are where the completion of the project would result in a physical loss or alteration to a heritage item which would impact the heritage value or significance of the place.

There would be no direct impacts to any listed heritage items as no items have been identified within the project area or within 100 metres.

Potential direct impacts on heritage elements within the project area include:

– Demolition of farm dwelling and shed as part of construction of main access road to laydown area
– Temporary visual impact to the former RNE-listed Port Macquarie Rifle Range during construction

9.3.2 Indirect impacts

Indirect impacts include any secondary impact to a heritage item related to alterations to the environment or setting of the item which would result in a loss of heritage value.

Activity within the project area would be limited to increased vehicle and foot traffic during construction works and/or for any future maintenance requirements. As the nearest listed site, the 'Lake Innes House ruins and environs' has potential to be indirectly impacted by the project. However, due to the residential area located between the project area and Lake Innes House ruins, construction and future maintenance activities would have a low visual impact to and from the heritage item. Any vibration caused by construction and/or maintenance activity would be temporary and is unlikely to impact any archaeological deposits or built heritage items.

9.3.3 No impact

No historical heritage was identified within the project area during the survey undertaken for the site inspection. Overall, the project would have a negligible to low direct, visual and cumulative impact on historical heritage values within the project area.

9.4 Mitigation and management measures

Proposed mitigation measures for non-Aboriginal heritage are provided in Table 9-3.

Table 9-3 Non-Aboriginal management and mitigation measures

ID	Impact	Environmental safeguard	Responsibility	Timing
HH1	Avoidance of harm to "Farm Dwelling and Shed" site.	If possible, works should be amended to avoid these structures. If not possible to do so, it is recommended that archival recording of the structure is undertaken prior to construction.	Contractor	Pre-construction
HH2	Location of project works	This assessment is confined to within the Subject Area defined in this report. The parameters of project works should not extend beyond these boundaries. Should planned works locations alter, further assessment of the potential impacts would be required.	Contractor	Pre-construction / Construction
HH3	Stop work in case of unexpected archaeological finds	In the event that unexpected historical heritage, including archaeological relics, is discovered during proposed works, all work in the immediate area will cease. A qualified archaeologist and, if necessary, Heritage NSW (in accordance with section 146 of the Heritage Act) should be contacted to assess the significance and advise on further requirements prior to the recommencement of works.	Contractor	Construction

10. Social

This chapter provides a detailed summary of the potential social impacts (both positive and negative) from the construction and operation of the project, and where required, identifies feasible and reasonable mitigation and management measures. The full assessment is provided in Technical Report 4 – Social Impact Assessment.

10.1 Assessment approach

10.1.1 Legislation and policy context

The Social Impact Assessment (SIA) was guided by the following state, regional and local plans and policies that are relevant to the project:

– *Environmental Planning and Assessment Act 1979*
– Port Macquarie Regional City Action Plan 2036
– North Coast Regional Plan 2041
– North Coast Regional Water Strategy
– Imagine2050 Port Macquarie Hastings Community Strategic Plan
– Shaping our Future 2040 – Local Strategic Planning Statement
– Draft Economic Development Strategy 2022-2032
– Urban Growth Management Strategy 2017-2036

10.1.2 Methodology

Social impacts are understood as the consequences that people and communities experience as a result of project-induced changes that affect the way they 'live, work, play, relate to one another, organise to meet their needs and generally cope as members of society' (Burge and Vanclay 1996). The methodology for the SIA has been prepared to respond to the SEARs and in line with leading practice for SIA including:

– Social Impact Assessment Guideline for State Significant Projects (NSW DPE 2021a) (SIA Guideline).
– Technical Supplement - Social Impact Assessment Guideline for State Significant Projects (NSW DPE 2021b).
– International Association for Impact Assessment International Principles for Social Impact Assessment (Vanclay 2003) and Social Impact Assessment: Guidance for assessing and managing the social impacts of projects (Vanclay et al. 2015).

The methodology for assessing the potential social impacts of the project was as follows:

– **Scoping of potential social issues**
  - Potential social impacts were identified in Thrumster Wastewater Scheme Scoping Report – State Significant Infrastructure (GHD 2023).
  - The social impacts identified in the Scoping Report have been further developed to inform the focus areas of this chapter.
– **Defining the social locality**
  - The social locality for the project considers the communities that have potential to experience changes to social conditions due to direct impacts resulting from location of the project or project infrastructure, construction activities and land use changes (refer to Table 10-1).

– **Establishing the social baseline**
  - The social baseline establishes the existing social characteristics for the social locality and informs the prediction of potential social impacts and benefits of the project. A social baseline has been prepared for the project area, regional study area and potentially affected communities.
  - Data for the social baseline has been gathered from a rage of sources including, Australian Bureau of Statistics (ABS) Census data, economic data, online sources, literature and research reports, outcomes of targeted stakeholder consultation and Local, State and Australian Government websites and publications.
– **Stakeholder consultation**
  - Council have been engaging with community and stakeholders throughout the project planning, scoping, and design process. Chapter 5 (Community and stakeholder consultation) of the EIS describes these activities and the stakeholders that have been consulted and provides a summary of the issues raised.
  - The SIA has been informed by various community and stakeholder engagement activities. These include consultation activities undertaken by Council and GHD to inform the EIS, and stakeholder interviews undertaken the by the SIA team.
– **Description and assessment of social impacts and benefits**
  - Identifying and assessing potential socio-economic impacts of the project's construction and operation, including on local amenity, access and connectivity, social infrastructure and local community values.
  - The evaluation of the identified social impacts was undertaken using a likelihood and magnitude significance rating, based on the significance criteria outlined in the NSW SIA Guideline and Technical Supplement, and shown in Table 10-2, Table 10-3 and Table 10-4.
– **Proposed social impact mitigation and enhancement measures**
  - Identifying mitigation measures to mitigate or manage the identified impacts and to enhance social benefits.
  - Mitigation measures have been developed in addition to those proposed in other technical studies of the EIS, which could also help to manage social impacts.

Table 10-1 Social locality

Study Area	Description	Statistical Area
Project area	The project area includes the area directly occupied by the project infrastructure and immediate surrounds, namely the WWTP, water recycling plant and associated pipeline network.	N/A
Regional study area	The project site is located within the Port Macquarie-Hastings LGA. Communities across the LGA are likely to experience some impacts and benefits from construction and operation of the project.	Port Macquarie-Hastings Local Government Area (LGA)
	The regional study area considers the state of NSW as a regional benchmark.	New South Wales (NSW) State
Potentially affected communities	The WWTP, water recycling plant and associated pipeline network are located in the suburb of Fernbank Creek. The pipeline extends through the suburbs and localities of Fernbank Creek and Thrumster, concluding at Port Macquarie.	Fernbank Creek Suburb and Locality (SAL)
		Thrumster SAL
		Port Macquarie SAL

Table 10-2 Defining likelihood levels of social impacts

Likelihood level	Meaning
Almost certain	Definite or almost definitely expected (e.g. has happened on similar projects)
Likely	High probability
Possible	Medium probability
Unlikely	Low probability
Very unlikely	Improbable or remote probability

Table 10-3 Dimensions of social impact magnitude

Dimensions		Details needed to enable assessment
Magnitude	Extent	Who specifically is expected to be affected (directly, indirectly, and/or cumulatively), including any vulnerable people? Which location(s) and people are affected? (e.g. near neighbours, local, regional, future generations).
	Duration	When is the social impact expected to occur? Will it be time-limited (e.g. over particular project phases) or permanent?
	Severity or scale	What is the likely scale or degree of change? (e.g. mild, moderate, severe).
	Intensity or importance	How sensitive/vulnerable (or how adaptable/resilient) are affected people to the impact, or (for positive impacts) how important is it to them? This might depend on the value they attach to the matter; whether it is rare/unique or replaceable; the extent to which it is tied to their identity; and their capacity to cope with or adapt to change.
	Level of concern / interest	How concerned/interested are people? Sometimes, concerns may be disproportionate to findings from technical assessments of likelihood, duration and/or intensity.

Table 10-4 Defining magnitude levels for social impact

Magnitude level	Meaning
Transformational	Substantial change experienced in community wellbeing, livelihood, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20% of a community.
Major	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area.
Moderate	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
Minor	Mild deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
Minimal	Little noticeable change experienced by people in the locality.

Table 10-5 Social impact significance matrix

			Magnitude level				
			1	2	3	4	5
			Minimal	Minor	Moderate	Major	Transformational
Likelihood Level	A	Almost certain	Low	Medium	High	Very high	Very high
	B	Likely	Low	Medium	High	High	Very high
	C	Possible	Low	Medium	Medium	High	High
	D	Unlikely	Low	Low	Medium	Medium	High
	E	Very unlikely	Low	Low	Low	Medium	Medium

10.2 Existing environment

10.2.1 Potentially affected communities

10.2.1.1 Fernbank Creek

Fernbank Creek is a rural, low-density residential suburb located approximately six kilometres west of the Port Macquarie CBD. Characterised by large residential lots, farmland and bushland, the suburb is bordered by the Hastings River in the north and bisected by Fernbank Creek, with several oyster farms dispersed along the banks of the Hastings River, downstream of the WWTP (Oceanwatch 2016) (discussed further in Chapter 3 (Project description)). The majority of residential properties are situated alongside the river or off the main road, Fernbank Creek Road. The suburb is accessed via the Pacific Highway, Hastings River Drive and Winery Drive.

Partridge Creek, Fernbank Creek and associated wetlands are located within the WWTP site. These wetlands are visited by members of the Hastings Birdwatchers Club, as according to SIA consultation, it's felt to be 'one of the best' birdwatching locations in the Port Macquarie-Hastings area. Members of the club currently visit the site three times a year on official visits, with several members unofficially visiting the site regularly. The club currently has 120 members, with about half who are actively attending monthly excursions.

10.2.1.2 Thrumster

Thrumster is a small residential suburb located approximately two kilometres from the proposed location of the WWTP and RWTP, with RWM and PC lines extending through the suburb along Thrumster Street before terminating at John Oxley Drive. Thrumster is accessed via Pacific Highway, Oxley Highway and John Oxley Drive.

Thrumster is identified in the *Port Macquarie-Hastings Urban Growth Management Strategy* as a key urban release area. Thrumster would play a major role in the development of the Port Macquarie-Wauchope Corridor, containing the majority of urban growth and 'higher order' services and facilities required to serve the growing population of the region (Council 2018).

10.2.1.3 Port Macquarie

The suburb of Port Macquarie is the main CBD and service centre for the region. Port Macquarie provides the majority of the region's housing and jobs as well as higher-level services and facilities. Ongoing investment in the health, education and tourism sectors has been the main driver of residential and economic growth and expected continued growth of the region (Council 2020).

A portion of the alignment traverses the northern boundary of the Port Macquarie Race Club and a new sewer pump station is located approximately 200 metres from the race club on Oxley Highway.

10.2.1.4 Key demographic indicators

Table 10-6 provides a summary of the key demographic indicators within the potentially affected communities of Fernbank Creek, Thrumster and Port Macquarie.

Table 10-6 Key demographic indicators, potentially affected communities

Indicator	Fernbank Creek	Thrumster	Port Macquarie
Population and demography			
Total population (2021)	122 persons	2,382 persons	47,693 persons
Population change (2016-2021)	- 8.3%	471.2%	6.4%
Under 18 years	13.1%	29.6%	19.1%
Over 65 years	23.8%	11.3%	28.9%
Median age (years)	50	32	48

Indicator	Fernbank Creek	Thrumster	Port Macquarie
Family Characteristics			
Total families	38	683	13,035
Couple families with children	28.9%	45.8%	33.1%
Couple families without children	50.0%	36.5%	48.4%
One parent family	15.8%	15.2%	17.4%
Other family	0.0%	1.0%	1.2%
Population mobility			
Lived at same address one year ago (per cent)	85.7%	66.3%	79.5%
Lived at same address five years ago (per cent)	67.2%	19.9%	50.6%
Culture and diversity			
Born in non-main English-speaking country	4.1%	6.7%	6.2%
Languages spoken at home other than English	7.4%	7.9%	5.2%
Employment and Economy			
Top industry of employment	Construction (22.4%)	Health care and Social Assistance (23.6%)	Health care and Social Assistance (22.4%)
Labour force participation	60.7%	70.0%	52.4%
Unemployment	0.0%	3.5%	4.9%
Median individual income per week ($)	$712.00	$882.00	$679.00
Median household income per week ($)	$1,625.00	$1,988.00	$1,282.00
Dwelling Type			
Occupied dwellings	83.3%	95.2%	90.8%
Separate House (per cent)	100.0%	89.6%	66.1%
Semi-detached, terrace house, townhouse (per cent)	0.0%	8.4%	18.0%
Flat, unit or apartment (per cent)	0.0%	0.8%	15.2%
Other dwelling	0.0%	0.0%	0.5%
Median persons per household	2.8	2.9	2.2
Tenure Type			
Owned (fully or with a mortgage) (per cent)	72.5%	67.9%	63.8%
Rented	20.0%	30.5%	31.1%
Weekly median rent ($)	$275.00	$460.00	$375.00
Education			
Completion of Year 12 (or equivalent) (per cent)	40.6%	55.2%	47.9%
Bachelor degree level (per cent)	9.1%	23.3%	24.9%
Certificate level (per cent)	52.7%	46.3%	44.4%
Advance diploma and diploma level (per cent)	21.8%	18.1%	18.3%
Socio-economic disadvantage			
SEIFA IRSAD decile (2021) (Within NSW)	7	7	4

10.2.2 Community health and wellbeing

10.2.2.1 Landscape values and character

The Port Macquarie-Hastings region is characterised by a coastal environment and hinterland area, with a variety of urban, suburban and rural areas.

As noted in the *Community Strategic Plan*, the Port Macquarie-Hastings community places high value on its environmental setting, including various national parks, forests and nature reserves. Areas of high value vegetation also provide habitat for a wide range of species including threatened flora and fauna. Environmental challenges include flooding and coastal erosion as well as challenges in wastewater generation and increased stormwater runoff carrying pollutants (PMHC, 2022).

Port Macquarie-Hastings region supports many nature-based recreational activities through its surrounding beaches and wildlife. There is a large number of nature reserves, playgrounds, hiking trails, parks and open spaces that provide both formal and informal recreation opportunities including walking, exercising, playground use and picnicking. Due to its coastal location, there are also many water-based recreational activities including swimming, boating, fishing, kayaking and surfing. Partridge and Fernbank Creeks flow to surrounding coastal flats and wetlands into the lower Hastings River. Hastings River is popular among residents and visitors for a range of boating activities, including sailing, rowing, power boats, kayaking and jet-skiing. The river also contributes to a large part of the tourism economy through oyster farming, boat charters and cruises (Intrawater, 2024).

Kooloonbung Creek, which also flows to the Hastings River is highly valued by the local and regional community for the biodiversity, both flora and fauna and the surrounding nature reserve. During SIA consultation, stakeholder noted that there is a strong community presence in the Kooloonbung Creek area which is involved in volunteering, environmental education, weed management and environmental preservation. Some recreational activities occur at Kooloonbung Creek, particularly near the confluence with the Hastings River.

Port Macquarie-Hastings LGA also has one of the largest remaining coastal koala populations in Australia, which the government works to carefully manage through Koala Management strategies and spreading awareness of threats (PMHC, 2023).

10.2.3 Access and connectivity

The Port Macquarie-Hastings LGA is well serviced by road, rail and air, which plays an important role in regional connectivity between Sydney and the Gold Coast. There are two major highways, one providing north-south connectivity, the Pacific Highway, and one providing east-west connectivity, the Oxley Highway. The newly upgraded Port Macquarie airport supports over 100 direct flights a week in and out of Sydney, Brisbane, Melbourne, Canberra and Lord Howe Island.

The region has two rail stations in Kendall and Wauchope, which connect to Sydney and Brisbane. There are local public bus services available, however regional bus services are limited to private coach companies. There is also a vehicle ferry which services Port Macquarie CBD to the North Shore, providing access to Limeburners Creek Nature Reserve, North Beach and Crescent Head.

10.3 Social infrastructure

Table 10-7 provides a summary of the existing social infrastructure and services within the suburbs of Fernbank Creek, Thrumster and Port Macquarie.

Table 10-7 Social infrastructure and services

Suburb	summary of surrounding social infrastructure and services
Fernbank Creek	As there is no main residential centre in Fernbank Creek, residents would travel to the nearby suburbs of Thrumster, located approximately four kilometres to the south, or Port Macquarie approximately six kilometres east to access a variety of services and shops. Key features and services located in Fernbank Creek include Cassegrain Winery, Port Macquarie Horse Riding Centre, Big Oyster Seafood Market and a public boat ramp.

Suburb	summary of surrounding social infrastructure and services
Thrumster	Thrumster features a small town centre with a shopping centre (Sovereign Place Town Centre) and several businesses located at the intersection of Oxley and Pacific Highway. Key businesses, services and facilities located in Thrumster include: – Shops and businesses – including a local supermarket, three cafes, six takeaway restaurants, a fitness centre, gift shop, two hair salons and a service station. – Community services and facilities – including a pharmacy, medical centre, retirement community and two playgrounds. – Education – including St Joseph's Regional College. – Emergency services – serviced by Sancrox/Thrumster Rural Fire Service. – Thrumster Business Park precinct industrial area with targeted completion date February 2023. The park provides an opportunity for a wide variety of business and industry, and would become a major employment hub and contributor to the local economy.
Port Macquarie	The suburb of Port Macquarie is the main central business district and service centre for the region. Port Macquarie provides the majority of the region's housing and jobs as well as higher-level services and facilities. Ongoing investment in the health, education and tourism sectors has been the main driver of residential and economic growth and expected continued growth of the region (Council 2020).

10.4 Potential impacts and benefits

A social impact can be direct, indirect or cumulative, and negative or positive. It can also vary according to the individual, community, or segment of a community by whom it is experienced.

10.4.1 Construction

Table 10-8 provides a summary of the potential social impacts that may occur during construction of the project. Impacts have been evaluated both before and after the implementation of the recommended mitigations identified in Section 10.5.

Table 10-8 Social impact summary table - construction

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
WWTP				
Property and land use				
Temporary and permanent land use requirements and land use change during construction to accommodate WWTP. Residents in close proximity, and birdwatchers who regularly access the site area, are likely to be sensitive to these changes.	Surroundings	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)
Establishment of an easement and emergency access road would lead to impacts for the affected private property owner, including disruption to usual activities and demands on time.	Way of life Health and wellbeing	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan	– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)
Access and connectivity				
Additional heavy and light vehicle movements is likely to reduce access and lead to delays for road users on Hastings River Drive, and residents located on Fernbank Creek Road.	Accessibility	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Potential for reduced access to WWTP site for birdwatchers.	Accessibility	– Magnitude: Minor – Likelihood: Likely – **Significance:** Medium (negative)	– Communication Plan – Consultation with Hastings Birdwatchers group	– Magnitude: Minor – Likelihood: Likely – **Significance:** Medium (negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Changes in local amenity				
Increases in noise as a result of construction activities and vehicles, particularly heavy vehicles during the day and night may disturb day-to day activities for residents in close proximity to the site which may affect their daily routines and quality of life. This could include closing windows whilst indoors or spending less time outdoors engaging in recreational activities or relaxation.	Surroundings	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
The presence of construction activities and associated construction equipment as well as the clearing of vegetation may result in a visual disturbance and affect the sense of place for local residents, recreational users, and road users. It should however be noted that the majority of the WWTP would be constructed within a forested area with limited view of construction activities.	Surroundings	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
During construction, there may be increases in dust, noise and visual amenity, particularly construction traffic. The presence of construction traffic including light and heavy vehicles traveling along Fernbank Creek Road and Hastings River Drive would be visible to residents, road users and visitors travelling along Fernbank Creek Drive and Hastings River Drive. Increased dust and noise may be noticeable and perceived as intrusive and annoying at times for some. This may temporarily reduce enjoyment of outdoor areas or views from the road, some windows and yards.	Surroundings	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
During construction, the landholder of the adjoining private property (in vicinity of WWTP) may experience combined amenity impacts associated with noise, vibration, dust and visual changes during construction. Construction activities are likely to result in temporary changes in air quality and noise amenity.	Surroundings	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
The presence of the construction workforce may result in a perceived loss of privacy for some landholders. The changes in amenity and privacy are expected to be minimal for the majority of landholders based on the distance between dwellings and the location of the Project, however the level of intrusion and impact of amenity would be based on the viewpoints from dwellings.	Surroundings	– Magnitude: Minor – Likelihood: Possible – **Significance:** Low (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Aboriginal cultural heritage and values				
There are three Aboriginal cultural heritage sites located within the project area, and one located directly adjacent to the project area. Implementation of the mitigation measures proposed in the ACHA are expected to support avoidance of impacts to tangible Aboriginal cultural values.	Culture	– Magnitude: Moderate – Likelihood: Unlikely – **Significance:** Medium (negative)	– ACHA mitigation measures – Maximise opportunities for local and First Nation employment and business participation (positive)	– Magnitude: Minor – Likelihood: Very unlikely – **Significance:** Low (negative)
Pipeline and sewer pump stations				
Property and land use				
Adjustment of easements would be required in some instances to accommodate the alignment may result in construction activities moving closer to homes and businesses.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Communication Plan	– Magnitude: Minor – Likelihood: Very unlikely – **Significance:** Low (negative)
Temporary land use changes may result in reduced amenity during construction of the pipeline alignment.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Communication Plan	– Magnitude: Minor – Likelihood: Very unlikely – **Significance:** Low (negative)
Some residents and businesses may experience reduced enjoyment or pride in their properties due to construction activities, however these impacts would be temporary during construction and would move along the alignment as the pipelines are constructed.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Communication Plan	– Magnitude: Minor – Likelihood: Very unlikely – **Significance:** Low (negative)
Access and connectivity				
HDD would be implemented in some areas to minimise potential disruption. Although access to properties would be maintained during construction of the pipelines, some community members may be temporarily disrupted by changes in property access.	Accessibility	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Communication Pan – Consultation with local residents	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Temporary potential changes in access for non-residential land uses (businesses and community facilities) along the proposed alignment during construction as a result of trending, drilling, partial lane closures and other construction activities. Changes to access may be inconvenient for some residents and cause frustration, however, is not expected to deter customers.	Accessibility	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Additional heavy and light vehicle movements and trenching works is likely to reduce access for some residents and businesses located alongside the alignment. However, this is expected to be temporary.	Accessibility	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Consultation with local residents – Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Increased light and heavy vehicle movements, trenching and potential lane closures, may result in disruptions and delays for people travelling along the roads associated with the pipeline alignment.	Accessibility	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Trenching works located within the road verges detailed above may reduce any on-street parking along these roads, however these impacts would be temporary as trenching activities move along the alignment.	Accessibility	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
During construction of the pipelines, there would be relocation of some bus stops to accommodate construction equipment and works. Relocation and delay in service and increases in travel time may be inconvenient for residents who use the bus service to access employment, education or other services, which may cause frustration.	Accessibility	– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Traffic Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Changes to local amenity				
Increases in noise as a result of construction activities, particularly heavy vehicles during the day and night may disturb day-to-day activities for nearby residents and community members which may affect their daily routines and quality of life. This could include closing windows whilst indoors or spending less time outdoors engaging in recreational activities or relaxation.		– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
During construction, residential and non-residential receivers that are nearby the pipeline alignment may potentially experience discomfort due to noise and vibration. Impacts from construction vibration would be temporary as construction works move along the alignment.		– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Construction activities would have the potential to generate dust for residents and businesses in close proximity to the proposed pipeline, as a result of excavations and trackout works. Increases in dust may lead some residents and businesses to alter their way of life, such as closing windows whilst indoors, spending less time outside, or spending additional time cleaning indoor and outdoor surfaces.		– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Temporary changes in visual amenity during construction of the pipeline alignment, particularly trenching, drilling and excavation works and construction traffic. The presence of construction traffic including light and heavy vehicles would be visible to residents and visitors along the associated routes. This may temporarily reduce enjoyment of outdoor areas or views from some windows and yards.		– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)	– Communication Plan – Construction Environmental Management Plan	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Project wide impacts				
Economy, employment and business				
Increased demand for goods and services would benefit local businesses through subcontracting to the primary construction contractor.	Livelihoods	– Magnitude: Possible – Likelihood: Minor – **Significance:** Medium (positive)	– Maximise opportunities for local and First Nation employment and business participation	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (positive)
Construction employment opportunities for skilled and unskilled workforce.	Livelihoods	– Magnitude: Possible – Likelihood: Minor – **Significance:** Medium (positive)	– Maximise opportunities for local and First Nation employment and business participation	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (positive)
Some food and beverage retail businesses located in close proximity to construction activities may benefit from increased revenue due to construction workers spending wages.	Livelihoods	– Magnitude: Possible – Likelihood: Minimal – **Significance:** Low (negative)	– No additional mitigation measures	– Magnitude: Minimal – Likelihood: Possible – **Significance:** Low (negative)

10.4.2 Operation

Table 10-9 provides a summary of the potential social impacts that may occur during operation of the project. The potential impacts have been evaluated both before and after the recommended mitigation measures would be implemented.

Table 10-9 Social impact summary table - operation

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
WWTP				
Access and connectivity				
Upgrades to Fernbank Creek Road may benefit residents living on this road by providing safer access.	Accessibility	– Magnitude: Minor – Likelihood: Likely – **Significance:** Medium (positive)	– No additional mitigation	– Magnitude: Minor – Likelihood: Likely – **Significance:** Medium (positive)
Changes in access to the WWTP site for members of the Hastings Birdwatching group. This may be offset by potential enhancements in design of the WWTP, such as a boardwalk, signage, and inclusion of 'hides'.	Accessibility	– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)	– Ongoing consultation with Hastings Birdwatchers group	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Changes to local amenity				
Permanent visual changes from some viewpoints of the WWTP infrastructure may alter views from some properties close to the proposal site. Views of the site and changes to the character of the area may reduce some residents enjoyment of their properties. Birdwatchers may also experience reduced enjoyment of the area, although this may be offset by design enhancements to support birdwatching activities. Most people are expected to adapt to these visual changes over time.	Surroundings	– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Possible – **Significance:** Medium (negative)
Some residents in close proximity to the WWTP and along local roads may be disturbed by traffic noise.	Surroundings	– Magnitude: Minimal – Likelihood: Unlikely – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minimal – Likelihood: Unlikely – **Significance:** Low(negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Although the predicted odour concentrations would comply with criteria, and design of the WWTP would help to manage odour, residents close to the WWTP may notice odour. This could lead to changes in behaviour for some residents, such as spending more time indoors, closing windows and doors of houses or vehicles.	Surroundings	– Magnitude: Minor – Likelihood: Possible – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Community health and wellbeing				
Despite the Health Impact Assessment (Enrisks, 2024) finding that odours during the operation of the WWTP are expected to be negligible, residents in the local study area may be concerned that the project may increase the potential for the ingestion of contaminated produce or water or inhaling air-borne pollutants. These concerns have the potential to cause stress and anxiety for some community members, which could affect wellbeing for some individuals.	Health and wellbeing Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Ongoing consultation with residents located in proximity to the WWTP	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Some residents may be concerned about the value of their properties due to proximity to the WWTP. This may cause stress and anxiety for some community members, which could affect wellbeing for some individuals.	Health and wellbeing Livelihoods	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– Ongoing consultation with residents located in proximity to the WWTP	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Pipeline alignment and pump stations				
During operation, periodic inspections of the pipeline would be undertaken. This would involve a vehicle or individual on foot assessing the easement and valves visually. This is not expected to result in any social impacts during operation.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
As pipelines would be buried underground, there are no expected visual, noise, or air quality impacts to residents and recreational areas in close proximity to the pipeline alignment.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
There is potential for minor visual and odour impacts to residents and recreational areas in close proximity to the vent stacks and odour control units on the network.	Surroundings	– Magnitude: Minor – Likelihood: Possible – **Significance:** Low (negative)	– Operation and maintenance Plan and manuals	– Magnitude: Minor – Likelihood: Possible – **Significance:** Low (negative)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Provided the sewerage pumping stations associated with the project are designed and operated in accordance with the Hunter design manual, odour impacts for the surrounding community is expected to be minimal.	Surroundings	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Project wide impacts				
Community health and wellbeing				
Despite the findings of the Health Impact Assessment (Enrisks, 2024) that no significant changes in water quality Kooloonbung Creek or Partridge Creek are predicted, community perception of the expected outcomes during operation of the project may lead to individuals changing the manner in which they access public recreation areas associated with Kooloonbung and Partridge creeks.	Way of life Accessibility Health and wellbeing	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Ongoing consultation with residents, community groups and organisations.	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)
Some stakeholders expressed a high level of concern around impacts to biodiversity as a result of changes in water quality due to the project. While actual changes in water quality were identified to be minimal, perceived reduction in water quality may result in stress and anxiety for those residents who highly value the natural environment in Kooloonbung Creek.	Way of life Community Health and wellbeing	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)	– Ongoing consultation with residents, community groups and organisations.	– Magnitude: Moderate – Likelihood: Possible – **Significance:** Medium (negative)
Due to the location of discharge points for the project being downstream of the Hastings River, impacts to recreational users of the Hastings River and impacts to oyster growers would be minimal.	Way of life Community Health and wellbeing	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)	– No additional mitigation	– Magnitude: Minor – Likelihood: Unlikely – **Significance:** Low (negative)
Economy, employment and business				
Provision of critical infrastructure to support the region's growing population and economic growth.	Livelihoods	– Magnitude: Major – Likelihood: Likely – **Significance:** High (positive)	– No additional mitigation	– Magnitude: Major – Likelihood: Likely – **Significance:** High (positive)
Approximately three to four full time equivalent roles would be required to operate the project, which would provide long term benefits for local workers who gain employment.	Livelihoods	– Magnitude: Minor – Likelihood: Likely – **Significance:** Low (positive)	– Local employment and participation policies	– Magnitude: Minimal – Likelihood: Likely – **Significance:** High (positive)

Summary of social impact	SIA Guideline social impact category	Impact before mitigation	Mitigation measures	Impact after mitigation
Treated effluent would be discharged downstream of oyster leases, avoiding potential contamination of the Hastings River and impacts to the local oyster industry.	Livelihoods	– Magnitude: Moderate – Likelihood: Likely – **Significance:** High (positive)	– No additional mitigation	– Magnitude: Moderate – Likelihood: Likely – **Significance:** High (positive)
Potential for new and emerging industries to be developed due to the beneficial reuse of outputs associated with the WWTP via connection of treated and recycled water to the existing Thrumster recycled water scheme.	Livelihoods	– Magnitude: Likely – Likelihood: Likely – **Significance:** Medium (positive)	– Consultation with local stakeholders	– Magnitude: Minor – Likelihood: Likely – **Significance:** Medium (positive)

10.4.3 Cumulative

This section presents a summary of the potential cumulative social impacts and benefits that may result from the project and other key projects in the social locality. There is potential for the project to overlap or occur concurrently with other projects in the social locality.

A list of other major projects and applications in Port Macquarie-Hastings LGA is provided in Chapter 2 (Strategic context) of the EIS.

10.4.3.1 Construction

From a social perspective, the key cumulative impacts that may occur during construction are summarised below:

– Competition for skilled labour during construction of projects, which could result in more roles being filled by non-residents, leading to increased demand for housing and accommodation in the region.
– Increased traffic and changes in access to businesses, community facilities and residential areas in the potentially affected communities during construction which could increase disruptions and delays, particularly during construction of the pipeline alignment.
– Combined amenity impacts (noise, vibration, air quality) during construction, particularly along Fernbank Creek Road, Hastings River Road, Oxley Highway and John Oxley Drive which may disturb day-to-day activities for nearby residents and community members which may affect their daily routines and quality of life.

10.4.3.2 Operation

The project is one of two infrastructure schemes that Council have identified to assist with the anticipated population growth projection in the LGA. The other complimentary scheme is the Cowarra Water Supply Scheme, subject to a separate SSI application being developed concurrently as related development.

Together, these schemes would provide servicing for over 7,000 additional homes across the LGA and would also indirectly cater for over an additional 3,000 dwellings via in-fill development within Port Macquarie. This is almost 25 per cent of the required 41,300 extra dwellings on the North Coast that would be needed to support growth over the next 20 years as identified in the Draft North Coast Regional Plan 2041 (NSW DPE 2022d). Population forecasting has predicted that the population within the LGA will reach 115,302 residents by 2046 (PMHC, 2024), increasing demand on the existing wastewater infrastructure and utilities.

The project is also aligned to the land-use principles outlined in Council's Local Strategic Planning Statement ensuring critical infrastructure supports growth (Council 2020). Overall, operation of the two projects is expected to indirectly support the region's economic growth as critical and enabling infrastructure which would support the region's population growth.

Together, the two projects are also expected to support an overall healthier environment and waterways in Port Macquarie, supporting community values and aspirations, and community health and wellbeing.

10.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise socio-economic impacts of the project are detailed in Table 10-10.

Table 10-10 Social management measures mitigation measures

ID	Social impact / benefit	Mitigation measure	Responsibility	Timing
SE1	Amenity and access impacts for local communities and landholders	A Communication Plan (CP) will be prepared and implemented as part of the Construction Environmental Management Plan (CEMP) to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): – Mechanisms to provide details and timing of proposed activities to affected stakeholders, including changed traffic and access conditions. – Toll free number and email address for enquiries and complaints. – How the project webpage will be maintained for the duration of the project. – A complaint's handling procedure. – Consultation activities to be carried out.	Construction contractor	Pre-construction / construction
SE2		Council will continue to consult with the community until completion of the project. This will include approaches to: – Consult with landowners, landholders, emergency services, schools, aged care facilities, businesses, community groups and community and recreation facilities in close proximity to the project to notify them about the project design, construction activities and timing of construction works. During operation of the project, this may include managing responses to enquiries and complaints and providing accurate and accessible information. – Identify and engage with vulnerable persons that might be affected by the project – Communicate information about potential access changes and delays, including targeted communication to affected local stakeholders (e.g., affected residents, businesses, emergency services, bus services, community and recreation facilities).	Council	Pre-construction / construction / operation
SE3	Impacts on community and recreational facilities	Access to community facilities and infrastructure will be maintained during construction as far as practicable. Where alternate access arrangements need to be made, including changes to access for public and active transport facilities, these will be developed in consultation with relevant stakeholders and service providers, and communicated to users in accordance with the Communication Plan. Any changes to access arrangements will be managed in accordance with the Traffic Management Plan.	Council Construction contractor	Pre-construction / construction
SE4		Council will continue to consult with relevant key stakeholders in relation to community and recreation infrastructure with the potential to be directly affected (by the project's land requirements) and/or indirectly affected (for example, as a result of amenity impacts or access changes). Consultation will be undertaken in accordance with the Communication Plan and will assist with identifying measures to minimise the potential impacts of the project on community and recreation infrastructure as far as possible.	Council	Pre-construction / construction

ID	Social impact / benefit	Mitigation measure	Responsibility	Timing
		Stakeholders to be consulted will include, but not be limited to, Hastings Birdwatchers, Friends of Kooloonbung Creek, Port Macquarie Airport, Port Macquarie Racecourse, Port Macquarie Rifle Club, Newman Senior Technical College, Glenfern Lifestyle Community, emergency services, and residential neighbours.		
SE5	Local and First Nation employment and business opportunities	Council will maximise the participation of local, regional and First Nation businesses in the project, such as: – Preferential local and First Nation participation inclusions in tender documents which outline the sub-contracting and local employment goals that construction contractors would need to deliver. – Promotion of supply and employment opportunities through local industry channels and employment organisations. – Investigation of partnerships with local educational institutions and universities to support local residents to fill jobs during operation. – Explore opportunities to commission artwork from the local Aboriginal artists in design of the WWTP and RWTP to support interpretation and celebration of local Aboriginal community and culture.	Council Construction contractor	Pre-construction / construction / operation

11. Terrestrial biodiversity

This chapter provides a detailed summary of the assessment of potential biodiversity impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides proposed mitigation and management measures.
The full assessment is provided in Technical Report 5 – Biodiversity Development Assessment Report.

11.1 Assessment approach

11.1.1 Legislation and policy context

The plans, policies and guidelines that were considered for the terrestrial biodiversity impact assessment include:

– Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* – provides protection for MNES including listed threatened species and ecological communities, listed migratory species and wetlands of international importance.
– *Biodiversity Conservation Act 2016* – establishes a framework for assessment and offsetting of biodiversity impacts as well as investment in biodiversity conservation. The BC Act established the Biodiversity Offsets Scheme (BOS) and BAM which have informed the preparation of Technical Report 5 – Biodiversity Development Assessment Report.
– *Biosecurity Act 2015* – provides a framework for the prevention, elimination, and minimisation of biosecurity risks on public and private land in NSW. Consideration of declared pests and weeds listed in Division 1 of Part 2 of Schedule 3 and Part 3 of Schedule 3 of the *Biosecurity Act 2015* and Schedule 3 of the *Biosecurity Regulation 2017* recorded in project footprint is included in Section 1.
– *State Environmental Planning Policy (Biodiversity and Conservation) 2021*:
    - Chapter 3 Koala Habitat Protection 2020
    - Chapter 4 Koala Habitat Protection 2021

11.1.2 Methodology

Council sought to avoid and minimise impacts on biodiversity values throughout the development of the project. This has included applying biodiversity criteria during options assessment (refer to Chapter 2 (Strategic context).

The BDAR involved:

– Reviewing available data and existing reports relevant to existing vegetation, threatened flora and threatened fauna including searches of the NSW BioNet Atlas Database, BAM – Important Areas viewer and the EPBC Act Protected Matters Search Tool of the locality (i.e. a 10 kilometres buffer around the project footprint).
– Defining the landscape assessment area (i.e. the project footprint with a buffer of 500 metres as required by the BAM for linear development) to describe the landscape context for the project.
– Determining candidate threatened flora and fauna species for the project based on the list generated by the Biodiversity Assessment Method Credit Calculator (BAM-C) as well as additional species with a moderate or higher likelihood of occurrence in the project footprint.
– Applying a mapping process to delineate the extent of potential habitats for candidate threatened flora and fauna species in which further assessment of species presence/absence would be required by means of targeted surveys, an expert report or assumed presence.
– Carrying out multiple field surveys within accessible lands in accordance with the BAM and other relevant Commonwealth and state government guidelines to:
    - Verify vegetation communities present and develop a map of vegetation zones.
    - Assess habitat suitability for threatened fauna including the presence/absence of known habitat constraints.

- Undertake BAM plots within vegetation zones to calculate vegetation integrity.
- Undertake targeted surveys for candidate threatened flora and fauna species.

– Assessing aquatic habitat condition and suitability for threatened aquatic biota.
– Assessing potential direct, indirect, prescribed, and serious and irreversible impacts (SAII) in accordance with the BAM.
– Assessing potential direct and indirect impacts on aquatic habitat and biota and any potential impacts on riparian corridors and GDEs.
– Identifying mitigation measures to address any potential impacts.
– Determining the need for offset requirements to address any residual impacts.

In order to provide a context for the project, records of flora and fauna from within 10 kilometres (the 'locality') were collated from the following databases:

– 'Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (NSW DPIE, 2021).
– *Argynnis hyperbius inconstans* (Australian fritillary) Conservation Advice, (DDCEEW 2017).
– Biodiversity Values Map and Threshold Tool (NSW DCCEEW 2024c).
– BirdLife Australia, the New Atlas of Australian Birds 1998-2013.
– Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST), for matters protected by the EPBC Act (NSW DCCEEW 2024).
– Groundwater Dependent Ecosystems Atlas (BoM 2022).
– Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide) (DPE 2022f).
– Matters of National Environmental Significance (CoA 2013).
– NSW BioNet - the database for the BioNet Atlas and BioNet Vegetation Classification (NSWDCCEEW (NSW DCCEEW, 2024b).
– NSW BioNet Threatened Biodiversity Profile Data Collection (Threatened Biodiversity Data Collection (TBDC)).
– NSW Department of Primary Industries (DPI) Spatial Data Portal for NSW Fisheries Management Act 1994 listed threatened species, populations and communities (DPI 2024).
– NSW Scientific Committee (1998) Giant dragonfly - Endangered species determination - final. DEC (NSW), Sydney.
– PlantNET (Royal Botanic Gardens and Domain Trust 2013).
– Port Stephens Council Comprehensive Koala Plan of Management (KPOM) (PSC 2002).
– Relevant vegetation mapping, including SVTM (State Government of NSW & NSW DCCEEW 2022) and Vegetation of the Port Macquarie Hastings Local Government Area Version 1.08. (Phillips et al, 2013).
– Relevant vegetation mapping, including vegetation mapping of Port Macquarie-Hastings area (State Government of NSW & NSW DCCEEW, 2022, Phillips et al, 2013).
– Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c).
– Survey guidelines for Australia's threatened bats (CoA 2010a).
– Survey guidelines for Australia's threatened birds (CoA 2010b).
– Survey guidelines for Australia's threatened fish (CoA 2011a).
– Survey guidelines for Australia's threatened frogs (CoA 2010c).
– Survey guidelines for Australia's threatened mammals (CoA 2011b).
– Survey guidelines for Australia's threatened reptiles (CoA 2011c).
– Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b).
– The Australian Dragonflies: a guide to the identification, distributions and habitats of Australian Odonata. CSIRO, Canberra & Melbourne (1991).

– The complete field guide to Dragonflies of Australia. Orr, Albert, Günther Theischinger, and John Hawking. CSIRO Publishing, 2021.
– The Spot Assessment Technique: determining the importance of habitat utilisation by Koalas (Phascolarctos cinereus) (Phillips and Callaghan 2011).
– The wetland habitats, biogeography and population dynamics of Petalura gigantea (Odonata: Petaluridae) in the Blue Mountains of New South Wales (Doctoral dissertation, University of Western Sydney (Australia)) Baird, I. R. (2012).
– Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004).
– Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE 2022e).

Project area

The project area includes the outer extent of predicted direct impacts associated with the proposed works. The project area includes the WWTP, roads and electricity supply upgrade areas, a 10-metre-wide corridor (increasing to 20 metres wide where suitable) along the SRMs and RWMs, and laydown/compound areas.

The assessment area was developed in two parts:

– 500 metres buffer was placed around all SRMs and RWMs
– A 1500 metres buffer was placed around the WWTP and laydown/compound areas

These two buffers were then merged to create the assessment area. The 500-metre buffer is applicable as the SRMs and RWMs are classified as a linear; the 1500-metre buffer is applicable as the remaining parts are non-linear. The assessment area consists of a variety of developed land, disturbed exotic grassland and native vegetation.

Field survey

Threatened flora surveys of the project area were undertaken in accordance with the Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b). this included a comprehensive survey of all vegetation zones within the project area. The threatened flora surveys were undertaken on the following dates:

– 27-29 September 2023
– 20-24 November 2023
– 26 March 2024
– 9-10 and 29 April 2024

All threatened flora species were survey during the appropriate survey period. Targeted surveys were performed for candidate flora species credit species.

The project area was investigated to determine its values for fauna. This included direct observation, examination of tracks and scats, identifying calls and recording other signs of animal activity (e.g. nests, burrows, hollow utilisation, scratches and diggings). Particular attention was given to searching for threatened biota and their habitats. This includes such survey techniques; ultrasonic recording, funnel traps, spot lighting, arboreal trapping, flog transects, specific for resource searches, aural-visual survey and remote camera survey. Fauna surveys were undertaken on the following dates:

– 21-22 June 2023
– 11 August 2023
– 27-28 September 2023
– 30 October 2023
– 6-17 November 2023
– 19-22 February 2024
– 24-25 January 2024

– 25-28 March 2024
– 2-4 April 2024

11.2 Existing environment

11.2.1 Landscape features

Table 11-1 Landscape Features

Landscape feature	Description
General landscape features	– Project area is generally at a low elevation. The WWTP is approximately 2-4 m above sea level and the SRMs/RWMs are mostly below 25 m above sea level. – Partridge Creek is located to the east and flows south to north, while Fernbank Creek is located to the north west and flows northwards, both creeks enter the Hastings River. – The project consist of a mix of Alluvial Plan and Coastal Barrer Systems. – Soils types feature Podosols at the sand plain, Hydrosols in the wetlands and a mix of Ferrosols, Hydrosols, Kandosols, natric Kurosols, and Podosols.
Interim Biogeographic Rationalisation for Australia (IBRA)	– Located within the NSW North Coast IBRA region (Macleay Hastings IBRA subregion). – The NSW North Coast Bioregion extends from just north of Newcastle to just south of the border of Queensland with a total area 5,924,130ha, including 7.11% of NSW.
Rivers and streams	– The WTTP drains towards Partridge Creek, which flows generally south to north on the eastern side of the WWTP. – Partridge Creek was identified as an acid sulfate soil hot spot, covering a 540 ha area, and was having economic consequences for the local oyster and fishery industries, as well as causing the degradation of the local estuarine ecosystem.
Wetlands	– Wetlands surrounding and intersecting the project area and in the LGA are not identified as being of international importance (Ramsar Wetlands). – An area identified as a Coastal Wetlands under the Resilience and Hazards SEPP is within the WWTP project area and a small section of the SRMs and RWMs, east of the Port Macquarie Airport. – The Coastal Use Area is intersected in several areas of the project area; Areas within the WWTP, Sewer Rising Main and the return effluent pipeline near Kooloonbung Creek.
Groundwater Dependent Ecosystems	– The Groundwater Dependent Ecosystems (GDE) Atlas did identify GDE within the project area. – High potential GDE, moderate and low are mapped within the project area and within the assessment area. – additional probable GDE vegetation mapping (DPE 2022g) identified two potential GDE within the project area (i.e. Wetland – Freshwater wetland and Terrestrial – Forested wetland).
Habitat connectivity	– Project area sits within a mosaic of managed, disturbed and natural landscapes. – The WWTP is within a sand plain dominated by exotic grass and is surrounded by a diversity of habitats that could facilitate dispersal for a wide range of species. – The SRMs and RWMs are dominated by exotic vegetation with some areas of moderate condition vegetation. Native vegetation near Port Macquarie Base Hospital and Lake Innes Village are partially degraded by existing tracks with regular public use, and are separated from other large areas of vegetation by roads and residential development.
Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance	– There were no recorded karst, caves, crevices, cliffs or other areas of geological significance within the project area or within its locality.
Areas of outstanding biodiversity value	– Of the four entities listed on the Area of Outstanding Biodiversity Value Register, none occur within the project area or the locality of the project.
NSW (Mitchell) Landscape	– The project area occurs within the NSW North Coast Coastal Barriers Bioregion Manning Macleay Alluvial Plains NSW Landscape. – landscape contains a variety of soils including, dark organic loams and silty clays on floodplains, gradational brown loams and yellow-brown texture-contrast soil on terraces, and organic silty mud in swamps.

Landscape feature	Description
Soil hazard features	– The subject contains Class 2, Class 3 and Class 5 acid sulfate soils. – The WWTP location has a history of acid sulfate soils exposure and risk. – Potential asbestos areas have been mapped to occur within the project area.
Native vegetation extent	– Approximately 44.06% of the assessment area is occupied by native vegetation. – Assessment area: 3,543.90ha, total area of native vegetation cover: 1,561.32 ha.

11.2.2 Native vegetation

Vegetation within the project area has been assessed as aligning with the BioNet Vegetation Classification PCTs identified within Table 11-2.

Table 11-2 Native vegetation

PCT ID	PCT Name	Condition class	Vegetation zone	Project area (ha)
3167	Northern Hinterland Blackbutt-Forest Oak Wet Forest	Low	VZ1	0.18
3167	Northern Hinterland Blackbutt-Forest Oak Wet Forest	Moderate	VZ2	0.6
3250	Northern Foothills Blackbutt Grassy Forest	Low	VZ3	0.12
3250	Northern Foothills Blackbutt Grassy Forest	Moderate-Good	VZ4	0.61
3544*	Coastal Sands Apple-Blackbutt Forest*	Exotic	VZ5	17.57
3544	Coastal Sands Apple-Blackbutt Forest	Low	VZ6	1.61
3544	Coastal Sands Apple-Blackbutt Forest	Moderate	VZ7	0.21
3967	Northern Lower Floodplain Eleocharis Wetland	Good	VZ8	1.67
4006	Northern Paperbark-Swamp Mahogany Saw-sedge Forest	Moderate	VZ9	0.04
			Total	**22.61**

* VZ represents vegetation that is dominated by exotic vegetation, this VZ has been assessed for vegetation integrity against PCT 3544 Coastal Sands Apple-Blackbutt Forest.

11.2.3 Threatened ecological communities

The threatened ecological communities (TECs) within the project area are listed in Table 11-3.

Table 11-3 TEC within the project area

TEC Name	Profile ID (from TBDC)	BC Act status	EPBC Act status	Vegetation zones within the Project area	Area within Project area
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	10786	Endangered	Not listed	VZ9	0.04
Coastal Swamp Sclerophyll Forest of New south Wales and South East Queensland	-	Not listed	Endangered		
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	10929	Not listed	Endangered	VZ8	1.67

11.2.4 Threatened species

A list of species credit species potentially occurring within the Project area was generated in accordance with Section 5.2 of the BAM and is detailed in Table 21, Table 22 and Table 23 in Technical Report 5 – Biodiversity Development Assessment Report. A list of the identified species determined to be present within the project area is provided in Table 11-4.

Table 11-4 Candidate species credit species present within the Project area

Common name	Scientific name	Listing status		Method used to determine presence
		BC Act	EPBC Act	
Scented Acronychia	*Acronychia littoralis*	E	E	Targeted Flora Transects
Rufous Bettong	*Aepyprymnus rufescens*	V	-	Terrestrial Remote camera survey
Floyd's Grass	*Alexfloydia repens*	E	-	Targeted Flora Transects
Dwarf heath Casuarina	*Allocasuarina defungens*	E	E	Targeted Flora Transects
Nabiac Casuarina	*Allocasuarina simulans*	V	V	Targeted Flora Transects
Laced Fritillary	*Argynnis hyperbius*	E	CE	Species food resource searches, Meandering surveys
Bush Stone-curlew	*Burhinus grallarius*	E	-	Spotlighting and Call Playback
Small Pale Grass-lily	*Caesia parviflora var. minor*	-	-	Targeted Flora Transects
Netted Bottle Brush	*Callistemon linearifolius*	V	-	Targeted Flora Transects
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	V	Targeted Flora Transects Nest Searches
White-eared Monarch	*Carterornis leucotis*	V	-	Targeted Flora Transects
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Arboreal trapping and spotlighting
Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	V	V	Pitfall Traps Reptile Habitat Surveys
Wallum Froglet	*Crinia tinnula*	V	-	Opportunistically and Frog Transects
Leafless Tongue Orchid	*Cryptostylis hunteriana*	V	V	Assumed Presence/ Assumed Present
White-flowered Wax Plant	*Cynanchum elegans*	E	E	Targeted Flora Transects
Spider Orchid	*Dendrobium melaleucaphilum*	E	-	Targeted Flora Transects/ Assumed Present
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Opportunistic, Targeted Flora Transects, Nest Searches
Tree Guinea Flower	*Hibbertia hexandra*	E	-	Targeted Flora Transects
Little Eagle	*Hieraaetus morphnoides*	V	-	Targeted Flora Transects, Nest Searches
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Spotlighting, Funnel traps
Stephens' banded Snake	*Hoplocephalus bitorquatus*	V	-	Spotlighting

Common name	Scientific name	Listing status		Method used to determine presence
		BC Act	EPBC Act	
Swift Parrot	*Lathamus discolor*	E	CE	Assumed Present (Important Area Mapping)
Noah's False Chickweed	*Lindernia alsinoides*	E	-	Targeted Flora Transects
Green and Golden Bell Frog	*Litoria aurea*	E	V	Call Playback, spotlighting, Frog transects
Green-thighed Frog	*Litoria brevipalmata*	V	-	Call Playback, spotlighting, Frog transects
Square-tailed Kite	*Lophoictinia isura*	V	-	Targeted Flora Transects, Nest Searches
Slender Marsdenia	*Marsdenia longiloba*	E	V	Targeted Flora Transects/ Assumed Present
Maundia triglochinoides	*Maundia triglochinoides*	V	-	Targeted Flora Transects
Biconvex Paperbark	*Melaleuca biconvexa*	V	V	Targeted Flora Transects
Groves Paperbark	*Melaleuca groveana*		--	Targeted Flora Transects
Stuttering Frog	*Mixophyes balbus*	E	V	Call Playback, spotlighting, Frog transects
Giant Barred Frog	*Mixophyes iteratus*	E	E	Call Playback, spotlighting, Frog transects
Southern Myotis	*Myotis macropus*	V	-	Ultrasonic Bat Detector
Rusty Plum	*Niemeyera whitei*	V	-	Targeted Flora Transects
Parma Wallaby	*Notamacropus parma*	V	-	Terrestrial Remote camera survey
Red-flowered King of Fairies	*Oberonia titania*	V	-	Targeted Flora Transects
Black Grass-dart Butterfly	*Ocybadistes knightorum*	E	-	Targeted Flora Transects
Milky Silkpod	*Parsonsia dorrigoensis*	V	E	Targeted Flora Transects
Brown fairy-chain Orchid	*Peristeranthus hillii*	V	-	Targeted Flora Transects
Giant Dragonfly	*Petalura gigantea*	E	-	Opportunistic, Targeted Flora Transects, Burrow Searches
Southern Greater Glider	*Petauroides volans*	E	E	Arboreal trapping and spotlighting
Squirrel Glider	*Petaurus norfolcensis*	V	-	Arboreal trapping and spotlighting
Southern Swamp Orchid	*Phaius australis*	E	E	Targeted Flora Transects
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Arboreal trapping and spotlighting
Koala	*Phascolarctos cinereus*	E	E	Assumed Presence
Common Planigale	*Planigale maculata*	V	-	Pitfall Traps
Scant Pomaderris	*Pomaderris queenslandica*	E	-	Targeted Flora Transects

Common name	Scientific name	Listing status		Method used to determine presence
		BC Act	EPBC Act	
Long-nosed Potoroo	*Potorous tridactylus*	V	V	Terrestrial Remote camera survey
Scrub Turpentine	*Rhodamnia rubescens*	CE	CE	Targeted Flora Transects
Native Guava	*Rhodomyrtus psidioides*	CE	CE	Targeted Flora Transects
Rainforest Cassia	*Senna acclinis*	E	-	Targeted Flora Transects
Manning Yellow Solanum	*Solanum sulphureum*	E	E	Targeted Flora Transects
Magenta Lilly Pilly	*Syzgium paniculatum*	E	V	Targeted Flora Transects
Austral Toadflax	*Thesium australe*	V	V	Targeted Flora Transects
Red-backed button quail	*Turnix maculosus*	V	-	Spotlighting and Call Playback
Cryptic Forest Twiner	*Tylophora woollsii*	E	E	Targeted Flora Transects
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Ultrasonic Bat Detector

Target surveys

The threatened flora and fauna species recorded within the project area during the field investigation undertaken or assumed present in accordance with the BAM include:

– Small Pale Grass-lily (*Caesia parviflora var. minor*) (species credit)
– Wallum Froglet (*Crinia tinnula*) (species credit)
– Leafless Tongue Orchid (*Cryptostylis hutneriana*) (species credit)
– Spider Orchid (*Dendrobium melaleucaphilum*) (species credit)
– Black-necked Stork (*Ephippiorhynchus asiaticus*) (ecosystem credit)
– White-bellied Sea-eagle (*Haliaeetus leucogaster*) (ecosystem credit)
– Swift Parrot (*Lathamus discolor*) (species credit)
– Green-thighed Frog (*Litoria brevipalmata*) (species credit)
– Slender Marsdenia (*Marsdenia longiloba*) (species credit)
– Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (ecosystem credit)
– Little Bent-winged Bat (*Miniopterus australis*) (ecosystem credit)
– Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (ecosystem credit)
– Southern Myotis (*Myotis macropus*) (species credit)
– Giant Dragonfly (*Petalura gigantea*) (species credit)
– Squirrel Glider (*Petaurus norfolcensis*) (species credit)
– Koala (*Phascolarctos cinereus*) (species credit)
– Eastern Grass Owl (*Tyto longimembris*) (ecosystem credit)
– Eastern Cave Bat (*Vespadelus troughtoni*) (species credit)

Further details on their abundance and extent of subject habitat are detailed in Table 26 in Technical Report 5 – Biodiversity Development Assessment Report.

11.3 Potential impacts – construction

11.3.1 Avoidance and minimisation

Opportunities to avoid and minimise impacts to terrestrial biodiversity and their supporting habitats was considered throughout the development of the project. This has included consideration of alternate project locations, pipeline routes and construction methodologies. Chapter 2 (Strategic context) provides an overview of the alternatives and options considered.

The process for selecting the preferred project location and construction methodology, particularly for the construction of the WWTP, included several biodiversity related criteria to avoid and minimise impact on biodiversity values. In designing the WWTP, the specific location of facilities has been modified over time to avoid impacts where practical. Key factors when considering the location of the WWTP was to limit direct impacts to native vegetation. The ability of the WWTP to avoid all native vegetation was constrained by its size, with priority given to retaining higher condition vegetation where possible.

Compound locations have been selected to target areas of completely cleared land or land that already contains built structures. These compounds have been located across the project area minimise impacts to surrounding land.

The project will produce effluent that is discharged to Kooloonbung Creek. Other options for discharge were considered and this option was determined as likely to have the least ecological impact overall. As treated effluent is already flowing to Kooloonbung Creek, the impacts of additional discharge on the hydrology of the locality is likely to be minimal. Transport of effluent across the SRMs and RWMs has sought to use direct paths where possible to reduce the distance required and therefore reduce the area impacted by the project. This has meant that the alignment of the SRMs and RWMs follows through the Bio-Certified land within the Port Macquarie Airport, where impact is restricted to a narrow stretch of land that does not require further assessment under the BAM. The project has adopted HDD extensively to avoid impacts on the wetlands and conservation areas surrounding the WWTP, as well as avoiding critically endangered species and Koala habitat between Acacia Avenue and Central Road, Port Macquarie. Over 4.2 kilometres of HDD is proposed as part of the project.

Four options were considered for emergency discharges from the WWTP. Consideration was given to impacts to surrounding native vegetation, non-native vegetation and hydrological processes. Emergency discharges would only be required peak flooding events, and as such they are not intended to be the standard release method of effluent. It is likely that releases during these events would go into already flooded systems and be rapidly diluted. The design options included:

– Option A - Discharge through a weir using the natural swale of the ground to direct emergency discharge.
– Option B - A series of berms in three direction around the pond to dissipate the energy of overflow.
– Option C - Discharge via rip rap to minimise the energy of the discharge for gentle dispersion to the sand plain.
– Option D - Discharge via a pipeline to the existing drain upstream of the hydraulic gate (within Wetland A).

Option D was considered to have high construction impact on the native vegetation, non-native vegetation and TECs, and could be ineffective during a 95-99% discharge event. Options B and C were considered to reduce low in erosion risk but were limited in ability to contain and monitor the discharge event. Ultimately option A was selected as the preferred method of emergency discharge as it contains the discharge to a swale, requires minimal disturbance to native and non-native vegetation and enables the monitoring of emergency discharge.

The design has specifically placed the WWTP and SRMs and RWMs within exotic dominated vegetation where possible, limiting the overall impact on native species, including those that are not listed as threatened by the BC Act and EPBC Act.

11.3.2 Residual direct impact

Direct impacts will occur within the project area with the removal of vegetation and species habitat, including habitat for threatened species. A detailed list documenting residual impacts likely to occur is summarised in Table 11-5.

Table 11-5 Summary of residual direct impacts

Direct impact	BC Act status	EPBC Act status	Project phase	Extent (ha)
Removal of VZ1 PCT 3167 Northern Hinterland Blackbutt Forest Oak Wet Forest – Low Condition	Not Listed	Not Listed	During pre-construction clearing	0.18
Removal of VZ2 PCT 3167 Northern Hinterland Blackbutt Forest Oak Wet Forest – Moderate Condition	Not Listed	Not Listed		0.6
Removal of VZ3 PCT 3250 Northern Foothills Blackbutt Grassy Forest – Low Condition	Not Listed	Not Listed		0.12
Removal of VZ4 PCT 3250 Northern Foothills Blackbutt Grassy Forest – Moderate to Good Condition	Not Listed	Not Listed		0.60
Removal of VZ5 Exotic Vegetation	Not Listed	Not Listed		17.57
Removal of VZ6 PCT 3544 Coastal Sands Apple-Blackbutt Forest – Low Condition	Not Listed	Not Listed		1.61
Removal of VZ7 PCT 3544 Coastal Sands Apple-Blackbutt Forest – Moderate Condition	Not Listed	Not Listed		0.21
Removal of VZ8 PCT 3967 Northern Lower Floodplain Eleocharis Wetland – Good Condition	Endangered Ecological Community	Not Listed		1.67
Removal of VZ9 PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest – Moderate Condition	Endangered Ecological Community	Endangered Ecological Community		0.04
Removal of habitat for Black-necked Stork (*Ephippiorhynchus asiaticus*)	Endangered	Not Listed		Ecosystem credit*
Removal of habitat for White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Vulnerable	Not Listed		Ecosystem credit*
Removal of habitat for Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)	Vulnerable	Not Listed		Ecosystem credit*
Removal of habitat for Little Bent-winged Bat (*Miniopterus australis*)	Vulnerable	Not Listed		Ecosystem credit*
Removal of habitat for Large Bent-winged Bat (*Miniopterus orianae oceanensis*)	Vulnerable	Not Listed		Ecosystem credit*
Removal of habitat for Eastern Grass Owl (*Tyto longimembris*)	Vulnerable	Not Listed		Ecosystem credit*
Removal of potential habitat for Smale Pale Grass-Lilly (*Caesia parviflora var. minor*)	Endangered	Not Listed		0.73
Removal of habitat for Wallum Froglet (*Crinia tinnula*)	Vulnerable	Not Listed		4.2
Removal of potential habitat for Leafless Tongue Orchid (*Cryptostylis hutneriana*)	Vulnerable	Vulnerable		2.32
Removal of potential habitat for Spider Orchid (*Dendrobium melaleucaphilum*)	Endangered	Not Listed		0.73
Removal of mapped important habitat for Swift Parrot (*Lathamus discolor*)	Endangered	Critically Endangered		1.07
Removal of potential habitat for Green-thighed Frog (*Litoria brevipalmata*)	Vulnerable	Not Listed		0.76
Removal of potential habitat for Slender Marsdenia (*Marsdenia longiloba*)	Endangered	Vulnerable		1.11
Removal of habitat for Southern Myotis (*Myotis Macropus)*	Vulnerable	Not Listed		11.26

Direct impact	BC Act status	EPBC Act status	Project phase	Extent (ha)
Removal of foraging habitat for Giant Dragonfly (*Petalura gigantea*)	Endangered	Not Listed		14.32
Removal of habitat for Squirrel Glider (*Petaurus norfolcensis*)	Vulnerable	Not Listed		1.87
Removal of habitat for Koala (*Phascolarctos cinereus*)	Endangered	Endangered		1.87
Removal of potential habitat for Eastern Cave Bat (*Vespadelus troughtoni*)	Vulnerable	Not Listed		22.61
Removal of habitat features including 4 hollow-bearing trees containing 7 hollows	-	-		-

**Ecosystem credit species have been included in this table for clarity but have an extent that is specific to the vegetation zones that they are associated with, see Table 21 in Technical Report 5 – Biodiversity Development Assessment Report.*

There will be a direct impact to hollow bearing trees, specifically four trees containing seven hollows between them as follows:

– HBT 3 and HBT 4 are both *Eucalyptus teriticornis* containing one small (5-10 cm) hollow each. These HBTs are both located near the intersection of John Oxley Drive and Major Innes Road.
– HBT 7 is a *Eucalyptus teriticornis* containing two small (5-10 cm) hollows and two medium (10-20 cm) hollows. This HBT is located off John Oxley Drive, near Lake Innes Village.
– HBT 9 is a *Eucalyptus pilularis* containing one medium (10-20 cm) hollow. This HBT is located near the access road to the WWTP.

These impacts will be permanent and will occur from the outset of the development.

11.3.3 Prescribed impacts

Assessment of prescribed biodiversity impacts as detailed in Technical Report 5 – Biodiversity Development Assessment Report and are summarised in Table 11-7.

11.3.4 Indirect impacts

Potential indirect impacts from the project as detailed in Technical Report 5 – Biodiversity Development Assessment Report and are summarised in Table 11-8.

11.3.5 Assessment of significance

An assessment of the impacts of the project on MNES, against heads of consideration outlined in Commonwealth of Australia (2013) was prepared. MNES relevant to the project are summarised in Table 11-6 (refer to Technical Report 5 – Biodiversity Development Assessment Report for detailed assessment).

Table 11-6 Assessment of the project against the MNES and the EPBC Act

MNES	Project specifics / potential impact
Threatened species	18 flora species and 63 fauna species listed under the EPBC Act have been recorded or are predicted to occur in the Assessment Area. The following species were identified during works undertaken for this project but are not considered to be at risk for this project. – Scented Acronychia (*Acronychia littoralis*) – Biconvex Paperbark (*Melaleuca biconvexa*) – Scrub Turpentine (*Rhodamnia rubescens*) – Native Guava (*Rhodomyrtus psidioides*)

MNES	Project specifics / potential impact
	Previous reports noted the presence of Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) around the sand plain (HWR Ecological, 2005). The TBDC notes that this species was allocated to 'ecosystem credit' species due to its 'boom and bust' life cycle. Surveys within the Project area did not detect Eastern Chestnut Mouse but did identify the similar Swamp rat (*Rattus lutreolus*). The following species were assumed present within the Project area and are at risk of impact: – Swift Parrot (*Lathamus discolor*) – Leafless Tongue Orchid (*Cryptostylis hunteriana*) – Slender Marsdenia (*Marsdenia longiloba*) – Koala (*Phascolarctos cinereus*) Assessments against the Significant Impact Criteria (Commonwealth of Australia 2013) have been prepared for these species and concluded that a significant impact was not likely to result from the project, provided appropriate mitigation measures are adopted as outlined in Table 11-9. Based on the level of disturbance and the nature of the project, the habitat present within the project area does not constitute limiting habitat for the above threatened species.
Threatened ecological communities	Based on meeting the minimum condition thresholds (High Condition Class A), one endangered ecological community, Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, was recorded within the project area. With the with the proposed mitigation measures and adaptive management strategies to be adopted, it is not anticipated that the proposed action will significantly impact Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland.
Migratory species	57 migratory species have been recorded or are predicted to occur in the locality. Surveys of the project area did not detect any of these species. Many of the species identified in the Protected Matters search would only have marginal foraging habitat within the project area, such as Wandering Albatross (*Diomedea exulans*) and Far Eastern Curlew (*Numenius madagascariensis*). As such, these species are unlikely to be impacted by the project.
Wetlands of international importance (Ramsar sites)	During the field investigation, wetlands were observed within the project area. The closest Ramsar site is within the Mid-Coast local government area approximately 115 km south of the project area. Due to the location of the project area, there will be no impact on Wetlands of international importance (Ramsar).

Table 11-7 Assessment of prescribed impacts

Prescribed impact	Nature of Impact	Extent of Impact	Duration of Impact	Consequence of Impact
Human-made structures or non-native vegetation	A human made structure located to the west of the WWTP along the border of the project area is observed as being a potential habitat for bats, though none were identified during surveys. The non-native and degraded vegetation within the sand plain currently provides habitat for some threatened species, in particular the Eastern Grass Owl, White-bellied Sea-eagle, Giant Dragonfly, and likely the microbats including Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis and Eastern Cave Bat. This habitat does prove suitable for a variety of insect species, which is a beneficial food source for microbats and other native species.	The human made structure is a dilapidated house with small wooden shed. This structure may require removal. The project will impact 17.57 ha of exotic dominated vegetation, of which 10.05 ha occur within the sand plain.	Duration for the WWTP and access roads would be from clearing into the future. The SRM and RWM will be re-vegetated with species from PCTs within the locality.	Displacement of species that rely on structures for habitat and non-native vegetation for habitat and foraging grounds. This will likely reduce the availability of foraging habitat for threatened species that utilise the exotic vegetation, and may impact on the breeding habitat of a population of Eastern Grass Owl.
Habitat connectivity	The project has endeavoured to reduce impacts to native vegetation and will generally be placed along existing lines of fragmentation. This may cause a small increase in fragmentation and minor reduction in habitat connectivity but many of the species impacted by this, such as Squirrel Glider and Koala, are relatively mobile and are unlikely to be significantly impacted by the project. The WWTP will occupy a large portion of the sand plains exotic dominated grassland. While selecting this location has reduced the impacts on habitat connectivity to many other native species, it may impact on the habitat connectivity of the Eastern Grass Owl and Giant Dragonfly. Wetland connectivity is not anticipated to be affected and it is anticipated that threatened species such as the Wallum Froglet will continue utilising all parts of the wetland.	Impacts to canopy will occur in the emergency access road and along the SRM and RWM. The position of the WWTP may impact grassland connectivity. The connectivity is not severed, but reduced as species such as the Eastern Grass Owl and Giant Dragonfly can still move around the WWTP to the other vegetated areas.	WWTP will be a permanent feature. Where possible, SRM and RWM will be restored with shallow rooting native species.	There may be a small increase in the gaps of canopy within the SRM and RWM, the project will implement measures to reduce impacts as outlined described in Table 11-9. Revegetation using shallow rooting plants will occur along the SRM and RWM, therefore impacts will be reduced. The WWTP will reduce the connectivity present in the sand plain for the Eastern Grass Owl and Giant Dragonfly. However, these are both mobile species that will be likely to not experience a break in habitat connectivity.

Prescribed impact	Nature of Impact	Extent of Impact	Duration of Impact	Consequence of Impact
Water bodies, water quality and hydrological processes	The project will produce treated effluent that will enter Kooloonbung Creek, this effluent will be managed and controlled where possible to not negatively impact on Kooloonbung Creek.	Effluent in Kooloonbung Creek is anticipated to mix with existing effluent discharge and dilute into the creek.	The effluent release to Kooloonbung Creek will be ongoing. The emergency discharge will occur during peak events only.	Effluent in Kooloonbung Creek is anticipated to have a minimal impact on the creek, water quality and hydrological processes. (Refer to Chapter 7 – Water quality and hydrology).
	The WWTP will have an emergency overflow that will release partially treated effluent during peak periods of flow. These periods will likely correspond to peaks in rain and flooding that will dilute any released effluent. The emergency discharge will release to an existing swale where the flow can be monitored. The release will temporarily increase total nitrogen, phosphorus and Enterococci. This has potential to influence habitat for Freshwater Wetlands on Coastal Floodplains TEC as well has habitat for the Wallum Froglet, Southern Myotis, Giant Dragonfly and Black-necked Stork.	The emergency discharge will be localised to a swale immediately adjacent to the WWTP. The emergency discharge will flow through the swale to Wetland A and into Partridge Creek where it is expected to be flushed very quickly.	The emergency discharge will occur during peak events only. Modelling has indicated that impacts to Partridge Creek will cease very quickly after the overflow event.	The emergency discharge will only be discharging for a short period of time that corresponds with major rainfall and likely flooding events. It is likely that there will be significant flushing involved in this event though it is acknowledged that there are uncertainties associated with this. It is expected to be a temporary event. Due to the high flows at the time of overflow, it is assumed that there will be no impact on lands that are identified under the BioBanking Agreements (BA487) and the federal EPBC approval (EPBC2016/7842).
	There will be a small area of wetland habitat impacted by the project, including 1.67ha of PCT3967 in good condition and 0.04ha of PCT4006 in moderate condition. Both of these communities are associated with TECs and are likely GDEs. As the impact to PCT3967 in good condition will occur in the upper section of the path of water flow, there will be an impact to downstream waterways. However, these impacts can be reduced through appropriate management of sedimentation and erosion control measures (refer to Chapter 15 – Soils and contamination).	Impacts to PCT 3967 in good condition and PCT4006 in moderate condition would be restricted to the project area.	Impacts to PCT3967 in good condition and PCT4006 in moderate condition will occur during construction and, in some areas, may be revegetated following the construction process.	Removal of PCT3967 in good condition and PCT4006 in moderate condition may make a minor alteration to hydrological processes in the surrounding wetlands, particularly wetland A.

Prescribed impact	Nature of Impact	Extent of Impact	Duration of Impact	Consequence of Impact
	There is the potential for a prescribed impact to groundwater associated with the construction of the emergency storage pond, which could intercept groundwater (refer Figure 60 in Technical Report 5 – Biodiversity Development Assessment Report)	Technical Report 1A – Water Resources and Flooding Assessment, indicates that the interception of groundwater would generate an inflow rate of 0.11 cubic meters per day and have a drawdown of 48.8 m radius. Our mapping indicates that this may intercept a small (0.02 ha) area of PCT3967 associated with Freshwater Wetlands on Coastal Floodplains TEC.	The impact is anticipated to be temporary, only lasting during construction. Once construction of the emergency storage pond has completed, it is expected that groundwater drawdown will be negligible.	Temporary reduction in water availability to a small section of Freshwater Wetlands on Coastal Floodplains TEC. The vegetation will be monitored as part of the VMP such that it can be restored following the impacts if needed. As restoration will be performed in the event that an impact is realised, credits are not considered necessary for this prescribed impact.
	There will be minor interceptions of groundwater through the construction of trenches for the SRM & RWM.	Dewatering of the trench would result in localised groundwater drawdown.	For the duration of the trenching activity.	Technical Report 1A – Water Resources and Flooding Assessment has recommended that a Trigger Action Response Plan approach be implemented to minimise and respond to any groundwater inception such that impacts to existing groundwater are minimised.
	Accidental runoff contamination originating from construction within the project area can be avoided, minimised and mitigated by implementing sedimentation and erosion control measures (refer to Chapter 15 – Soils and contamination).	Accidental runoff will be managed throughout the project to ensure it does not occur any further than the project area boundary.	Accidental runoff may occur during the construction period.	Runoff will be minimised during the project and restricted to the project area.

Table 11-8 Assessment of indirect impacts

Indirect impact	Impacted entities	Project Phase / Timing of Impact	Assessment / likelihood of occurrence
Inadvertent impacts on adjacent habitat or vegetation.	Vegetation immediately surrounding the Project area.	During removal of vegetation and construction.	The project will be performed next to native vegetation, including areas that contain TECs, habitat for threatened species, and are identified conservation areas. Consideration of these biodiversity values has been made throughout the design process. The project is unlikely to result in inadvertent impacts on adjacent retained habitat or vegetation. Mitigation measures implemented during the construction of the project will ensure no encroachment to adjacent vegetation and habitat by construction workers.

Indirect impact	Impacted entities	Project Phase / Timing of Impact	Assessment / likelihood of occurrence
Reduced viability of adjacent habitat due to edge effects.	Vegetation immediately surrounding the Project area.	From the time that vegetation is removed onwards, until the pipeline is removed, and remediation measures are established.	The project will be performed next to native vegetation, including areas that contain TECs, habitat for threatened species, and are identified conservation areas. Consideration of these biodiversity values has been made throughout the design process. The project is not anticipated to result in a significant increase in edge effects impacting upon the retained vegetation. This is because the locations chosen for the project are generally in already disturbed areas. The WWTP will be restricted to disturbed exotic dominated areas. The SRM and RWM will be generally placed within exotic dominated areas, as well as focusing along existing paths through native vegetation areas. The emergency access road will pass through an area of vegetation that has been less impacted, but it is a relatively small area. Though there will be an increase in edge effects in some areas, these are small in comparison to the size of the project.
Reduced viability of adjacent habitat due to noise and dust.	Flora and fauna immediately surrounding the Project area.	During removal of vegetation and construction.	Mitigation measures outlined in Table 11-9 and standard construction environmental controls will ensure potential impacts are minimised.
Transport of weeds and pathogens from the project area to adjacent vegetation.	Flora and fauna immediately surrounding the Project area.	During removal of vegetation and construction.	The potential introduction and spread of weeds and pathogens will be managed through implementation of weed hygiene controls during the construction phase (see mitigation measures in Table 11-9).
Increased risk of starvation, exposure and loss of shade or shelter.	Fauna and shade adapted flora within the Project area.	From the time that vegetation is removed onwards.	In the vicinity of the WWTP, there is significant native vegetation in the surrounding landscape that has been secured in the long term through a conservation agreement.
Loss of breeding habitats.	Fauna within the Project area.	From the time that vegetation is removed onwards.	The project will impact on native trees, of which four contain hollows. This is a relatively small number for the size of the project, and other hollow-bearing trees will not be impacted by the project, remaining surrounding the Project area. The project will impact on terrestrial dry sclerophyll forest, forested wetlands, wetlands and exotic grasslands. Threatened fauna recorded within the Project area that are likely to utilise these environments as breeding environments include Wallum Froglet and Eastern Grass Owl. Surveys did not identify any burrows suitable for breeding by Giant Dragonfly. Mitigation measures outlined in Table 11-9 would ensure potential impacts outside the Project area are avoided, which will protect the substantial areas of suitable breeding habitat for Wallum Froglet in the surrounding conservation areas. It is likely that the area of suitable breeding habitat for the Eastern Grass Owl will be reduced.

Indirect impact	Impacted entities	Project Phase / Timing of Impact	Assessment / likelihood of occurrence
Inhibition of nitrogen fixation and increased soil salinity.	Vegetation within and immediately surrounding the Project area.	From the time that vegetation is removed onwards.	Nitrogen fixation can occur through free living microbiota as well as in mutual relationship between plants and bacteria. The typical flora species that are associated with nitrogen fixation are members of the Fabaceae family, such as members of the *Acacia* genus. Some species of grass have also been found to have relationships with nitrogen fixing bacteria. There are very few members of the Fabaceae family within the Project area across the project area. Though grasses occur across the Project area, with many exotic species occurring, particularly in the vicinity of the WWTP, it is unclear how many of these species would contribute to supporting nitrogen fixation. It is also unlikely that the removal of these individuals these will lead to a significant reduction in nitrogen fixation in a way that would impact the surrounding landscape as the sand would not support the holding of nitrogen in the soil. The trenching activity may disturb nitrogen fixation, but the restoration of the soil and revegetation following the trenching would likely restore that activity.
Fertiliser drift	-	-	Fertiliser application may be made during the revegetation process but this would be targeted and applied by professional regenerators and landscapers.
Rubbish dumping	General environment	All phases	The construction contractor (refer to Chapter 16 - Waste) will clearly set out waste management areas and procedures during the proposed works.
Wood collection	-	-	There will be no retained woody vegetation within the Project area.
Removal and disturbance of rocks, including bush rock	-	-	No bush rocks were identified during surveys.
Increase in predatory species populations	Native flora and fauna	-	Waste management measures outlined in Table 11-9 will mitigate the potential increase in predator species populations.
Increase in pest animal populations	-	-	Pest animals are currently being controlled within the sand plain, particularly deer. The project is unlikely to result in an increase in pest animals.
Change in fire regimes	-	-	The project will not significantly impact on the bushfire rating within the area.
Disturbance to specialist breeding and foraging habitat.	-	-	It is likely that the Eastern Grass Owl is using the sand plain as a foraging and possibly breeding habitat. Giant Dragonfly was identified foraging within the Project area. The impact of this project on vegetation types does not completely remove any form of habitat from the surrounding landscape. There will, therefore, be other opportunities for species to forage and breed in the surrounding landscape, though they may not be as ideal as the sand plain currently is for these species. Assuming that the mitigation measures outlined in Table 11-9 are implemented, indirect impacts on specialist breeding and foraging habitat by the project will be reduced.

Indirect impact	Impacted entities	Project Phase / Timing of Impact	Assessment / likelihood of occurrence
Fragmentation of movement corridors and riparian zone.	Flora and fauna	From the time that vegetation is removed onwards, until the pipeline is removed, and remediation measure are established.	Construction of the project will involve the use of a 10 m corridor in native vegetation areas to construct the SRM and RWM. The SRM and RWM have generally been placed in areas where there is already fragmentation of vegetation, to reduce the impacts of fragmentation. The emergency access road will cause a small amount of fragmentation that may impact less mobile arboreal species, however there will not be fences along the roads, so access across these areas will still be possible. The WWTP has been placed within the sand plain such that it impacts on less native vegetation, including the surrounding TECs and forested areas. While the WWTP will reduce connectivity within the sand plain, the Eastern Grass Owl is a highly mobile species that will likely still be able to navigate the available habitat. Additionally, mitigation measures outlined in Section 11.5, outline revegetation is to occur where areas of TEC occur within the project area. It is noted that impediments to movement such as minor roads / tracks and managed exotic grassland, currently exist within the project area.
Contamination to adjacent waterways	Vegetation immediately surrounding the project area.	During removal of vegetation and construction.	The project will produce treated effluent that will enter Kooloonbung Creek, this effluent will be managed and controlled where possible to not negatively impact on Kooloonbung Creek. The WWTP will have an emergency overflow that will release partially treated effluent during peak periods of flow. These periods will likely correspond to peaks in rain and flooding that will dilute any released effluent. The emergency discharge will release to an existing swale where the flow can be monitored. Accidental runoff contamination originating from construction within the project area can be avoided, minimised and mitigated by implementing sedimentation and erosion control measures (refer to Chapter 15 – Soils and Contamination).
Land use pattern change disrupting biodiversity	Vegetation within and immediately surrounding the project area	During and after removal of vegetation and construction	Repurposing of land through clearing or landscape changes can deteriorate biodiversity value by removal or runoff effects. Mitigation measures outlined in Table 11-9 highlight protocols to further reduce the impacts on biodiversity. A Vegetation Management Plan will be in use to support an increase in ecological values in designated zones to reduce the permanent change in landscape for the WWTP and SRM and RWM.

11.4 Potential impacts – operation

During operation, the project would be majority underground or within the established WWTP footprint. For this reason, the majority of potential terrestrial biodiversity impacts would be occurring during construction. During ongoing inspection and maintenance activities there may be the potential for impacts to eventuate without adequate management. Appropriate mitigation and management measures (refer to Table 11-9), including an OEMP, would be implemented during the operation of the project to ensure unnecessary impacts do not eventuate.

11.4.1 Direct impact

Potential direct impacts on native vegetation and habitats of threatened species during operation would occur through ongoing vegetation management to ensure vegetation clearance requirements and APZs are maintained (refer to Section 11.3).

11.4.2 Indirect impacts

Some indirect impacts associated with construction (refer to Table 11-8) of the project may also occurring during operation, including:

– Inadvertent impacts on adjacent habitat or vegetation
– Transport of weeds and pathogens from the site to adjacent vegetation
– Inhibition of nitrogen fixation and increased soil salinity
– Reduced viability of adjacent habitat due to edge effects
– Reduced viability of adjacent habitat due to noise and dust
– Fertiliser drift
– Rubbish dumping
– Removal and disturbance of rocks, including bush rock
– Increase in predatory species populations
– Increase in pest animal populations
– Contamination to adjacent waterways through effluent discharges

These indirect impacts are summarised in Table 11-8, however, given the limited scale of work associated with the operation of the project compared to construction, the extent of these impacts would typically be less.

11.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise socio-economic impacts of the project are detailed Table 11-9.

Table 11-9 Biodiversity impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
B1	Biodiversity offsets	A total of 105 ecosystems credits and 895 species credits are required for the project in accordance with the Biodiversity Offset Scheme. Full details of the required ecosystem and species credits for the project are summarised in Table 37 and Table 38 in Technical Report 5 – Biodiversity Development Assessment Report.	Council	Pre-construction
B2	General	All workers are to be provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.	Construction contractor	Prior to clearing / construction works

ID	Impact	Environmental safeguard	Responsibility	Timing
B3		A Vegetation Management Plan (VMP) will be required for a duration of five years in order to guide the restoration or rehabilitation of the SRM and RWM and construction compounds. – All areas of the SRM and RWM shall be revegetated with shallow rooted species of the PCT mapped in the area by this BDAR. Where exotic vegetation is indicated in this BDAR, the restoration may be with suitable native species of a local PCT or suitable exotic species that are not listed on the High Threat Weed list ((NSW DPE, 2022) as per Dorrough, Oliver and Wall (2018)). – If areas of nearby conservation lands are impacted, they shall be added to the VMP. The VMP will be required for a duration of five years to guide the restoration and rehabilitation of the project. – The VMP must take into consideration the key monitoring tasks outlined in Table 34 in Technical Report 5 – Biodiversity Development Assessment Report.	Qualified ecologist or suitable council representative	Prior to clearing/ construction works/ up to and including five years beyond construction completion.
B5		The contact details for the nearest Koala Hospital shall be kept at each site office during construction.	Construction contractor	Prior to clearing/ construction works and during construction works.
B4	Vegetation clearing	Limit disturbance of vegetation to the minimum necessary to undertake the project. Where possible in the implementation stage, undertake further refinement of the infrastructure such as the SRM and RWM to avoid impacts to biodiversity values including native vegetation, particularly Koala feed trees of the species Forest Red Gum (*Eucalyptus tereticornis*), Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) Tallowwood (*E. microcorys*) and Bastard Mahogany (*E. paterntinervis (*a hybrid of *E. robusta and E. tereticornis*)).	Prior to works commencing	Construction contractor and Project Ecologist
B5		Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Prior to works commencing	Construction contractor and Project Ecologist
B6		Signage should be placed at the entrance to sites warning of the potential of Koala's to be present. The signs should contain details of the nearest Koala Hospital to facilitate prompt reporting of sick or injured Koalas.	Prior to works commencing	Construction contractor and Project Ecologist
B7		Native vegetation to be retained on site is to be protected in accordance with Development Control Plan 2014 Guidelines – Tree Preservation and Native Vegetation Management Guidelines (Section 6) and the Australian B9Standard AS4970-2009 – Protection of Trees on Development Sites.	Construction contractor and Project Ecologist	Prior to works commencing.
B8		Stockpiles of soil, vegetation etc should be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Construction contractor	Prior to clearing/ construction works.
B9		Sedimentation and erosion control measures including silt fencing, sediment traps, etc. to prevent sediment-laden stormwater exiting the construction areas and to prevent scouring and erosion of land beyond the development footprint. All erosion and sediment control measures are to be constructed and installed in accordance with relevant guidelines, are to be regularly maintained for the duration of the construction period and are to be carefully removed at completion of works.	Construction contractor	Prior to clearing/ construction works.

ID	Impact	Environmental safeguard	Responsibility	Timing
		Sediment and erosion control measures should follow recommendations of The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). Dust suppression measures to ensure dust deposition beyond the construction area is minimised.		
B10		In line with the Area 13 Koala KPOM (refer to Figure 72 in Technical Report 5 – Biodiversity Development Assessment Report), where koala food trees are removed, compensation should be provided by way of a minimum of four replacement trees (that are also preferred koala food trees) for every preferred koala food tree that is to be removed, such trees to be planted within a 100m radius of those to be removed, and shall comply with Part 3(G)(iv) of the plan. Pre and post clearing reports are to be submitted to Council by the project ecologist for any significant vegetation removal.	Construction contractor and qualified ecologist	During construction works
B11	Introduction of weeds and pathogens	Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor.	Construction contractor	Prior to clearing/ construction works/ project lifespan
B12		The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings. All priority weeds identified on the site will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2016* and Council's relevant Weed Control Manuals. Due to the sensitive nature of the lands to be impacted (surrounding wetland TECs and the possible contamination in the water treatment facilities by herbicide chemicals), weed control is not to involve the use of herbicides. Ongoing weed management shall be performed for at least five years following the project. All priority and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. Disposal must be documented, and evidence of appropriate disposal must be kept. Waste management areas and processes are to be clearly identified.	Construction contractor	Prior to clearing/ construction works
B13		All machinery entering the site must be appropriately washed down and disinfected prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*), Myrtle Rust (*Austropuccinia psidii*) and Amphbian Chytrid Fungus (*Batrachochytrium dendrobatidis*) in accordance with the NSW hygiene guidelines for Phytophthora, Myrtle Rust and Amphibian Chytrid Fungus (NSW DPIE, 2020) for hygiene control.	Construction contractor	Prior to any plant or machinery being brought onto the site
B14		Incorporate control measures in the design of the project to limit the spread of weed propagules downstream of subject land. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds.	Construction contractor	Prior to clearing/ throughout construction works

ID	Impact	Environmental safeguard	Responsibility	Timing
B15		Construction activities will be managed through standard practices to avoid further spread of weeds and pests such as ensuring equipment and clothing are free of soil and vegetative matter prior to being brought to site, establishing vehicle cleaning stations with high pressure water hoses and brushes to remove soils, weeds and seeds; conducting regular vehicle inspections and restricting vehicle access zones and designated entry; ensure erosion controls are in place to minimise the spread of weed from run off (NSW Transport 2019).	Construction contractor	Prior to clearing/ throughout construction works
B16		Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor.	Construction contractor	Prior to clearing/ construction works/project lifespan
B17	Removal of fauna habitat	Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECC, 2008b).	Construction contractor	Prior to clearing throughout construction works
B18		Staged vegetation clearing shall be performed, commencing with the exotic dominated vegetation to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury. Where higher condition vegetation is to be cleared, this shall be performed such that fauna species are directed away from threats such as roads and developed areas. Staged clearing should avoid creating an 'island' of habitat that is isolated from adjoining habitat.	Construction contractor	During clearing phase
B19		Pre-clearance fauna surveys, undertaken in accordance with the following procedure: – Land shall be broken into small units to stage the clearing activities such that a pre-clearing survey can clear the area with minimal time for mobile fauna (such as the Eastern Grass Owl, Giant Dragonfly and Swift Parrot) to re-establish within an area. The pre-clearing survey should be performed with the intention of flushing all fauna from the unit of land to be cleared within the Subject Land. Habitat features such as logs should also be checked. – Pre-clearing surveys shall ensure that habitat features, such as hollow-bearing trees are clearly identified.	Qualified ecologist	Prior to and during clearing works
B20		Clearing of hollow-bearing trees procedure. If possible, tree hollows should be inspected directly prior to felling. Before felling, the HBTs should be tapped along the trunk by heavy machinery to substantially shake the tree, with the intention of causing fauna to exit. Shaking should stop if fauna is observed to be leaving the tree. Where safe to do so, take the HBT down in stages, beginning with no-hollow bearing branches before moving towards the hollow. Where safe to do so, hollows should be cut around such that they remain intact and can be gently lowered to the ground. Hollows should be thoroughly checked following felling to ensure no fauna have become trapped or injured during operations.	Qualified ecologist and construction contractor	Prior to and during clearing works
B21		Trees should be felled into an already disturbed area to avoid damaging adjacent vegetation.	Qualified ecologist and construction contractor	During clearing works

ID	Impact	Environmental safeguard	Responsibility	Timing
B22		Consistent with the Area13 KPoM, the clearing of native vegetation and/or earthworks or for any other purpose must be temporarily suspended within a range of 25 m from any tree that is occupied by a Koala and must not resume until the koala has moved from the tree of its own volition. If a Koala does not voluntarily move on, it is to be removed by Port Macquarie Koala Hospital staff.	Qualified ecologist	Prior to and during clearing works
B23		Where appropriate, native vegetation cleared from the Subject Land should be moved into the retained vegetation as habitat or mulched for re-use on the site, to stabilise bare ground. Hollows may be reused elsewhere on site if suitable.	Construction contractor	During clearing phase
B24		A suitably qualified and appropriately licenced ecologist is to be present during clearing of all native vegetation to ensure felling of trees is limited to the least extent and carried out in an appropriate manner, and that any fauna present can be rescued and relocated. Appropriate fauna 'capture and release' techniques will be implemented.	Qualified ecologist	During clearing phase
B25		A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. FAWNA or Koala Conservation Hospital Port Macquarie) should be made aware of operations in case any injured fauna is found.	Qualified ecologist	During clearing phase
B26		Security lighting within the construction site is to be minimised and where required, is to be oriented such that light spill beyond the Subject Land and into patches of retained vegetation is minimised.	Construction contractor	During clearing phase
B27		A reduced speed limit should be implemented in the development area, accompanied by appropriate signage indicating the speed limit within the Subject Land. The speed limit determined should be appropriate for the area and potential risk to Koalas from vehicle strike.	Construction contractor	Prior to clearing/ construction works/up to and project lifespan
B28		All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the *NSW Prevention of Cruelty to Animals Act 1979*, including: – Australian code of practice for the care of animals for scientific purposes (NHMRC, 2013). – Code of practice for the welfare of wildlife during rehabilitation (Victoria, 2001). – Animal ethics considerations and protocols outlined in this document.	Qualified ecologist	During clearing phase

ID	Impact	Environmental safeguard	Responsibility	Timing
		If the project ecologist considers an animal is at risk of injury or undue stress, it is to be gently directed into secure adjoining habitat. Where deemed necessary by the project ecologist, the animal may be required to be captured and released. Capture and release operations will proceed via the following protocols: – All construction activities that are considered by the project ecologist be likely to increase the risk of injury, mortality or stress to the animal will be halted until the animal has been removed, which will be enforced with the co-operation of the Contractor. Construction activities that do not contribute to the risk of injury, mortality or stress to the animal can continue (as determined by the project ecologist). – Only qualified ecologists or wildlife carers are authorised to handle animals. – Animals will be captured (if required) by the project ecologist using a safe and ethical technique, as is appropriate for the particular species. Native animals that are unable to depart of their own accord will be captured and held in a receptacle appropriate for that species until release. All captive-held animals will be provided with food, water and warmth as is appropriate for the species. Each receptacle will only hold one animal at a time and will be cleaned and disinfected between use to avoid the spread of disease. Any fauna relocated from trees, shrubs or other areas would be recorded.		
B29		The construction contractor is to contact the Project ecologist for advice if any unexpected fauna is found during the construction period (i.e. following clearing of native vegetation when the Project ecologist is no longer on site).	Construction contractor	During clearing phase
B30		In line with the Port Macquarie Airport Koala Plan of Management, any branches removed from the following species should be offered to a Koala Hospital or other Koala preservation groups: – Tallowwood (*Eucalyptus microcorys*) – Grey Gum (*Eucalyptus propinqua*) – Forest Red Gum (*Eucalyptus tereticornis*) – Swamp Mahogany (*Eucalyptus robusta*) – The hybrid of Forest Red Gum and Swamp Mahogany, referred to as *Eucalyptus patentinervis*	Construction contractor	During clearing and construction phases
B31	Water quality and aquatic habitats	Erosion and sediment control plans should be prepared in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase.	Construction contractor	Prior to construction commencing
B32		Soil stockpiles are to be placed away from, and ideally downslope of, receiving water bodies and drainage lines.	Construction contractor	During clearing phase
B33		Erosion and sediment control controls would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality.	Construction contractor	Weekly during construction phase or after any significant rainfall event
B34		Stabilised surfaces should be reinstated as quickly as practicable after construction.	Construction contractor	Immediately following clearing

ID	Impact	Environmental safeguard	Responsibility	Timing
B35		Appropriate speeds are to be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike.	Construction contractor	During construction
B36		Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value.	Construction contractor	Prior to clearing / construction works
B37		All stockpiled material should be stored in bunded areas and, where practicable, kept away from waterways to avoid sediment or contaminants entering the waterway.	Construction contractor	During construction
B38		Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.	Construction contractor	During construction
B39	Conservation area	If an impact occurs to a conversation area, then the VMP shall be revised to ensure the conservation area is restored. Regulators from the Biodiversity Conservation Trust should be notified.	Construction contractor and project ecologist	During construction and operation

12. Aquatic ecology

This chapter provides a detailed summary of the assessment of aquatic ecology potential impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures. The full assessment is provided in Technical Report 6 – Aquatic Ecology Assessment.

12.1 Assessment approach

12.1.1 Legislation and policy context

The plans, policies and guidelines that were considered for the Aquatic Ecology Assessment (AEA) include:

– *Environmental Planning and Assessment Act 1979.*
– *Environmental Planning and Assessment Regulation 2000.*
– *Environmental Protection and Biodiversity Conservation Act 1999* – provides protection for MNES including listed threatened species and ecological communities, listed migratory species and wetlands of international importance.
– *Biodiversity Conservation Act 2016* – establishes a framework for assessment and offsetting of biodiversity impacts as well as investment in biodiversity conservation. The BC Act established the Biodiversity Offsets Scheme (BOS) and BAM which have informed the preparation of Technical Report 5 – Biodiversity Development Assessment Report.
– *Fisheries Management Act 1994* – contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, threatened species, populations, and ecological communities. The potential impact of the project on KFH and threatened species, populations and ecological communities listed under the FM Act, is provided in Section 12.3.1.
– *Coastal Management Act 2016.*
– *State Environmental Planning Policy (Resilience and Hazards) 2021.*
– State Environmental Planning Policy (Biodiversity and Conservation) 2021.
– *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull 2013).
– Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DCCEEW 2013).

12.1.2 Methodology

Study area

The study area for the purposes of the AEA comprises the aquatic habitats that traverse, are within or will directly receive proposed discharges as a result of the project, which include:

– Fernbank Creek
– Partridge Creek
– Kooloonbung Creek
– Hastings River

Key tasks

The following key tasks were undertaken as part of the AEA:

– In order to provide a context for the project, records of aquatic ecology from within 10 kilometres (the 'locality') were collated from the following databases and were reviewed:
  - Biodiversity Values Map and Threshold Tool (NSW DPE 2022a).

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST), for matters protected by the EPBC Act (NSW DCCEEW 2022).
- NSW Department of Primary Industries (DPI) Spatial Data Portal for NSW Fisheries Management Act 1994 listed threatened species, populations and communities (NSW DPI 2022).
- Biodiversity Values Map and Threshold Tool (NSW DPE 2022a).
- NSW DPI Fisheries Threatened species lists and distribution maps (NSW DPI 2024b).

– Review of various studies that included other aquatic ecological assessments within the project area, or receiving waters and previous works.

– Site investigations of the proposed TWWTP, including two proposed discharge points, associated infrastructure, pipelines, and surrounding aquatic habitats in the vicinity of the site.

– Verification of existing mapped Key Fish Habitat conducted by NSW DPI (2024a) *in-situ* at each site and throughout the wider study area. This included a categorisation of fisheries type and classification of the waterway class.

Field surveys

Field surveys (15-18th April 2024) including riparian assessment, fish assemblage surveys, in-situ water quality, infauna surveys, and general habitat observations were conducted at seven survey sites along Kooloonbung Creek and five sites along Partridge Creek. The specific site locations are detailed below in Table 12-1.

Table 12-1 Survey site locations (Data coordinate system GDA2020 MGA Zone 56)

Site	Coordinates	Tributary
Site K01	-31.439606, 152.904998	Located on a 4th order Strahler stream section of Kooloonbung Creek. This site is on the western side of the creek and is located within the Kooloonbung Creek Nature Reserve.
Site K02	-31.441503, 152.903481	Located on a 4th order Strahler stream section of Kooloonbung Creek. This site is on the western side of the creek, approximately 300 m upstream of Site 1 and is located within the Kooloonbung Creek Nature Reserve.
Site K03	-31.443388, 152.90143	Located on a 4th order Strahler stream section of Kooloonbung Creek. This site is on the western side of the creek, is approximately 330m upstream of Site 2 and is located within the Kooloonbung Creek Nature Reserve.
Site K04	-31.4447, 152.901172	Located on a 4th order Strahler stream section of Kooloonbung Creek. This site is located on the eastern side of the creek, is approximately 170m upstream of Site 3 and is located within the Kooloonbung Creek Nature Reserve.
Site K05	-31.448583, 152.900851	Located on a 4th order Strahler stream section of Kooloonbung Creek. This site is located between Ocean Drive and John Fraser Place.
Site K06	-31.450093, 152.902218	Located on a 3rd order Strahler stream section of Cattle Brook Creek, downstream of the current Port Macquarie WWTP.
Site K07	-31.44861, 152.896661	Located on a 3rd order Strahler stream section of Kooloonbung Creek. This site is located on the boundary of the Lake Innes Nature Reserve, approximately 150m off the walking trail.
Site K08	-31.420476, 152.847683	Unnamed 1st order Strahler stream that is an upper tributary of Fernbank and Partridge Creek.
Site P09	-31.42159, 152.850046	Located on a 4th order Strahler stream section of Partridge Creek. The site is located on private lands, approximately 150m upstream of a causeway.
Site P10	-31.423148, 152.850399	Located on a 4th order Strahler stream section of Partridge Creek.
Site P11	-31.422746, 152.848687	Unnamed 1st order Strahler stream that is an upper tributary of Partridge Creek. The area is located within a fenced compound (managed by PMHC) which contains a causeway.

Site	Coordinates	Tributary
Site P12	-31.425737, 152.845857	Unnamed 1st order Strahler stream that is an upper tributary of Partridge Creek. The site is located within a wetland region and is approximately 500 m upstream of Site 11.

Riparian assessment

A visual assessment of the riparian zone was undertaken at each site (see Table 12-1) along a 50 metre stretch of the creek bank. The riparian assessment is derived from the AUSRIVAS riparian protocols, including physical characteristics of the stream, site observations, substrate description, stream features, disturbances, riparian characteristics and composition and observable macrophytes (Parsons et. al., 2002).

Fish assemblage survey

Three baited fish traps were deployed overnight at each site (see Table 12-1) to survey the fish and aquatic invertebrate assemblages. This survey was conducted under H2O Consulting Group's Scientific Collection Permit (P20/0001-1.0) issued by NSW DPI. All fish traps were deployed for at least 20 hours before collection. The total count for each species was recorded *in-situ.*

In-situ water quality measurements

A YSI Pro Plus water quality meter was used to conduct three replicate water quality measurements at each site (see Table 12-1). Where possible, measurements were taken in areas of flow at a depth of approximately 0.5 metres. Descriptions of average stream width and depth were calculated using five measurements along the surveyed stream section.

Infauna sampling

Survey of macroinvertebrate assemblages were conducted in intertidal muds along the Mean Low Water Mark (MLWM) along Kooloonbung Creek using 100-millimetre diameter PVC cores to a depth of 200 millimetres into the sediment. Three cores were taken at each of the downstream Sites K01-K04 on Kooloonbung Creek, with samples retained in one litre sealed buckets filled with 100 percent ethanol to preserve infauna samples for laboratory identification. Samples were sieved using a 0.5-millimetre sieve, and sorted to the most discernible class, order or family of taxa.

12.2 Existing Environment

12.2.1 Aquatic habitat

Table 12-2 summarises the aquatic habitat and biota identified at each site assessed in Technical Report 6 – Aquatic Ecology Assessment.

Table 12-2 Aquatic habitat

Site reference	Description
Site 1 (K01)	– Comprises pool habitat, with a moderate amount of creek shading and gradually sloped intertidal mud banks. – Waterlogged and muddy area, with an observable laying of silt on the substrate. – Intertidal downstreams at this site were inhabited by extensive stands of fringing Grey Mangroves *(Avicennia marina*). – Accommodates native invertebrate species including juvenile Eastern King Prawns *(Melicertus plebejus)* and Cherabins (likely *Macrobrachium*). – Macroinvertebrates of four different phylum recorded at this site. These included Aschelminthes (*Nematoda*), Mollusca *(Bivalvia and Gastropoda),* Annelida *(Oligochaeta and Polychaeta*), Arthropoda *(Crustacea – Amphipoda and Isopoda).* – Highest salinity was recorded at this site, at of 0.76 ppt, reflecting oligohaline conditions. – Lowest dissolved oxygen percent saturation was recorded at this site at 45.3%.

Site reference	Description
	– Riparian zone consisted of continuous supporting a moderate to high density of vegetation along Kooloonbung Creek, with low disturbance.
Site 2 (K02)	– Comprises pool habitat, with a moderate amount of creek shading and gradually sloped intertidal muds. – Creek banks are muddy but defined, with a high amount of silt on the creek bed substrate. – Only one aquatic fauna species was recorded at this site, being the Eastern king prawn (juvenile). – Riparian zone consisted of continuous supporting a moderate to high density of vegetation along Kooloonbung Creek, with low disturbance.
Site 3 (K03)	– Comprises pool habitat, with a moderate amount of creek shading and gradually sloped intertidal muds. – Creek banks are muddy but defined with some moss evident along the banks and a moderate amount of silt laying on the creek bed substrate. – Intertidal and shallow subtidal areas at this site were typically inhabited by dense mats of Common Water Starwort (*Callitriche stagnalis*). – Macroinvertebrates of four different phylum recorded at this site. These included Aschelminthes (*Nematoda*), Mollusca *(Bivalvia and Gastropoda),* Annelida *(Oligochaeta and Polychaeta*), Arthropoda *(Crustacea – Amphipoda and Isopoda).* – Riparian zone consisted of continuous supporting a moderate to high density of vegetation along Kooloonbung Creek, with low disturbance.
Site 4 (K04)	– Comprises pool habitat, with a moderate amount of creek shading and gradually sloped intertidal muds. – Muddy creek banks, with a defined creek bank with high silt laying on the substrate. – Intertidal downstreams at this site were inhabited by extensive stands of fringing Grey Mangroves *(Avicennia marina*). – Intertidal and shallow subtidal areas at this site contained a small patch of Common Reeds *(Phragmites australis)*. – Macroinvertebrates of four different phylum recorded at this site. These included Aschelminthes (*Nematoda*), Mollusca *(Bivalvia and Gastropoda),* Annelida *(Oligochaeta and Polychaeta*), Arthropoda *(Crustacea – Amphipoda and Isopoda).* – Riparian zone consisted of semi-continuous supporting a moderate to high density of vegetation along Kooloonbung Creek, with low disturbance. – Taxa recorded at the site closest to the existing discharge point (this site) included polychaetes, crustacea and bivalves, with the lowest average abundance of bivalves of all sites.
Site 5 (K05)	– Comprises pool habitat, with a moderate amount of creek shading, and clearly defined gradually sloped banks. – Waterlogged and muddy area, with high silt laying on the substrate. – Intertidal downstreams at this site were inhabited by extensive stands of fringing Grey Mangroves *(Avicennia marina*). – Mangrove limit of Kooloonbung Creek identified at this site, however mangrove coverage at this site is considerably less than downstream sites. – Intertidal and shallow subtidal areas at this site were typically inhabited by dense mats of Common Water Starwort (*Callitriche stagnalis*). – Site was observed to support small assemblages of the floating White Waterlily *(Nymphaea alba).* – Riparian zone comprises a similar species composition to Site 3 and Site 4, however, the riparian zone was present in occasional clumps and trees great than 10 metres were dominated by *M. quinquenervia* and *Allocasuarina*, with low disturbance.
Site 6 (K06)	– Consists of 90% pool and 10% iffle habitat, with moderate tree shading and clearly defined steep banks. – Supports small assemblages of the floating White Waterlily (*Nymphaea alba*). – Highest total abundance of fauna recorded at this site, with 36 aquatic fauna individuals. – Riparian zone was observed to be highly disturbed compared to other sites, with the southern side of the creek bordering the fenced existing wastewater treatment plant, with infrastructure including a small bridge and discharge outlet cutting through the riparian zone in the southern section of the site. – The section of Cattlebrook Creek encompassing this site was classified as Type 1 – Highly sensitive KFH as a 3rd order stream containing native aquatic plants.

Site reference	Description
Site 7 (K07)	– Consists of pool habitat, with moderate tree shading and clearly defined banks. – Mangrove limit of Kooloonbung Creek identified at this site. – This site is the furthest upstream site on Kooloonbung Creek and was observed to support the greatest diversity of aquatic flora with a dense reed and rush community along the southern side of the creek, and other emergent and floating macrophyte species throughout the site. – Native invertebrate species associated with Kooloonbung Creek were found at this site and included juvenile Eastern King Prawns *(Melicertus plebejus)* and Cherabins (*likely Macrobrachium* sp.). – Two smaller areas along Kooloonbung Creek on the southern side of Lake Road near this site were observed to be classified as Type 1 – Highly sensitive KFH, as Coastal Wetlands mapped under the Resilience and Hazards SEPP. – Riparian zone was observed to be diverse, with semi-continuous vegetation and approximately 80% coverage by native vegetation species.
Site 8 (K08)	– The Site comprises pool habitat, with a low amount of creek shading and defined creek banks, with a high level of silt observed on the substrate. The survey was conducted at the start of the ebb tide and the creek had a low flow, with moderate water level. Water depth was approximately one m and stream width averaged three m. Site K08 is located on private property with cattle grazing.
Site 9 (P09)	– The Site comprises of 100 percent pool habitat, with moderate to high shading and soft, muddy gradually sloped banks. At the time of survey, the creek had no obvious flow and possessed a moderate water level. The creek bed was covered by a high amount of loose silt and coarse particulate material and snags. Water depth was approximately one m, and stream width averaged >50 m. Site P09 is located on private property with cattle grazing.
Site 10 (P10)	– The Site comprises of 100% pool habitat, with moderate to high shading and defined soft, muddy banks. At the time of survey, the creek had minimal obvious flow and possessed a moderate - high water level. Instream habitat at the creek supported a moderate amount of filamentous algae (10-35%) and an extensive coverage by macrophytes (65-90%). The creek bed was covered by a high amount of loose silt and coarse particulate material with snags also observed. The site had an average stream width of 40 m, with an average depth of approximately two m.
Site 11 (P11)	– The Site is comprised of 100% pool habitat, with moderate shading and soft, muddy banks. At the time of survey, the creek had low to no obvious flow and possessed a moderate - high water level, with a slight odour present. The Site was observed to be covered by a high amount of loose silt and coarse particulate material with large snags observed. Instream width varied 1 to 30 m, with water depth averaging 1m. The Site is located within a fenced compound which is utilised by the PMHC.
Site 12 (P12)	– The Site is comprised of 100% pool habitat, with minimal shading and no obvious banks. At the time of survey, water appeared brown coloured, with minimal obvious flow and possessed a moderate water level. The bed was covered by a high amount of loose silt and coarse particulate material. The site had an average stream width of approximately 50 m, with an average depth of one m.

12.2.2 Physical setting

The Hastings River is a large river system on the mid-north Coast of NSW extending approximately 100 kilometres inland. It has a tidal limit approximately 35 kilometres from the ocean and catchment area of 3,595 square kilometres. The lower reaches of the Hastings River flow through floodplains associated with the project and the aquatic environment includes the lower reaches of the southern shore of the Hastings River. A number of significant tributaries in the lower reaches intersect the project such as Kooloonbung Creek downstream, Patridge Creek, and Fernbank Creek upstream.

12.2.3 Threatened species

The Hastings River system to provide ecosystem services and functions, along with habitats that provide shelter, breeding grounds, and nurseries for a variety of fish. Threatened fish species with potential habitat in the Hastings River system includes the Endangered (FM Act) Southern Purple Spotted Gudgeon (*Mogurnda adspersa).* Various turtles, marine and freshwater are also known to occur in the lower Hastings River system. Marine turtles that are known to enter the lower Hasting River at times include the Endangered (FM Act; EPBC Act) and migratory (EPBC Act) Loggerhead Turtle (*Caretta caretta*) and Vulnerable (FM Act; EPBC Act) and migratory (EPBC Act) Green Turtle (*Chelonia mydas*). These species may use habitat in the lower Hastings River for shelter or refuge during transient movements up and down the coast or to forage, however, any nesting in NSW is confined to areas on the open coast.

Another rare species (although not considered threatened) that is known to occur in freshwater reaches of the lower Hastings River system is the Platypus (*Ornithorhynchus anatinus*). *Ornithorhynchus anatinus* is recorded throughout the Port Macquarie region, although the majority of sightings are generally confined to the upper Hastings River and its catchment.

Protected (although not threatened) freshwater turtles may occur in freshwater reaches of the lower Hastings River system include the protected Eastern Long-necked Turtle (*Chelodina longicollis*) and the Murray River Turtle (*Emydura macquarii*), which are widespread through coastal NSW.

12.2.4 Key fish habitat

Kooloonbung Creek

A large proportion of the study area encompassing the proposed discharge point along Kooloonbung Creek was classified as Type 1 – Highly sensitive KFH, as Coastal Wetlands mapped under the Resilience and Hazards SEPP. Additionally, the section of Cattlebrook Creek encompassing Site K06 was classified as Type 1 – Highly sensitive KFH as a 3rd order stream containing native aquatic plants. These areas were classified as Class 1 – Major KFH as a permanently flowing waterway.

Partridge Creek

A large proportion of the study area encompassing the proposed WWTP, overflow structure and pipelines at Partridge Creek was classified as Type 1 – Highly sensitive KFH as Coastal Wetlands mapped under the Resilience and Hazards SEPP. Additional sections of habitat along the western bank of Patridge Creek and the northwestern corner of the wetland were classified in-situ as Type 2 – Moderately sensitive KFH and Class 2 – Moderate KFH, whilst a small section between wetland areas along Partridge Creek was identified as Type 3 – Minimally sensitive KFH and Type 3 – Minimal KFH as ephemeral freshwater/wetland habitat.

Wider study area

The proposed pipeline route crosses some streams and areas of Coastal Wetlands. Refer to Figure 5 in Technical Report 6 – Aquatic Ecology Assessment for display of key fish habitat associated with the project.

12.2.5 Indicators of the environment

Water quality

The following physio-chemical water quality was reported:

– Average electrical conductivity was within ANZECC Guidelines for lowland rivers at Partridge Creek for sites K08, P09 and P11.
– Average electrical conductivity at Sites P10 and P12 were only slightly below the lower limit.
– Average dissolved oxygen percent saturations were below Guidelines (2000) for estuaries at all Kooloonbung Creek sites.
– Average dissolved oxygen at Partridge Creek sites were all below the Guidelines (2000) for lowland rivers.

– Sites K05 and K07 recorded average turbidity values within the Guidelines (2000) for estuaries, with turbidity below 10 NTU, whilst remaining Kooloonbung and Cattlebrook Creek Sites exceeded Guideline values.

Physical riparian assessment

Kooloonbung Creek

Along Kooloonbung Creek, the riparian zone at Sites K01 to K03 was continuous whilst Site K04 was semi-continuous, with riparian communities comprised of between 75 and 90 per cent native species. The riparian zone at Site K06 was highly disturbed compared to other sites, with the southern side of the creek bordering the fenced existing wastewater treatment plant, with infrastructure including a small bridge and discharge outlet cutting through the riparian zone in the southern section of the site. Similarly to its macrophyte community, the riparian zone at Site K07 was diverse, with semi-continuous vegetation and approximately 80 percent coverage by native species.

Partridge Creek

The riparian species composition was relatively uniform throughout Partridge Creek sites, typically dominated by *M. quiquenervia* and *Allocasuarina sp*. and grasses. The riparian zone at Site K08 was scattered, comprising of *B. articulata* along the upper banks, with occasional *Allocasuarina sp*. The riparian zones at Site P09, P10 and P11 were limited to a thin stand of *M. quiquenervia, Allocasuarina sp,. L. longifolia, H. muelleri* and pasture grasses along the edges of creek banks, with vegetation transitioning into mixed wetland vegetation of *Allocasuarina spp* and rushes as the creek at each site extended into wetland areas.

12.3 Potential impacts

12.3.1 Avoidance and minimisation

The project has been designed to largely avoid areas of key fish habitat, mapped and verified in-situ, and areas of coastal wetlands mapped under the Hazard and Resilience SEPP. The construction methodology has been designed for various section to utilise HDD through major Type 1 KFH/Coastal Wetland habitats to avoid direct habitat disturbances and geomorphic and scour risks.

12.3.2 Construction

Table 12-3 summarises the potential aquatic impacts during construction.

Table 12-3 Identification of potential aquatic impacts during construction

Impact	Likelihood	Description
Physical		
Removal or modification of creek bank and bed habitat	Known	Creek banks within the aquatic study area consist of intertidal muds along Kooloonbung Creek and soft, muddy sediment along Partridge Creek, with the exception of the Fernbank Creek connection which possessed more defined creek beds. Within the Study Area, creek banks were typically waterlogged and not well defined at the time of survey. The proposed construction methodology for the RTEP, SRM, RWM and power/communications line (PC) out of the TWWTP includes for horizontal-directional drilling (HDD) across wetland habitat, where the mains cross Partridge Creek and where the RTEP crosses an upper tributary of Kooloonbung Creek to reduce geomorphic and scour risks. Any HDD carries risk of collapse of the creek bed, particularly around water charged or granular sediment. Some small sections of the RTEP, SRM, RWM and PC will be installed across some 1st order tributaries using trenching. This is expected to result in a small amount of habitat loss of the creek bed during construction by removal of substrate approximately 1 metre wide and 1.5-2 metres below ground surface, resulting in the temporary alteration of the natural creek lines and banks. These areas would be backfilled following works.
Removal of modification of instream creek habitat	Known	To facilitate trenching works, it is likely that the cross-section of creeks within the footprint will be bunded and drained of any water at the time of construction. The removal of this creek water will result in the temporary removal of that section of creek habitat, and any associated flora and fauna, such as small fish or invertebrates. Habitat in these sections of the wider study area were considered to be largely ephemeral and it is considered unlikely that fish would inhabit these 1st order tributaries within the Study Area, however, potential of their presence still remains.
Removal or modification of KFH and/or Coastal Wetlands	Known	The footprint of the TWWTP scheme largely avoids KFH and Coastal Wetlands, however, some areas of these sensitive habitats will still be directly impacted. The footprint of the TWWTP lies directly adjacent to, but outside of mapped KFH and Coastal Wetlands of Partridge Creek, whilst the RTEP, SRM, RWM and PC construction methodology has been designed to utilise HDD through mapped KFH and Coastal Wetlands, reducing direct habitat disturbance and modifications. Some areas of the SRM and RTEP that will be installed using trenching will pass along the edge of KFH/Coastal Wetlands in areas between the Port Macquarie Airport and the Port Macquarie Racecourse, which will likely result in some edge disturbances to these habitats. Areas of KFH/Coastal Wetlands mapped to occur within the Project Area where direct disturbances may occur equate to approximately 71 m^2 of mixed Type 1 and 3 KFH, whilst indirect disturbances equate to approximately 2,801 m^2 of mixed Type 1 and 3 KFH. In addition, there is another 7,757 m^2 of Type 1 KFH within the Project Area of the plant that does not overlay with the construction footprint but includes a proposed laydown area may be indirectly disturbed. The construction of the emergency overflow at the TWWTP may result in some direct disturbance to the Type 1 KFH/Coastal Wetlands, dependent on final construction methodology. The Project Area encompassing the emergency discharge includes approximately 3,066 m^2 of Type 1 KFH with potential for disturbance.
Removal or loss of aquatic flora	Known	Aquatic macrophytes ranged in coverage across the study area, with a majority of sites possessing some presence of macrophytes either within the creek or along the creek banks. Construction works that involve trenching for the installation of the RTEP, SRM, RWM and PC will remove small cross sections of creek habitat throughout the Study Area. Any macrophytes that are present within this footprint (approximately 1 metre wide across creek width) are expected to be removed as part of these works. It is expected that the trenching will result in the damage or destruction of macrophyte leaf and root systems during this process.

Impact	Likelihood	Description
Removal or loss of aquatic fauna	Likely	Aquatic fauna observed during site surveys included various freshwater fish, macroinvertebrates, reptiles and avifauna. Construction works that involve trenching for the installation of the RTEP, SRM, RWM and PC will remove small cross sections of creek habitat throughout the study area. This will include an area approximately one metre wide across the width of the creeks that require excavation. Creek banks or wetland habitat, even if ephemeral, may provide habitat for small aquatic fauna species, such as macroinvertebrates, that will be removed and/or crushed as part of trenching works if within the trenching footprint. Trenching works will also require the draining of water with trench footprints, resulting in the potential removal of any small fauna such as freshwater fish or invertebrates that may be inhabiting the creek water.
Physical disturbance or smothering of aquatic flora or fauna	Likely	Trenching for the installation of the RTEP, SRM, RWM and PC will involve both the initial trenching to remove creek sediment, and the replacement of this sediment back into the creek following pipeline installation. Without the implementation of designated laydown area for sediment, there exists potential for removed sediment to smother adjacent flora and fauna while stockpiled. Additionally, any slumping that may occur due to trenching works has potential to smother flora and fauna in creek habitat adjacent to the trench footprint. The addition of sediment back into the creek following the installation of the pipeline will also result in the smothering of any flora or fauna that remains or has since moved into the trench footprint, and in adjacent areas as the creek bed and bank are reconstructed.
Sedimentation of adjacent waterways	Possible	Construction activities associated with the TWWTP, RTEP, SRM, RWM and PC and any associated infrastructure have potential to mobilise sediments within the Study Area to adjacent aquatic areas, including Type 1 KFH and Coastal Wetlands. Sediment disturbed by works may be mobilised and transported downstream to adjacent areas following a rain event, which may result in reduced water quality including increased turbidity for downstream communities of flora and fauna.
Removal or degradation of native riparian vegetation	Known	Construction activities associated with the TWWTP, RTEP, SRM, RWM and PC are expected to be necessary in riparian zones of creeks and wetlands in the study area. These works may result in the physical removal of vegetation, damage or destruction of vegetation as part of trenching, or damage or destruction of root systems during trenching and HDD.
Alteration of natural flow regimes	Possible	During instream works to construct the pipeline, some temporary alteration of natural flow regime may be required during construction. This is not expected to occur at survey sites along Kooloonbung or Partridge Creek. Kooloonbung Creek is not within the footprint of construction works, whilst HDD will be used in habitat around Partridge Creek, minimising the risk of creek and therefore flow alterations. However, some smaller, more ephemeral creeks in the wider study area in the footprint of trenching works may experience temporary alterations to flow regimes as a result of bunding, dewatering and modifications of creek banks and beds due to excavation and backfilling works.
Barriers to fish passage	Likely	The works may result in temporary barriers to fish passage during construction where trenching works requires bunding of creeks or wetland habitat, which will temporarily block fish passage. Considering the habitat quality observed during surveys, it is likely that a majority of sites do not provide permanent fish habitat, however, these channels may be transiently used at times.
Injury caused by ingestion of, or entanglement in, harmful marine debris	Possible	Materials used during construction and operational works that are not contained or disposed of correctly have potential to find their way into the water and be ingested by aquatic and marine fauna.
Potential for spread of microplastic and marine debris	Possible	Given the extensive distribution of microplastics, their spread may be unavoidable. Some spread of microplastics may occur if present in basin sands during construction.

Impact	Likelihood	Description
Chemical		
Changes in water quality	Possible	Construction works are likely to result in changes to water quality in the study area. This is likely to include increased sedimentation and turbidity in the locality of works, as sediment is mobilised. It is expected that these changes in water quality would be short-term and appropriately managed by sediment and erosion control measures.
Mobilisation of contaminants / ASS	Possible	The construction of the pipeline is not expected to result in the mobilisation of contaminants. However, some portions of the study area are mapped as high and low probability of occurrence for ASS, where construction of the SRM and RWM may occur. Exposure of ASS is likely to result in increased acidity of adjacent or receiving waterways, reduced pH and detrimental effects for local biota.
Spillages	Possible	The construction of the TWWTP and infrastructure may result in inadvertent chemical spills such as drilling muds or fuel from machinery. Such spills can pollute adjacent waterways and reduce habitat quality, whilst some materials may be harmful and toxic to aquatic fauna.
Biological		
Introduction or spread of an aquatic pest species	Possible	It is not expected that construction works will directly facilitate the introduction or spread of an aquatic pest species. However, given the prevalence of algal blooms throughout the study area, machinery may facilitate the spread of algal species if not cleaned thoroughly between sites. Additionally, disturbances to aquatic habitat across the study area may favour invasive species that are adapted to environmental disturbance, which have potential to outcompete native vegetation.
Introduction of disease or pathogens	Unlikely	No known diseases or pathogens have been identified as an environmental issue for aquatic fauna and flora in this locality, while no aquaculture occurs in the vicinity of the study area.
Behavioural		
Generation of construction noise with potential to impact on fauna behaviour	Possible	Some construction noise will occur during construction of the TWWTP and infrastructure. This may result in some short-term disturbances to fauna relative to construction periods of the pipeline.

Key fish habitat and coastal wetlands

The TWWTP scheme has been designed to largely avoid areas of KFH, mapped and verified *in-situ*, and areas of Coastal Wetlands mapped under the Hazards and Resilience SEPP (2021). However, some small areas of these sensitive habitats will still be directly or indirectly impacted during construction works. Direct impacts will occur where trenching works traverse through KFH, whilst indirect impacts may occur from laydown areas, stockpiles, safety areas and truck movements adjacent to works.

Approximate areas of potentially impacted KFH have been calculated based on the project area boundaries and considering a trenching footprint of approximately one metre width to facilitate the installation of the RTEP, SRM, RWM and PC lines, assumed to be installed along the centre of the marked project area (refer Figure 19 of Technical Report 6 – Aquatic Ecology Assessment). Assuming a trench of approximately one metre width, direct impacts are expected to occur to approximately 13 m^2 of Type 1 KFH and 58 m^2 of Type 3 KFH (Table 12-4). A further 9,307 m^2 of Type 1 KFH and 1,251 m^2 of Type 3 KFH lie within the project area that may have potential for indirect impacts, depending on final construction methodology.

The assessment has considered a reduction from the approximate 20-metre-wide project area along the SRM and RWM to 10 metres in areas of native vegetation to reduce impacts (deWitt 2024), which will likely include areas of KFH associated with Coastal Wetlands. This is expected to reduce potential indirect impacts to KFH along the pipeline, particularly in areas where the project area crosses the edge of these habitats (refer Figure 19 of Technical Report 6 – Aquatic Ecology Assessment). These calculations do not include the project area footprint encompassing the emergency overflow discharge into Partridge Creek wetlands, as this is expected to utilise an existing swale.

Table 12-4 Approximate direct and indirect impacts to Type 1 and 3 KFH as a result of construction works

KFH Type	Approximate Direct Impact Area (m^2)	Potential Indirect Impact Area ($m^{2)}$
Type 1 KFH/Coastal Wetlands	13	9,307
Type 3 KFH	58	1,251

The proposed WWTP is situated in non-KFH on the western side of Partridge Creek, surrounded by extensive Coastal Wetlands on the northern, eastern and southern sides. While the design does not encroach into KFH or mapped Coastal Wetlands, the eastern and western corners of the plant are both within 15 metres of mapped wetlands.

Pipeline routes utilise HDD construction methods to avoid key fish habitats and coastal wetlands. Any HDD carries risk of collapse of the creek bed, particularly around water charged or granular sediment. The failure of HDD and associated impacts are expected to be negligible for the project, with the development of appropriate mitigation measures.

Some section of pipeline installed using trenching will pass along the edge of some key fish habitat and coastal wetlands. Edge disturbances that are likely to occur in these locations include removal of native vegetation and macrophytes and some modification of sediments associated with trenching, with potential for reduced water quality if not controlled. The emergency discharge at the TWWTP will utilise an existing swale directly adjacent to the TWWTP and is not expected to result in construction impacts to KFH and Coastal Wetlands.

Other aquatic habitat

Direct impacts to other aquatic habitat are expected to occur at all sites in the study area where the pipeline crosses a creek line and trenching is required. This is expected to occur across four stream sections.

Trenching works will physically remove and/or disturb aquatic habitat by excavating the creek bed and banks in the four identified locations. Any macrophytes or benthic infauna associated with sediments that are removed will likely be lost or physically disturbed. Considering the minor areas of disturbance in each creek (approximately one metre trench across the creek), the ecological significance of impacts on benthic infauna is expected to be minimal and infauna are expected to recolonise the creek bed and bank within several months following backfilling.

The trenching works will also result in the alteration of the natural morphology of each creek within the trenching footprint. Changes in the creek morphology as a result of trenching works may create instability or exacerbate erosion along adjacent creek banks, which has potential to create new erosive preferential pathways for flow that may scour large sections of the natural creek without proper management of backfilling methodology.

Construction may result in a moderate amount of disturbance to the unnamed creek on the western side of the Airport which does provide semi-permanent habitat, however, disturbances to the creeks in the trenching footprint are typically expected to be temporary and minor if properly managed with appropriate sediment and erosion control and dewatering plans.

Aquatic flora

Aquatic macrophytes including freshwater and/or estuarine species were present at all of the survey sites in the Study Area, dominated by native species. The construction methodology for the installation of the pipelines indicates that HDD will be used to install the pipeline infrastructure where the footprint crosses through Coastal Wetlands Areas, classified as Type 1 KFH under the FM Act; thus, the extensive native macrophyte communities in these areas are not expected to be directly impacted. However, macrophytes that are present within the footprint of trenching works will likely be physically disturbed or removed, with potential for damage or destruction to both macrophyte leaves and root systems.

The construction of the TWWTP and emergency discharge infrastructure has the potential to result in some direct or indirect impacts to the macrophyte communities adjacent to the eastern and western corners and in the emergency discharge footprint. Although the plant footprint does not encroach into the mapped Coastal Wetland Areas, it lies within approximately 15 metres of wetland vegetation, including species such as *E. sphacelata, L. articulata* and *C. appressa.* These communities may experience some edge disturbances during construction, such as damage or physical disturbance from construction vehicles, fencing, equipment or materials, without demarcation areas. It is likely that these areas would recover quickly following disturbance.

Aquatic fauna

A number of sightings have been recorded of Eastern Long-necked Turtle (*Chelodina longcollis*) and the Murray River Turtle (*Emydura macquarii*) (ALA 2024), whilst one *E. macquarii* individual was opportunistically observed during site surveys. As mobile species, it is expected that adult individuals would move away from disturbances during construction, unless nesting. Construction works is not expected to impact marine turtle species.

Some sightings of the Platypus (Ornithorhynchus anatinus) have been made in the vicinity of the Study Area, however, are predominantly confined to freshwater reaches upstream in the Hastings River and Kings Creek. Given the marginal suitability of the habitat in the study, permanent use of habitat by Platypus is considered unlikely and impact therefore negligible.

General construction works also have potential to result in injury caused by ingestion of or entanglement in harmful marine debris, a key threatening process under the EPBC Act. Any debris left within or adjacent to the waterway, such as plastic, strapping, sheeting, piping, adhesives, ropes, paints and general rubbish has potential to be ingested or entangle vertebrate marine life.

Riparian zone

Degradation of native riparian vegetation as part of project construction, particularly trenching works, may include clearing, cropping or trampling and has potential to negatively impact the wider ecosystem and downstream receiving waters. Construction activities associated with the pipeline route are likely to result in removal of riparian vegetation. Direct disturbances to these communities may include physical removal, damage or destruction of established vegetation or damage or destruction of root systems. Whilst loss of riparian vegetation has potential for fragmentation and loss of connectivity and habitat, the works to construct the pipeline infrastructure and plant are not expected to result in any significant fragmentation of habitat, with removal of riparian vegetation likely limited to small areas in the trenching footprint in already disturbed areas.

Acid Sulfate Soils

High-risk ASS areas are known to occur in within the project area, with the Kooloonbung Creek, Partridge Creek and Fernbank Creek sub-catchments. Potential impacts associated with ASS during construction of the SRM and RWM are expected to be appropriately managed through the use of HDD in these areas in conjunction with an ASS Management Plan (refer to Section 15).

12.3.3 Operation

Table 12-5 summarises the potential aquatic impacts during construction.

Table 12-5 Identification of potential aquatic impacts during operation

Impact	Likelihood	Description
Physical		
Removal or modification of instream creek habitat	Possible	Instream creek habitat may experience physio-chemical modifications in proximity to the discharge location within Kooloonbung Creek. These changes may include salinity, nutrient concentrations, changes in toxicants, and altered flow regimes.
Removal or modification of KFH and/or Coastal Wetlands	Possible	Operational discharges into Type 1 KFH/Coastal wetlands at Kooloonbung Creek and emergency discharge into Partridge Creek may result in modification of habitat.
Loss or modification of aquatic flora	Possible	Aquatic macrophytes ranged in coverage across the Study Area, with a majority of sites possessing some presence of macrophytes either within the creek or along the creek banks. Whilst water quality impacts are expected to be similar to Baseline conditions, shifts in chemical and physical water quality parameters in Kooloonbung Creek may disturb existing aquatic flora following commencement of discharge. This may lead to altered physical habitat conditions through structural habitat change and potential for increased erosion through reduced channel roughness. In addition, overflow of water with elevated nutrients at the TWWTP into Partridge Creek may impact on the health of aquatic flora within the wetlands, as well as mangroves and saltmarsh in the Study Area and beyond towards the confluence with the Hastings River.
Removal or loss of aquatic fauna	Possible	Aquatic fauna observed during site surveys included various freshwater fish, macroinvertebrates, reptiles and avifauna. No threatened aquatic biota were observed and those that are considered to have a moderate likelihood of occurrence (marine turtles) are not expected to be impacted by operation. Whilst water quality impacts are expected to be similar to Baseline conditions, shifts in chemical and physical water quality parameters in Kooloonbung Creek may disturb existing aquatic fauna communities following commencement of discharge, particularly where changes in salinity, temperature, DO and pH occur. Sudden changes (particularly decreases) in DO especially have potential to result in fish kills, especially within freshwater reaches or areas with restricted connectivity to estuarine waters towards the Hastings River.
Physical disturbance or smothering of aquatic flora or fauna	Possible	Changes in water quality may induce growth by smothering algae and choking macrophytes, which may displace or smoother endemic or native aquatic flora and/or fauna.
Removal or degradation of native riparian vegetation	Possible	Operational discharge into Kooloonbung Creek may result in some dieback of riparian vegetation, in response to shifts in chemical and physical water quality parameters or increase waterlogging of soils. Natural vegetation communities in these areas may also shift, to be dominated by more tolerant or more brackish/freshwater marsh species.

Impact	Likelihood	Description
Alteration of natural flow regimes	Known	The operation of the TWWTP system will result in alterations to flow regime of Kooloonbung Creek. The natural flow regime of Kooloonbung Creek is already modified by the existing Port Macquarie WWTP and stormwater drain inputs. Discharge of treated effluent will result in increased flows, changes to frequency, timing and magnitude of flow events and changes to the rate of rise and fall of water levels. Alterations to the flow regime at Partridge Creek during overflow events are not expected to be significant relative to the surrounding flood levels that would concurrently occur in these events.
Barriers to fish passage	Possible	Reduced water quality may potentially form a chemical barrier to fish passage. This may be the as the result of low DO or mixing zone for toxicants such as for ammonia and nitrate. During periods of poor water quality barriers fish passage may prevent fish from moving out of the affected area and increase potential for fish kills.
Potential for spread of microplastic and marine debris	Possible	The treatment of wastewater through the MBR will likely remove a significant portion of microplastics present, however, some nano plastics that are smaller than membrane filter pores may be released into Kooloonbung Creek in treated effluent or Partridge Creek during overflow events.
Chemical		
Changes in water quality	Known	Operation of the WWTP will result in some changes to water quality in Kooloonbung Creek. Ambient nutrients (nitrogen and phosphorus) and BOD may increase with increased effluent flows in some areas of Kooloonbung Creek up to 1,600 m downstream.
Mobilisation of contaminants	Possible	The membrane bioreactor is expected to remove metals, with inflows largely from residential areas. However there remains some potential at the 95% Level of Species Protection for toxicity from increased ammonia and nitrate within the vicinity of the Kooloonbung Creek discharge.
Eutrophication	Possible	Increased nutrient loads with potential to result in some nutrification is possible in Kooloonbung Creek. The area immediately downstream of the discharge point is expected to be most susceptible to nutrification impacts. Over the long-term, the increased nutrient loads in estuarine areas of Kooloonbung Creek have been modelled to be buffered by SLR. Nutrification impacts from overflow into Partridge Creek are considered a lesser risk, as these events are typically expected to be pulse occurrences during flood events, thus effluent will likely be flushed through the system quickly.
Biological		
Introduction or spread of an aquatic pest species	Possible	Potential changes in water and habitat quality as a result of discharge may favour invasive species that are adapted to reduced water quality and higher nutrient loads, which have potential to outcompete native vegetation.
Introduction of disease or pathogens	Unlikely	No known diseases or pathogens have been identified as an environmental issue for aquatic fauna and flora in this locality, discharged water will be treated to a level that is expected to remove any disease or pathogen of concern to aquatic species.
Behavioural		
Generation of operation noise with potential to impact on fauna behaviour	Unlikely	Operational noise associated with the plant and discharge location are not expected to be of ecological significance among the ambient levels of noise.

Salinity

Kooloonbung Creek includes freshwater, brackish and saline habitats, with a tidal limit approximately 4.9 kilometres from the ocean that reaches approximately 900 metres upstream of Lake Road. Salinity throughout the creek is currently influenced by tide, rainfall, catchment runoff and the existing Port Macquarie WWTP effluent discharges (Intrawater 2024). Modelling of projected discharge scenarios indicated no substantial changes to salinity are expected to occur within Kooloonbung Creek or Hastings River compared to Baseline scenarios, assuming modelled increases to SLR and tidal flushing (Intrawater 2024).

No changes in salinity in Partridge and Fernbank Creeks as a result of storm storage pond discharge were identified and were not predicted to occur due to the low salinity content of both the bypass releases and catchment runoff during rainfall events. Refer to Chapter 7 – Water quality and hydrology and Technical Report 1A – Water quality and Flooding Assessment for further details.

Nutrients

Kooloonbung Creek is currently influenced by high nutrient loads from the Port Macquarie WWTP and runoff, with the catchment known to have high concentrations of nitrogen and phosphorus (Intrawater 2024). The operation of the WWTP is expected to result in an overall increase in nutrient loads in Kooloonbung Creek due to an increase in total discharge volumes. Increased nutrients in waterways can enhance aquatic plant and algae growth and biomass that in turn results in rapid levels of decay when this material breaks down, rapidly increasing the BOD and depleting the waterway of oxygen. It is expected that due to the significant flushing in Partridge Creek, nutrient concentrations will return to background levels following cessation of the releases to Partridge Creek, with impacts that do occur expected to reduce with distance travelled downstream due to dilution from the confluence from Fernbank Creek and Hastings River.

Toxicants

Technical Report 1A – Water quality and Flooding Assessment, identified that there would be an increased risk of ecotoxicity from elevated ammonia and nitrate concentrations in Partridge and Fernbank Creeks during emergency overflow events.

Dissolved oxygen and BOD

Elevated dissolved levels are indicative of the first stages of eutrophication. At this stage, impacts on aquatic habitat may include smothering of the creek bed or other aquatic plants by algae growth and choking of flow by aquatic macrophyte growth. Impacts typically result in a reduction in habitat quality and dominance of habitat by individual opportunistic species, which typically result in reduced diversity over the longer term. As this growth decays and eutrophication enters the second stage of the cycle, which is typically when BOD increases, a rapid depletion of dissolved oxygen can occur.

It is expected that the ongoing tidal exchange in Kooloonbung Creek will provide sufficient flushing of nutrients before eutrophication process can commence, provided nutrient levels in effluent discharge stay within expected effluent quality concentrations. In Fernbank Creek any disturbances are expected to be as the result of pulse events during periods of high rainfall and/or flood. Given this, the risk of eutrophication is considered to be less.

Altered flow regimes

Alteration to flow regimes may include changes to flow volumes and seasonal timings, the duration, frequency and magnitude of flows, and alteration of water levels. The operation of the WWTP will result in alterations to the natural flow regimes of Kooloonbung and Partridge Creeks and associated wetland areas. As Kooloonbung Creek is a permanently flooded waterway with tidal exchange, it is unlikely that alterations to flow regimes would have impacts of ecological significance.

Marine debris and microplastics

Wastewater entering the TWWTP may carry microplastics that are in water that has passed through drains from sinks, showers/baths, toilets and laundries in the population catchment. It is considered that the treatment of effluent including the removal of microplastics is considered to have an overall beneficial effect for the receiving waters in Kooloonbung Creek.

Key fish habitat and coastal wetlands

Impacts to these habitats from the operation of the WWTP are expected to be limited to indirect impacts, resulting from reduced water and habitat quality at times.

Within key fish habitat of Partridge Creek and the associated Coastal Wetlands, these reductions in water and habitat quality are expected to be limited to the rare event of emergency overflow discharge into the wetlands, with reduced water quality from the plant unlikely to impact further than the ambient flood conditions. In Kooloonbung Creek, indirect impacts include reductions in water quality and habitat, generally in the short-term, as a result of eutrophication and potential increased toxicants.

Riparian condition

Existing riparian condition was generally considered healthy, with moderate to high levels of coverage. Riparian vegetation may be of greater risk to disturbance in areas where mangroves are absent and other native species dominate the riparian zone. Riparian vegetation may be of greater risk to disturbance in areas where mangroves are absent and other native species dominate the riparian zone.

Aquatic macrophytes

The presence of extensive mangrove forests along Kooloonbung Creek may be beneficial for offsetting some of the expected increases in nutrient concentrations from the TWWTP discharges. Mangroves are highly productive and can alleviate excessive nutrient loads through rapid uptake, whilst mangrove soils are a long-term sink for nitrogen. Whilst some migration of mangroves is still expected by 2058 along Kooloonbung Creek, some of this encroachment into saltmarsh communities on the eastern banks may be reduced by the increased low salinity inputs to the creek from the WWTP. However, the discharges from the WWTP are not expected to impact on mangroves at an ecologically significant level, with mangroves likely to uptake some of the nutrient loads discharged as part of the effluent.

Saltmarsh are highly productive and intercept nitrogen and other pollutants, however, can be sensitive to salinity stress and waterlogging of soils. Kooloonbung Creek has potential to threaten the long-term viability of saltmarsh habitat, as excessive freshwater can prevent the formation of hypersaline sediments. Saltmarsh has also proven vulnerable to invasive species, and where disturbed, may quickly be outcompeted by species such as *J. acutus*. Also, levels of nutrients associated with eutrophication may also lead to loss. IF eutrophication were to occur within Kooloonbung or Partridge Creeks, the saltmarsh along creek banks would be at increased risk of geomorphic instability, with subsequent increased risks of erosion and loss of adjoining riparian habitat. However, given the risk of eutrophication is considered to be low under the predicted scenarios, this risk is considered to be low.

Given the extensive coverage of macrophytes throughout Partridge Creek and its wetlands, it would be expected that many plants would uptake these excess nutrients, with potential to decrease some of the higher loads as a result of the overflow event.

Aquatic fauna

Impacts from the operation of the WWTP may include minor changes to habitat quality in lower Kooloonbung Creek and Hastings River at times, however, these areas are only likely used as part of transient movements and potential for reduced habitat quality within Kooloonbung Creek is not considered to be of ecologically significance to marine turtles.

Native aquatic species present within the mixing zone when sudden changes occur, particularly native fish and bivalves, may experience mortality or significant impact, whilst species with a lower tolerance for pollution and disturbance may disperse from the one kilometre of affected habitat in the mixing zone in Kooloonbung Creek. Over the longer term, small changes in population dynamics such as recruitment, growth, survival and abundance may occur within this section of Kooloonbung Creek.

12.4 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise socio-economic impacts of the project are detailed Table 12-6.

Table 12-6 Aquatic impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
AE1	Trenching	The following recommendations will be considered to minimise impacts to aquatic and riparian habitats: – Any creek channels that require trenching to install the various mains will be re-instated to their original form or long-term stable condition in instances where this cannot be achieved or is undesirable. – Excavated bank and bed material will be stored (for return to the site at the completion of excavation) away from the waterway to minimise potential sedimentation of downstream habitats. – The backfilling of excavated creek banks or beds will use clean fill or the excavated sediments, ensuring adequate topsoil is maintained for revegetation works. – Where creek bank vegetation is removed or damaged as part of trenching, their rehabilitation will be incorporated into the project Vegetation Management Plan (VMP). – Where established assemblages of native macrophytes are removed, weed management of the area should be included in the project VMP to minimise opportunistic replacement by exotic species. This may include monitoring via macrophyte mapping.	Contractor	Construction
AE2	Fish passage	Temporary barriers will be in place for less than six to twelve months (Fairfull 2013). Any barrier will be avoided in areas mapped as key fish habitat. Currently, barriers for construction are expected to be in place only if required and for a short period of time. Where temporary barriers are required to be in place for over three days, water quality monitoring should be considered upstream and downstream of the barrier to alert to potential detrimental habitat impacts for fauna in the vicinity.	Contractor	Construction
AE3		Where excavation works requiring bunding are to be conducted through waterways, adequate alternate fish passage will be provided for works where fish passage will be blocked for several weeks or more due to construction. The use of HDD has been implemented as a less invasive methodology in most areas of KFH to avoid the obstruction of fish passage at these more sensitive habitats.	Contractor	Construction
AE4		Where possible, in-stream works will be staged to avoid blocking the entire waterway. If the entire waterway must be blocked, an alternative flow and passage channel should be considered to maintain natural flow conditions of the stream for the duration of construction works.	Contractor	Construction
AE5		Temporary in-stream structures will be installed during periods of low flow, with each structure to have a management plan included in the CEMP for high flow events to prevent erosion and sedimentation.	Contractor	Construction
AE6		Temporary barriers will not be comprised of loose, imported earth fill, with all material to be fully enclosed by geotextile, sheet piling or similar to prevent erosion and sedimentation.	Contractor	Construction

ID	Impact	Environmental safeguard	Responsibility	Timing
AE7	Dewatering	Prior to the commencement of dewatering inside any temporary barriers, a Dewatering Management Plan (DMP) that includes for translocation of any native fauna and management of exotic species will be prepared and undertaken by (or under the strict supervision of a suitable qualified aquatic ecologists). The DMP is required to address disposal of water, which will include the NSW DPI requirement that de-watering of a temporary in-stream structure will be pumped at least 30 metres from the waterway and not re-enter the waterway. A pre-works inspection will also be conducted by a qualified Aquatic Ecologist. Adequate sediment and erosion control structures will be erected to minimise sedimentation impacts.	Contractor	Construction
AE8	Water quality monitoring	Visual water quality monitoring will be implemented along the proposed HDD footprint during construction to alert to collapse of the creek bed. Council has an existing water quality monitoring program which would be continued. The protocols for management of water and dispersing bed sediments if the case of a collapse must be included in the projects Sediment and Erosion Management Plan.	Council/ Contractor	Construction and operation
AE9	Acid Sulfate Soil	An appropriate Acid Sulfate Soils Management Plan must be prepared and implemented to prevent and minimise potential exposure of Acid Sulfate Soils to adjacent sensitive habitats.	Contractor	Pre-construction, construction and operation
A10	Onsite Water, Sediment and Erosion Management	Prepare an implement a Sediment and Erosion Management Plan that includes: – Placement of alternative routes at stable sections of watercourses to minimise additional erosion. – On-site water management to reduce sedimentation and potential pollution of watercourses at both at trenching sites. – Management of stormwater and creek water during periods of high flow, considering the presence of flood prone areas within and in the vicinity of the Study Area. – Installing site drainage infrastructure to lead stormwater away from site, particularly where stormwater may exacerbate soil erosion and pollution of waterways. – Diverting run-on water from disturbance works occurring on upslope land, using non-erosive methods. – Installing protective measures to prevent sheet erosion where large portions of soil will be exposed. These will also need to be located in location where they are not at risk during flooding. – Implementing water management controls as stated above to prevent sedimentation and erosion resulting from movement of water. – Construction of sediment filters or sediment retention traps where appropriate, particularly below fill batters near waterways.	Contractor	Pre-construction, construction and operation

ID	Impact	Environmental safeguard	Responsibility	Timing
A11	General construction	A CEMP is to be prepared and implemented for the project. The following will be included: – Adequately manage and store waste products and material in designated areas on the site. To prevent injury caused by ingestion or entanglement in debris, an adequate Waste Management Plan (WMP) should be prepared for the project. – All construction work locations are to have designated litter disposal bins to avoid potential for aquatic debris, included in the project WMP. – All machinery should be routinely checked for leaks, with an emergency spill kit to be kept on site at all times. All staff are to be made aware of the location of the spill kit and trained in its use. – All fuels and hydrocarbon-based products are to be stored in a sealed bunded area(s) at least 30 metres away from the water's edge. – All vehicles and machinery should not enter the waterway except where absolutely necessary for installation of pipeline. Where they are required to enter the waterway a washdown procedure before doing so should be implemented.	Contractor	Pre-construction / construction
A12	Unexpected encounter procedure	An appropriate unexpected encounter procedure will be included in the project's Flora and Fauna Management Plan (FFMP).	Contractor	Pre-construction, construction and operation

13. Traffic and transport

This chapter provides a detailed summary of the assessment of traffic and transport potential impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures. The full assessment is provided in Technical Report 7 – Traffic Impact Assessment (GHD, 2024).

13.1 Assessment approach

13.1.1 Legislation and policy context

The Traffic and Transport Assessment (TTA) was undertaken in accordance with the SEARs and considered the requirements of relevant legislation, policies, and guidelines, including:

– *Environmental Planning and Assessment Act 1979*
– *Roads Act 1993*
– NSW Heavy Vehicle Access Policy Framework

13.1.1.1 Required approvals

Approval is to be obtained from TfNSW, Council and other relevant authorities as required.

Approvals that may need to be obtained for items such as but not limited to:

– Roadwork Speed Zone
– Council Road opening permits
– Road occupancy approvals
– Hoarding/fencing approvals
– Crane and barricades
– Oversize and Articulated Vehicle use on local roads

As outlined in Chapter 4 (Statutory context), a road occupancy licence under section 138 of the *Roads Act 1993* is required. Construction of the project may require installation of infrastructure in the road reserve or verge. Therefore, authorisation for consent under section 138 of the *Roads Act 1993* may be required and cannot be refused given the declaration of the project as SSI in accordance with section 5.24(f) of the EP&A Act.

The Construction Contractor would obtain the necessary approvals, as required by the *Roads Act 1993* and NSW Traffic guidelines and regulations, prior to conducting any works.

The three specific areas of approval would include:

– All construction works and/or any changes to existing infrastructure.
– The installation and/or changes of any regulatory traffic control device.
– Occupation of the road network to conduct works, and the associated installation of temporary traffic control devices.

Further detail regarding the approvals required for the project is provided in Appendix B (Statutory Compliance).

13.1.2 Methodology

13.1.2.1 Project area

The traffic assessment project area comprises the anticipated access routes within the existing road network required for the construction and/or operation of the project. As construction workforce and material origins are expected to be widely distributed across the broader region, the project area is identified as consisting of the existing road networks and associated transport facilities (e.g., parking, active transport, heavy vehicle, public transport networks) which provide access to the construction sites, back to the nearest external road. Beyond this point, the construction traffic is expected to diminish as it is distributed across the broader network to multiple origins and represents no measurable impact.

13.1.2.2 Key tasks

The key tasks of the TTA included:

– Defining the traffic project area through identification of access routes anticipated to be used for movement of construction workers and materials.
– Desktop analysis to identify and qualitatively assess existing transport conditions.
– Calculation of traffic generation and distribution within the traffic project area as a result of construction and operation of the project.
– Assessment of the impacts on Limit of Service (LoS) on access routes within the traffic project area based on the traffic generated by the project.
– Traffic and transport impact assessment during construction and operation.
– Assessment of cumulative impacts.
– Detailing appropriate traffic and transport mitigation and management measures.

13.2 Existing environment

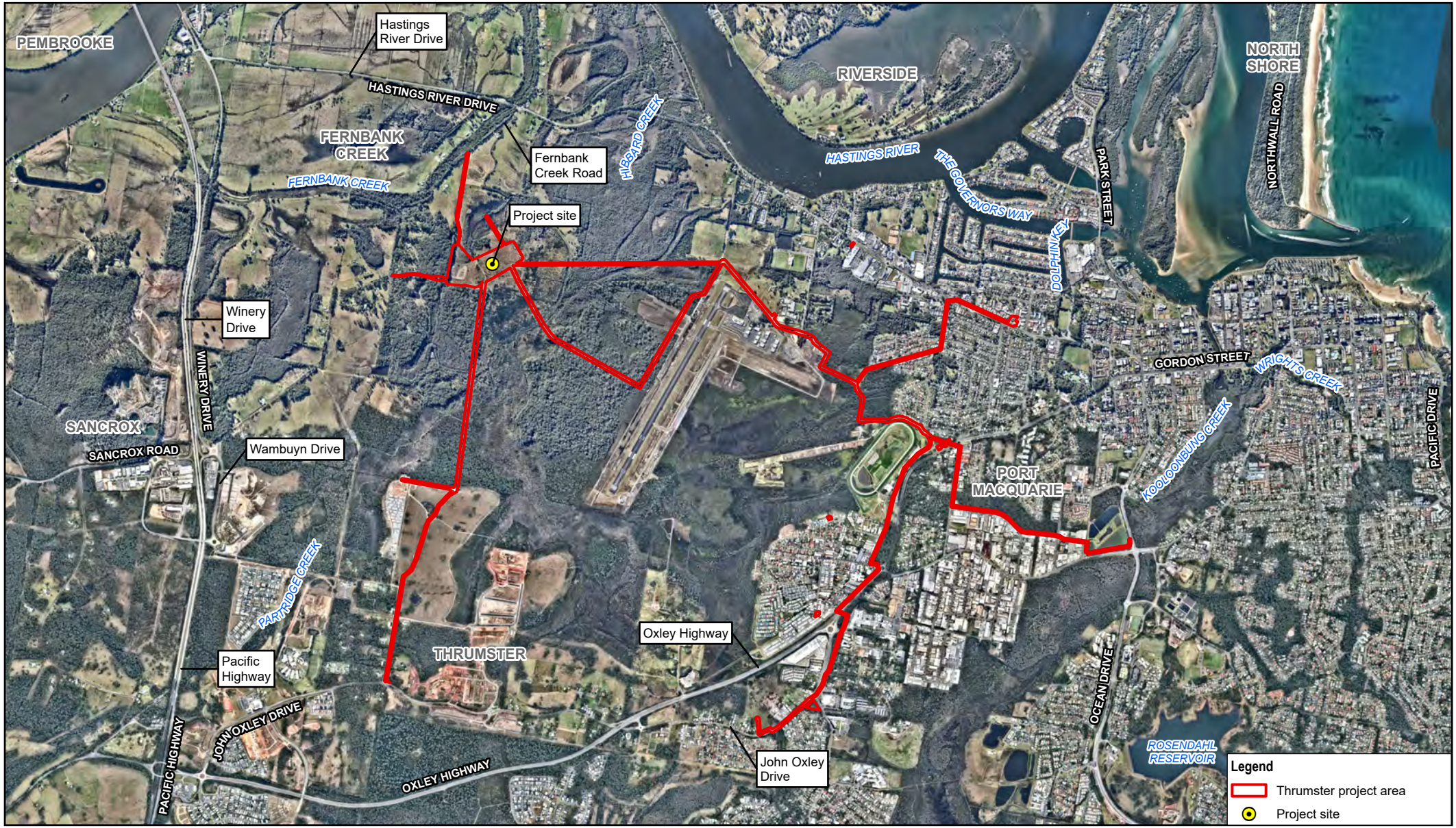
13.2.1 Road hierarchy

Table 13-1 below lists and summarises the roads which form the main road network providing access to the WWTP and pipeline components of the project, including their administrative classification and functional hierarchy. The network and location of these roads in proximity to the proposed WWTP and pipeline components are shown in Figure 13-1.

Table 13-1 Identified roads impacted by the project

Road name	Road classification	Functional hierarchy	Detail
Pacific Highway	State road	Arterial road	The Pacific Highway is an arterial and state road that connects Sydney to Brisbane via a number of coastal communities. It is a sealed divided carriageway with two lanes in each direct. The speed limit is 110 km/h and there are no dedicated cycling facilities, although cycling is permitted on the hard shoulder. All the Pacific Highway within NSW is designated as an authorised 26 m B-double route. There are no dedicated pedestrian facilities provided and bus stops are not located on the Pacific Highway in proximity to the subject site.

Road name	Road classification	Functional hierarchy	Detail
Fernbank Creek Road	Local road	Local road	Fernbank Creek Road is a local road that connects the Pacific Highway (in the southwest) to Hastings River Drive (in the northwest). It is a sealed undivided carriageway wide enough to allow most vehicles to pass. The local road provides access to a small number of low-density residential dwellings. The speed limit is 80 km/h (with 45 km/h advisory at turns). There are no dedicated pedestrian facilities provided, and no dedicated cycling facilities. However, cycling is permitted on the hard shoulder of the road. No public transport is provided, and no designed parking facilities are provided.
Hastings River Drive	Regional road	Sub-arterial road	Hastings River Drive provides a secondary connection between the Pacific Highway and Port Macquarie (other than the Oxley Highway). It is a sealed divided carriage way with one lane in each direction. The speed limit is 80 km/h. No designated parking facilities, pedestrian facilities, or cycling facilities are provided. No bus stops are provided on Hastings River Drive in proximity to the subject site.
Winery Drive	Local road	Sub-arterial road	Winery Drive connects the Pacific Highway to Hastings River Drive and provides access to Cassegrain Wines. Winery Drive intersects Fernbank Creek Road and Wambuyn Drive at a single lane roundabout, adjacent and east of the Pacific Highway. It is a sealed divided carriageway with one lane in each direction. The speed limit ranges between 60km/h and 80km/h. No designated parking facilities, pedestrian facilities, bus stops or cycling facilities are provided.
Wambuyn Drive	Local road	Local road	Wambuyn Drive provides access to a key roundabout to the project site via Winery Drive and is a sealed divided carriageway with one lane in each direction. The speed limit is 60 km/h and no designated parking facilities, pedestrian facilities, cycling facilities or public transport provision is provided.
Oxley Highway	State road	Arterial road	The Oxley Highway is an arterial and state road that runs in an east/west direction, connecting Nevertire to Port Macquarie via Tamworth. Oxley Highway is a sealed undivided carriageway with single lanes in each direction. The Oxley Highway intersects Burrawan Forest Drive at a priority-controlled junction with a short-left turn and right turn deceleration lanes. The speed limit along Oxley Highway is 90 km/h. There is no dedicated pedestrian or cycling facilities, although cycling is permitted on the hard shoulder. The Oxley Highway is an unrestricted 26 m B-double route. There are no pedestrian facilities provided and no bus stops are located on the Oxley Highway.
John Oxley Road	Local road	Collector road	John Oxley Drive provides connections to areas of Thrumster, north of John Oxley Highway. The southern extent of the proposed WWS works would reach John Oxley Drive. It is a sealed divided carriageway with one lane in each direction. The speed limit is 50 km/h and no designated parking facilities, pedestrian facilities, or cycling facilities are provided. The 336 bus service operates on John Oxley Drive.



Paper Size ISO A4

0 0.3 0.6 0.9 1.2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Key road network

FIGURE 13.1

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Print date: 22 Jul 2024 - 11:15

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

13.2.2 Existing traffic volumes

Existing traffic volumes were characterised by turning movement counts undertaken on 15 August 2023 between 6:00 am – 9:00 am (the AM peak) and 3:00 pm – 6:00 pm (the PM peak) at the following intersections:

– Wambuyn Drive/ Winery Drive/ Fernbank Creek Road
– Winery Drive/ Hastings River Drive
– Hastings River Drive / Fernbank Creek Road

The existing traffic movements and volumes associated with peak construction hours (6:00-7:00 am to 5:00-6:00 pm) are presented in Technical Report 7 – Traffic and Transport Assessment. The data revealed that:

– The volumes of traffic traversing Fernbank Creek Road, north of Hastings River Drive, are negligible, in the order of three vehicles per hour per lane.
– The majority of vehicles access/egress Hastings River Drive via Winery Drive to and from the north.
– All vehicles access and egress at Fernbank Creek Road (south) via Hastings River Drive to and from the east from the direction of Port Macquarie.

13.2.3 Intersection operation

The performance of an existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. The intersections within the project area, as modelled, include:

– Wambuyn Drive/ Winery Drive / Fernbank Creek Road
– Winery Drive / Hastings River Drive
– Hastings River Drive / Fernbank Creek Road

The results from the intersection modelling indicate that these intersections currently operate with a good LoS, during peak periods of proposed construction. Further detail regarding the modelling software and criteria used is detailed in Technical Report 7 – Traffic and Transport Assessment.

13.2.4 Road safety

Road crash information was collected from road crash statistics published by NSW Centre for Road Safety for the last five years (2018 – 2022). The data indicates the following:

– There were nine crashes recorded along Fernbank Creek Road.
– Five crashes on Hasting River Drive.
– Four on Winery Drive and five on the Pacific Highway in proximity to the proposed WWTP site.
– Approximately a third of crashes that resulted in moderate or serious injuries occurred at speeds greater than 100 kilometres per hour.
– A total of four crashes were recorded at the intersection of Hastings River Drive and Fernbank Creek Road, three were rear-end crashes and one involved vehicles impacting each other from an adjacent direction. These crashes resulted in one minor injury, one moderate injury and one serious injury. One crash was designated as “non-casualty”.

Further detail is provided in Technical Report 7 – Traffic and Transport Assessment.

13.2.5 Freight routes

The routes permitting the use of heavy vehicles on the road (unrestricted 26 metre B-double routes) and would be utilised for the construction of the project are provided in Chapter 3 (Project description).

The locations where large trucks would access the project site would be determined during planning for the construction phase. However, it is noted that:

– All the Pacific Highway within NSW is designated as an authorised 26 metre B-double route.

– A designated 26 metre B-double route is provided from Port Botany and the Port of Newcastle (for onward connectivity to the Pacific Highway).

The only road that large heavy vehicles are expected to traverse that do not form part of an authorised 26-metre B-double route is Fernbank Creek Road.

13.2.6 Active transport and public transport

There are no dedicated cycleways or footpaths on the roads in proximity to the WWTP site. However, in accordance with information obtained from the TfNSW Cycleway Finder, a road shoulder for cycling is provided on sections of the Pacific Highway and Oxley Highway. Given the remote location of the subject site, it is expected that all transport to the site would occur via cars and trucks.

The following bus services operate in proximity to the WWTP and pipeline components:

– Bus service 335 - Port Macquarie Base Hospital to Port Macquarie

– Bus service 336 - Port Macquarie to Wauchope

– Bus service 340 - Kempsey to Port Macquarie

Additionally, the following school bus services traverse Hastings River Drive in proximity to the proposed WWTP and pipeline components:

– S425 – Cooperabung Drive to St Joeseph's Regional College
– S427 – Gum Scrub Road to Hastings Public School
– S563 – Tracking Point Public School to Rollands Plains Road
– S580 – St Joseph's Regional College to Telegraph Point
– S581 – Hastings Public School to Gum Scrub Road

Generally, the volumes of buses traversing the roads in proximity to the WWTP site are low, and no other forms of public transport exist in proximity to the proposed WWTP. Further detail including the wider bus network in Port Macquarie in relation to the project area, is provided in Technical Report 7 – Traffic and Transport Assessment.

13.2.7 Construction access

Detail regarding the proposed access and egress routes for the project during both construction and operation is provided in Chapter 3 (Project description).

13.3 Potential impacts – construction

13.3.1 Road network impacts

The potential road network impacts associated with the construction of the project are detailed below in Table 13-2.

Table 13-2 Traffic generation and traffic distribution impacts – construction

Traffic generation	The construction activity for the WWTP is expected to generate up to 166 vehicle movements during AM and PM peak hours.
	Construction of the project is expected to require an average workforce of approximately 60 – 100 FTE employees. This is expected to typically generate approximately: – 110 light vehicles would arrive at construction site and 12 light vehicles would depart the construction site in the AM peak hour (typically around 6:00 am – 7:00 am). – 110 light vehicles would depart construction site and 12 light vehicles would arrive at the construction site in the PM peak hour (typically around 5:00 pm – 6:00 pm). – Up to 22 heavy vehicles will arrive and depart from the site during both the AM and PM peak hour. Further detail regarding these trips during the AM and PM peak hour, including a display, is provided in Technical Report 7 – Traffic and Transport Assessment.
Traffic distribution	Light vehicle trips would be generated by workers with 60% expected to originate from Port Macquarie, 15% from Kempsey and 15% from Taree LGA's, and 10% expected to be fly in fly out workers staying in short term accommodation in Port Macquarie, as follows: – Port Macquarie: 70% of construction light vehicles would access/egress the site via the intersection of Hastings River Drive and Fernbank Creek Road (to and from the east). – Kempsey: 15% of construction light vehicles would access/egress the site via the Pacific Highway, Winery Drive, Hastings River Drive and Fernbank Creek Drive (to and from the west). – Taree: 15% of construction light vehicles would access/egress the site the Pacific Highway, Winery Drive, Hastings River Drive and Fernbank Creek Drive (to and from the west).
	All heavy vehicles would access the WWTP site from the Pacific Highway via Hastings River Drive. Furthermore, 70% of heavy vehicles would access and exit egress the site from the north, and 30% of heavy vehicles would access and exit the site from the south (via the Pacific Highway).

13.3.1.1 Construction of the WWTP

The intersections of interest (refer to section 13.2.3) were analysed accounting for a five-year horizon (2028) in accordance with the expected construction timeframes (refer to the Technical Report 7 – Traffic and Transport Assessment for further detail).

The data indicated that during peak construction periods in the 2028 horizon year, the intersections of interest would continue to work with an acceptable LoS. Accordingly, the impacts of the project on the adjoining road network are expected to be negligible during construction.

However, there would be a slight increase in delay at the Hastings River Drive / Fernbank Creek Road intersection on the minor approaches departing the site. These delays would be minor and were calculated to have a level B LoS, which corresponds with acceptable delays and spare capacity. The LoS criteria applied to the study is specified in Technical Report 7 – Traffic and Transport Assessment.

13.3.1.2 Construction of pipeline

The construction of the proposed pipeline components would be undertaken utilising both open trenching and HDD methods, as detailed in Chapter 3 (Project description). The combination of these methods would assist with minimising impacts to traffic and sensitive environmental issues. Approximately 7.3 kilometres of the pipeline components would be constructed via HDD methods along the following roads:

– Oxley Highway west of Fernhill Road
– Oxley Highway north of Wrights Road
– Central Road north of Barton Crescent

The use of HDD would enable the roads to operate with bi-directional flows and minimise potential impacts of road users. However, localised reduction in speed limits may be required to support the safety of construction workers. A traffic management plan would consider critical components of HDD installations, including staging and mobilisation, to consider further potential impacts associated with HDD challenges, particularly the maintenance of traffic operations. Approximately 24 kilometres of the pipeline components would be constructed via open trenching methods. It is expected that trenching would occur in verges next to roads within Port Macquarie (detailed in Chapter 3 (Project description). As the construction of the pipeline would be undertaken in stages and move consecutively across the routes, With the implementation of mitigation measures provided in Section 13.5, impacts associated with constriction of pipeline components are considered to be short term and minor.

To support the movement of heavy vehicles and plant, and to ensure the safety of construction workers associated with trenching activity, localised lane closures may be required. Any lane closures would require the provision of a detailed traffic guidance scheme as part of the wider traffic management plan. As such, a traffic management plan would include information on the timing of road closures, detours, lane shifts and the duration of these closures, including potential impacts on businesses and local residents, and provide strategies to mitigate these impacts.

13.3.1.3 Construction of satellite compounds

As part of the construction process, pump stations and associated infrastructure would require upgrading, resulting in several smaller satellite construction compounds. Eight additional sites have been identified to support the construction of the pipeline and are shown in Figure 1-1. The locations of compounds expected duration of construction works and expected maximum daily vehicle activity at the satellite compounds is detailed in Table 13-3.

Table 13-3 Satellite compound construction vehicle capacity

Compound location	Light vehicles	Heavy vehicles
Major Innes Road /John Oxley Drive	10-20	20-30
Oxley Highway Racecourse	20-30	40
John Oxley Drive (-31.458952, 152.869014)	8	4
176 Hastings River Drive	16	6
71 Hastings River Drive	50	80
Lincoln Road (Newport Village)	8	2
-31.442971, 152.844456 Thrumster Street Access	12	10
Thrumster Street / John Oxley Drive	12	2

The construction duration for these compounds ranges from two to six months and would result in a maximum increase of 50 light vehicle and 80 light vehicle movements daily. Workers would be expected to access the sites in the morning and depart the sites in the afternoon, while trucks would be expected to access/egress the sites over the course of the day.

The phasing of construction at satellite construction compounds would be developed by the appointed construction contractor. The data in Table 13-4 indicates that in accordance with their capacity, the vehicle activity associated with the satellite compounds would have a negligible impact on the adjoining road network. Additionally, the size and nature of these construction sites are unlikely to impact traffic flows and the experience of road users. However, localised reduction in speed limits may be required to support the safety of construction workers.

The configuration of these sites during construction would be determined by the contractor but would allow for the parking of vehicles, the delivery and storage of plant and equipment and construction materials.

13.3.2 Road upgrades

The roads included in the key access routes were deemed suitable to accommodate the expected construction vehicle activity. However, the following road upgrades are proposed in proximity to the proposed WWTP site:

– Seal and widen a section of unsealed road (south of Fernbank Creek Road) to support access and egress to and from the WWTP.
– Construct a flood-proof access road through the easement from the adjoining property (as shown in Figure 3-1).

These upgrades have the potential to result in localised short-term impacts such as reduced speeds, and temporary lane closures at the intersection with Fernbank Creek Road. However, as the construction period at these road upgrade locations is short term and would be conducted in a staged approach, impacts to traffic are expected to be negligible.

These upgrades are illustrated in Figure 13-2. Improvements are not expected on any other roads, junctions, or parking areas during the construction phase.

Paper Size ISO A4

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Thrumster WWTP access road upgrade

FIGURE 13.2

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Print date: 22 Jul 2024 - 11:15

Data source: PMHC: Infrastructure data, 2023; BECCA: WWTP Design, 2024; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/12/2023. Created by: fmackay

13.3.3 Heavy vehicle use

The largest vehicle expected to access the WWTP site during construction is 26 metre B-double. As detailed in Section 13.2.5 the unrestricted 26 metre B-double routes traverse the Pacific Highway and Oxley Highway.

The only road that large heavy vehicles are expected to use that does not form part of an authorised 26-metre B-double route, is Fernbank Creek Road. The swept path analysis undertaken as part of the TTA indicates that under current road conditions and speed limits, safety issues are present at the Fernbank Creek Road/Hastings River Drive intersection when considering the manoeuvre of a 26-metre B-double vehicle. The analysis concluded that there is insufficient space for a 26-metre B-double truck to undertake this manoeuvre whilst staying within the westbound lane on Hastings River Drive.

However, an additional analysis was undertaken whereby a 26-metre B-double manoeuvres across the eastbound lane and merges into the westbound lane. Although this is possible, it would require the heavy vehicle to occupy both lanes of Fernbank Creek Road at the intersection of Hastings River Drive and therefore poses a potential impact to oncoming traffic.

To mitigate this potential impact to oncoming traffic and ensure road safety, it is recommended that any articulated heavy vehicle access (semi-trailers or longer) to Fernbank Creek Road for the project be limited to movements to/from the east along Hastings River Road, unless this is provided under traffic control.

Based on the outcomes of the swept path analysis, further consultation and information may need to be provided to either Council or TfNSW, including a Traffic Guidance Scheme at this location.

The following is recommended to mitigate potential impacts associated with the manoeuvres of heavy vehicles and traffic on Hastings River Drive and Fernbank Creek Road:

– A construction zone speed reduction to 40 km/h on both sides of Hastings River Drive in proximity to Fernbank Creek Road.
– The use of signage, i.e. Trucks Turning.
– The potential use of traffic controllers to stop vehicles on Hastings River Drive to support the turning manoeuvres of heavy vehicles.

13.3.4 Impacts to road assets

For the HDD and trenching works, all relevant licences and permissions for work on or around other assets, such as roads, are required to be obtained for all work prior to the commencement of any construction activities. This includes any required permission from Council for works on Council owned lands and roads, as well as acquiring any road occupancy licences for work on and around TfNSW maintained roads.

Where drilling/boring work under existing roads or trenching work is proposed to cross existing roads, appropriate consent from the body managing the asset is to be obtained prior to the commencement of any work, with all appropriate details of the construction works to be provided.

Further consultation and information may need to be provided to either Council or TfNSW as a part of the approval process, including Traffic Guidance Scheme (TGS) and vehicle movement plans, in order to ensure that the impact on assets is mitigated. Any regulations required by the Council or TfNSW as a part of the consultation process are also to be followed strictly throughout the construction at the site, including the depth of cover required underneath the asset.

13.3.5 Impacts to active transport

There are no dedicated active transport facilities on the roads in proximity to the WWTP site. Therefore, construction of the project is expected to have a negligible impact on walking and cycling routes.

Potential impacts to active transport are mainly associated with the construction of the pipeline components, and trenching on roads may result in temporary closure. However, alternative pedestrian facilities and paths are available to support the temporary closure of walking paths during trenching activities. A summary of the roads that are expected to experience trenching activities and the active transport facilities expected to be available is included below in Table 13-4.

Table 13-4 Alternative pedestrian facilities during trenching

Road	Active transport facilities
The Binnacle	Grassed verges provided on both sides of the road.
Hastings River Drive	Pedestrian footpaths are provided along the southern side of the road. A storage facility is provided in the median of Hastings River Drive at the intersection with New Port Island Road to support the safe crossing activities of pedestrians.
Fernhill Road	A pedestrian footpath is provided on the eastern side of Fernhill Road north of Fernvalley Parade. Grassed verges are provided on the eastern side of Fern Hill Road between Acacia Avenue and Fernvalley Parade.
Acacia Avenue	A grassed verge is provided on the southern side of the road. Pedestrian footpaths are not provided on the northern side of the road.
Barton Crescent	Footpaths and grassed verges are provided along the northern side of the road.
Lady Nelson Drive	Grassed verges are typically provided on the southern side of the road.
Oxley Highway	As a highway, active transport facilities are not available on either side of the road.
John Oxley Drive	A grassed verge is provided on the north-western side of the road.
Tulloch Road	Footpaths are provided on the eastern side of the road.

Based on Table 13-4, alternative pedestrian facilities/paths are available to support the temporary closure of walking paths during trenching activities.

Following the confirmation of the pipeline route, traffic controllers, signage and pedestrian barriers may be used as required to support the safe movements of pedestrians.

With regard to the construction of satellite compounds, potential impacts on active transport facilities are expected to be minor as walking and cycling facilities in proximity to the compounds would be maintained. The key potential impacts to active transport infrastructure during compound construction is associated with the safe movement of pedestrians and cyclists along 71 Hastings River Drive, which is in proximity to adjoining retail facilities. To ensure safe movements, traffic controllers would be used to guide pedestrians/cyclists on Hastings River Drive as required.

13.3.6 Impacts to public transport

There are no public transport services operating in proximity to the WWTP. As detailed in Section 13.2.6, a small number of buses operate on Hastings River Drive to the north of the WWTP site. It is noted that the majority of construction vehicle activity is not expected to coincide with the operation of school buses. Therefore, the construction vehicle activity associated with the construction of the WWTP is expected to have a negligible impact on public transport services.

A review of these routes indicates that bus services operate on the Oxley Highway, John Oxley Drive, Hastings River Drive and Major Innes Road. The satellite construction compounds on John Oxley Drive, Oxley Highway and Hastings River Drive may result in minor increases in bus travel times. However, typically the impacts on public transport services are expected to be minor. The potential impacts to public transport are largely associated with the construction of the pipeline components. A summary of the public transport services and infrastructure on sections of roads where trenching activity would occur is provided in Table 13-5.

Table 13-5 Potential public transport facilities impacted

Road	Public transport facilities
The Binnacle	No bus services or bus stops in trenching area.
Hastings River Drive	341 bus service and bus stops located on both sides of road near Hastings River Drive.
Fernhill Road	340 and 341 bus services and no bus stops located in trenching area.
Acacia Avenue	No bus services or bus stops in trenching area.

Road	Public transport facilities
Barton Crescent	No bus services or bus stops in trenching area.
Lady Nelson Drive	No bus services or bus stops in trenching area.
Oxley Highway	335 and 336 bus services and no bus stops.
John Oxley Drive	336 bus services and no bus stops.
Tulloch Road	No bus services or bus stops in trenching area.

In summary:

– Bus services on Kemp Street and Hastings River Drive may result in minor increases in bus travel times.
– Bus stops on Kemp Street may require temporary relocation during trenching works.
– Construction along Hastings River Drive and Oxley Highway would result in minor increases in bus travel times.

13.3.7 Impacts to parking

As on street parking is not available on the roads in the general proximity to the WWTP site, parking would be provided at the adjacent satellite compound to accommodate parking of construction and worker vehicles.

Potential impacts on parking are largely associated with the construction of the pipeline components. Construction works may result in the temporary loss of on-street parking, including on The Binnacle, Kemp Street, Hastings River Drive, Fernhill Road, Acacia Avenue, Barton Crescent, Tulloch Road and Lady Nelson Drive. However, the temporary loss of on street parking is expected to have a minor impact to the availability of on street parking spaces as:

– The residences on these roads typically have driveways and garages, and residents are not required to park on the street.
– Trenching works would typically only impact parking on one side of the street. Visitors would be able to park on the other side of the street or on other nearby residential streets, as required.

Where feasible, trenching works should be scheduled to occur outside of the peak hours to minimise impacts on local residents and other road users.

13.3.8 Impacts on access to surrounding development

A small number of rural residential properties are located on Fernbank Creek Road in proximity to the WWTP. Access and egress to and from these residences are not expected to be impacted by the project's construction activities. Accordingly, the impacts of construction vehicles on other nearby developments are expected to be negligible. With regard to the construction of the pipeline components of the project, ancillary pipelines are located in proximity to, or at the frontage of, the following:

– Port Macquarie Airport
– Port Macquarie Racing Club
– Port Macquarie Shooting Ranges
– Radio Control Car Club
– Retail and commercial facilities on Hastings River Drive
– Commercial facilities on Barton Crescent
– Port Macquarie Base Hospital
– A number of residential streets.

Access to these land uses would be maintained throughout the pipeline construction works. Accordingly, the impacts of construction vehicles on other nearby developments are expected to be negligible. It is anticipated that some assets (Council or other asset utilities) would potentially be required to be relocated to facilitate the installation of the pipeline. Determination of any required asset relocation would be undertaken during detail design. Liaison with other utilities would be carried out after determination and any adjustment to the construction methodology. Asset relocation would be undertaken in accordance with relevant design and safety guidelines and standards.

13.4 Potential impacts – operation

13.4.1 Road network

Once fully operational it is anticipated that three to four FTE employees would be required to manage the onsite operations at the WWTP, which is similar to the existing Port Macquarie WWTP. The impacts of the WWTP operational traffic on the adjoining road network are expected to be negligible.

13.4.2 Operational parking

Parking spaces have been provided near the ancillary site in the WWTP for operational staff. Maintenance checks on SPSs during operation are not anticipated to result in potential impacts to parking in proximity to SPSs, as vehicles would utilise existing street parking for short periods.

13.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise traffic and transport impacts of the project are detailed in Table 13-6.

Table 13-6 Mitigation and management measures – traffic and transport

ID	Impact	Environmental safeguard	Responsibility	Timing
T1	Design	The design will continue to be refined to avoid or minimise on the surrounding road and transport network and property access, as far as reasonably practicable.	Council	Pre-construction
T2	Construction traffic	A traffic management plan (TMP) will be developed and implemented as part of the construction environmental management plan. The TMP is to include as a minimum: – Confirmation of haulage routes and access point. – Measures to maintain access and capacity to existing roads. – Measures to minimise conflicts with pedestrians and cyclists. – Traffic control measures including signage at appropriate locations to notify road users of increase traffic volumes. – A response plan for any construction related traffic incidents. – Consultant with emergency to ensure that procedures are in place to maintain safe, priority access for emergency vehicles. – Relevant traffic safety measures including driver induction, training, safety measures and protocols.	Contractor	Pre-construction, Construction
T3	Induction	All personnel will be inducted on the requirements of the TMP.	Contractor	Pre-construction, Construction

ID	Impact	Environmental safeguard	Responsibility	Timing
T4	Temporary lane/road closure	Road closures will be undertaken with the approval of the appropriate road authority and under the relevant road occupancy licence to be obtained prior to construction. Where feasible, road closures will be planned outside of the traffic peak to minimise the impact on the road network.	Contractor	Pre-construction, Construction
T5	Car parking	Sufficient car parking spaces will be provided within the project construction site and compounds to accommodate anticipated construction parking requirements.	Contractor	Construction
T6	Road safety – driver related	A Code of Conduct applicable to all construction workers will be developed and implemented which will define acceptable driver behaviour. The purpose of the Code of Conduct is to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised. The Code of Conduct will be developed as part of a wider suite of documents under work health and safety requirements.	Contractor	Pre-construction, construction
T7	Community and stakeholder consultation	Community and stakeholder communication strategies will be established and implemented to notify the affected communities, visitors, emergency services and relevant road authorities in advance of any disruptions to traffic, anticipated delays, disruptions to property access and changes to travel routes. The strategies will be developed including details on communication channels, frequency of communication and response measures in relaying information to the community and stakeholders.	Contractor	Pre-construction, construction
T8	Consultation	Implement face-to-face consultation with landowners and tenants who will be directly affected, explaining construction processes and impacts to the surrounding area, answering questions they may have, and providing contact details that can be used for the project's entirety.	Contractor	Pre-construction, construction
T9	Environmental control	– All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or debris depositing onto the roadway during travel to and from the site, including but not limited to construction rumble strips/wheels wash at the site egress location. – All vehicles leaving the site would be cleaned of materials that may fall on the roadway before they are allowed to leave the site. – The lead contractors will monitor the roads leading to and from the site and take all necessary steps to rectify any road deposits caused by site vehicles to maintain the safety of all road users. – Roads leading to and from the project area to be monitored for any road deposits caused from site vehicles and will be rectified as soon as possible. – Vehicles operating to, from and within the site shall do so in a manner which does not create unreasonable or unnecessary noise or vibration. – Public roads and access points will not be obstructed by any materials, vehicles, refuse skips or the like, under any circumstances.	Contractor	Construction

ID	Impact	Environmental safeguard	Responsibility	Timing
		– All subcontractors must be inducted by the lead contractor to encourage that all the relevant procedures are met. – Water trucks will be used to supress dust as required.		
T10	Staff induction	All staff and subcontractors engaged on site will be required to undergo a site induction. The induction will outline the requirements on the CTMP, including site access routes, environmental and occupational health and safety responsibilities, emergency procedures, potential carpooling opportunities and vehicle height restriction under the power lines. Additionally, the Site Manager will discuss CTMP requirements regularly as a part of “toolbox talks”.	Site Manager	Pre-construction
T11	Occupational health and safety	– Any workers required to undertake works or traffic control shall be suitably trained and hold the required accreditation to carry out works on site and will also be site inducted. – All traffic control personnel will be required to hold TfNSW accreditation in accordance with the TfNSW TCAWS manual.	Site Manager	Pre-construction
T12	Contact of emergency services	In the event of an emergency related construction traffic incident on the public road network, it will be the responsibility of the Site Manager to ensure that emergency services are notified. The emergency services include but are not limited to: – Fire – Ambulance – Police – Phone “000” in cases of emergency Furthermore, it is the responsibility of the Site Manager to advice the emergency services of any restriction of vehicular access to the public and private areas (1) one week prior to its implementation.	Site Manager	Pre-construction, construction, operation
T13	Certificates and approvals	Approval is to be obtained from TfNSW, Council and other relevant authorities as required. Approvals that may need to be obtained for items such as but not limited to: – Roadwork speed zone – Council Road opening permits – Road occupancy approvals – Hoarding/fencing approvals – Crane and barricades – Oversize and Articulated Vehicle use on local roads	Contractor	Pre-construction
T14	Obtaining road occupancy approvals	The Construction Contractor will obtain the necessary approvals, as required by the *Roads Act 1993* and NSW Traffic Acts and regulations, prior to conducting any works. The Construction Contractor is required to seek the concurrence of the relevant road authority prior to undertaking works. The Construction Contractor will ensure that all public roads to be used by construction traffic will be identified prior to construction and that management methods will be undertaken so that construction traffic uses the identified roads.	Contractor	Pre-construction

ID	Impact	Environmental safeguard	Responsibility	Timing
		The three specific areas of approval will include: 1. All construction works and/or any changes to existing infrastructure. 2. The installation and/or changes of any regulatory traffic control device. 3. Occupation of the road network to conduct works, and the associated installation of temporary traffic control devices.		
T15	Roadwork speed limits	Temporary roadwork speed limits are one of many traffic controls that can be implemented to manage the speed of traffic approaching and passing through a work site. Roadwork speed zones must be logical and credible, as well as enforceable. When considering the use of roadwork speed zones, they will: – Only be used where they are self-enforcing or will be enforced. – Not be used alone but with other traffic control signs and devices. – Not be used in place of more effective traffic controls. – Only be used while road works are in progress or the lower speed road conditions exist.	Contractor	Pre-construction, construction
T16	Driver's code of conduct	A driver's code of conduct described how vehicles associated with construction activities are expected to behave. Typically, they will include: – The designated haulage routes and any restrictions. – Locations of rest stops. – Details around speed limits. – Protocols for dealing with the general public. – Emergency response protocols. – Details of driver responsibilities, including: • Ensuring that they are not suffering from fatigue or under the influence of drugs or alcohol. • Ensuring loads are appropriately covered. • Ensuring the use of appropriate personal and protective equipment. • Understand and abide by all road rules, including speed limits, road signs, use of seatbelts, avoiding taking unnecessary risks. • Required distances between vehicles to prevent convoying.	Drivers	Pre-construction, construction, operation

14. Air quality

This chapter provides a detailed summary of the assessment of air quality potential impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures. The full assessment is provided in Technical Report 8 – Air Quality Assessment (GHD, 2024).

14.1 Assessment approach

14.1.1 Legislation and policy context

The plans, policies and guidelines that were considered for the Air Quality Impact Assessment (AQIA) include:

- *Environmental Planning and Assessment Act 1979.*
- Environmental Planning and Assessment Regulation 2021.
- NSW *Protection of the Environment Operations Act 1997* (POEO Act).
- NSW Protection of Environment Operations (Clean Air) Regulation 2021 (POEO Clean Air Regulation).
- National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM).
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (NSW EPA 2022b).
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA 2022a) (the Approved Methods).
- Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management, [IAQM] 2024) (IAQM guidance).

14.1.2 Methodology

14.1.2.1 Project area

The project area for the AQIA comprise a two-kilometre buffer around the project area. This includes the proposed WWTP site, compound and laydown areas, proposed pipeline routes, the adjacent road network and area surrounding the project area.

14.1.2.2 Key tasks

The AQIA involved:

- Review of the existing environment (land use, ambient air quality and meteorology).
- Review of the proposed construction methodology including equipment and processes, and operational activities.
- Identification of construction and operational activities which may lead to emissions.
- Identification of nearby sensitive receptors to construction and operational activities.
- A qualitative construction assessment with a focus on particulates and dust.
- A quantitative operational assessment including a review of recommended separation distances, preparation of an odour emissions inventory using odour sampling data from similar WWTPs in NSW, followed by dispersion modelling to predict odour impacts on the surrounding area.
- Identification of project specific mitigation measures to manage the potential for dust and odour impacts.

The assessment has been completed with consideration to the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA 2022a) (the 'Approved Methods'). The qualitative construction dust assessment was completed in accordance with the Guidance on the assessment of dust from demolition and construction (IAQM 2024).

14.1.2.3 Assessing construction emissions

The generation of dust and particulate matter are the primary pollutants during the construction phase of the project. A risk-based assessment in accordance with the IAQM guidance was undertaken to assess potential particulate impacts during the construction of the project. The guidance states that the assessment is only required where there is:

– A 'human receptor' within 250 metres of the boundary of the site, or 50 metres of the route(s) used by construction vehicles on the public highway up to 250 metres from the site entrance.
– An 'ecological receptor' within 50 metres of the boundary of the site, or 50 metres of the route(s) used by construction vehicles on the public highway up to 250 metres from the site entrance.

Due to the differences in construction methodology, the construction assessment has been split into two parts:

– Construction of the WWTP.
– Construction of the pipelines – recycled water pipeline, sewer rising main, return effluent, power and communication services.

Potential impacts associated with construction emissions are addressed in Section 14.3.1.

14.1.2.4 Assessment criteria

14.1.2.4.1 Dust assessment criteria

The dust assessment criteria for the project were taken from the Approved Methods (NSW EPA 2022b). The objective of the criteria is ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution. There is an obligation during construction and operation of the project to comply with the criteria.

Relevant assessment criteria for the primary pollutants associated with construction of the project are presented in Table 14-1. The criteria apply to the total impact (increment plus background) and must be reported as the 100th percentile (maximum).

Table 14-1 Air quality impact assessment criteria

Pollutant	Averaging period	Impact location	Impact type	Criteria (µg/m^3)
Total suspended particles (TSP)	Annual	Sensitive receptor	Cumulative	90
Particulate matter (PM_{10})	24 hour	Sensitive receptor	Cumulative	50
	Annual	Sensitive receptor	Cumulative	25
Particulate matter ($PM_{2.5}$)	24 hour	Sensitive receptor	Cumulative	25
	Annual	Sensitive receptor	Cumulative	8
Deposited dust	Annual (maximum increase)	Sensitive receptor	Cumulative	2 g/m^2/month
	Annual (maximum total)	Sensitive receptor	Cumulative	4 g/m^2/month

Note:

– TSP (particles with generally up to 100 micrometres in diameter): for assessment against predominantly nuisance-based criteria.
– PM_{10} (particles with a diameter of 10 micrometres or less): for assessment against health-based criteria. These particles are small enough to pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs.
– $PM_{2.5}$ (particles with a diameter of 2.5 micrometres or less): for assessment against health-based criteria. These particles are small enough to get deep enough into the lungs and bloodstream. There is sufficient evidence that exposure to PM2.5 over long periods (years) can cause adverse health effects. Note that PM_{10} includes $PM_{2.5}$.
– Deposited dust (dustfall): refers to air particles that settle out over a given area and time under the influence of gravity. Measures to assessed if an emission source is causing a nuisance.

14.1.2.4.2 Odour assessment criteria

The odour assessment criteria for the project were taken from the *Technical Framework for Assessment and management of odour from stationary sources in NSW* (the Technical Framework) (NSW Department of Environment and Conservation [DEC] 2006). The odour criteria range from two odour units (OU) for densely populated areas up to seven OU for single isolated residences and can be seen in Table 14-2.

Table 14-2 Odour assessment criteria

Population of affected community	Odour performance criteria (OU) (nose response odour certainty units at 99th percentile[1])
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2
Note 1: This is a prediction of the odour level that may occur 1% of the time, or one hour in one hundred. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receptors can be minimised	

The maximum separation distance specified for a wastewater treatment plant recommended under NSW EPA guidelines is 520 metres. Several receptors are within this distance (refer to section 14.2.1), therefore further detailed assessment was undertaken to provide a more refined estimate of odour impacts on the surrounding area. Project specific odour criteria were determined based on population density at the identified sensitive receptors in accordance with the Technical Framework (refer to Technical Report 8 – Air Quality Assessment).

As part of the detailed assessment, dispersion modelling for three operational scenarios was undertaken to assess the effectiveness of an odour control unit (OCU) on the predicted odour impacts. The scenarios are as follows:

– Scenario 1: No OCU, all odour emissions directly from each source
– Scenario 2: Only air from inlet works, septage receival and sludge loading captured by the OCU
– Scenario 3: Air from the inlet works, septage receival, sludge loading and distribution chamber loading captured by the OCU

Impact assessment was undertaken by comparison of the predicted odour concentrations with the NSW EPA guidance. Sensitive receptors near the WWTP are all low-density residential receptors (refer to Section 14.2.1). Assuming four people per residence, an estimated 60 people may be affected by operation of the WWTP, therefore a corresponding odour criterion of 4 OU was adopted. Further detail on the project specific criteria and methodology used to assess the potential odour impacts of the proposed WWTP is available in Technical Report 8.

14.2 Existing environment

14.2.1 Sensitive receptors

Sensitive receptors are defined as a location where people are likely to work or reside. This may include a dwelling, school, hospital, office or public recreational area. All identified sensitive receptors within one kilometre of the proposed WWTP are residential, located to the north and west of the project. These receptors are located over 250 metres from the WWTP along Fernbank Creek Rd, Willow Crescent, and Hastings River Drive.

Land to the east and south is predominantly undeveloped bushland (refer to Figure 14-1). Where there is more than one receptor in a residential cluster, only one receptor was been identified. These are noted as residential clusters in the receptor type. The sensitive receptors and their location and distance from the project is detailed in Technical Report 8 – Air Quality Assessment.

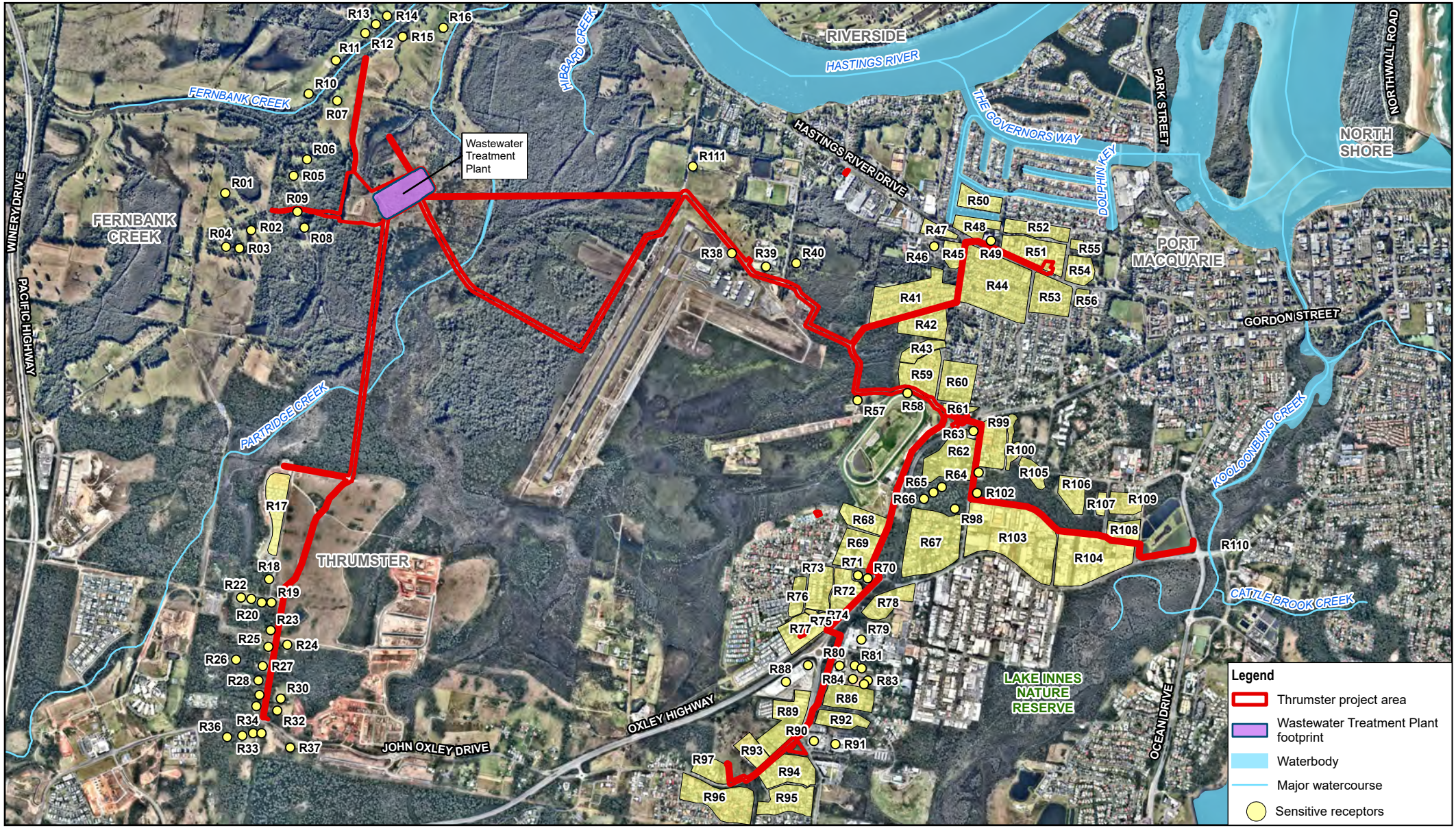
Clusters of residential receptors are predominantly situated within the vicinity of the proposed pipelines and along the southern portion of the recycled water main (towards John Oxley Drive), the southern section of the sewer rising main (along the Oxley Highway and John Oxley Drive), Avenue) and the northern section of the sewer rising main (along Kemp Street and Hastings River Drive) (refer to Figure 14-1). Several clusters of industrial receptors are situated along the eastern portion of the return effluent to Kooloonbung Creek (along Acacia Avenue) (refer to Figure 14-2). Additionally, several sensitive receptors were identified to be located within 20 metres of section of the proposed pipelines and are shown in Figure 14-2.

14.2.2 Climate and meteorology

The nearest meteorological station to the project is the Bureau AWS located at Port Macquarie Airport (ID: 060168) located approximately 1.5 kilometres southeast of the project site. Data from when this station was commissioned in October 2020 through to the end of 2023 has been reviewed. Table 14-3 provides a summary of the key climate statistics and wind conditions reported at each of this weather stations. Detailed findings are described in Technical Report 8 – Air Quality Assessment.

Table 14-3 Key climate and meteorological conditions

Feature	Condition
Wind	The average wind rose over the period 2020 to 2023 was generated from information obtained from the BoM. The following features are observed: – The average wind speed is moderate at 2.9 m/s. – Calm conditions (wind speeds less than 0.5m/s) occur 6.1% of the time. – Winds predominantly occur from the northeast, west and southwest. – High wind speeds (winds greater than 5 m/s) were not observed to occur. The highest wind speed identified was a maximum of 4.2 m/s after sunrise from the western quadrant. – The winds display a strong diurnal pattern, which is evidence of sea breeze conditions at the site.
Temperature	The mean monthly temperature statistics measured at the Port Macquarie Airport station from 2020-2023 were examined: – Temperatures in the region wide range, which is moderated somewhat by the site's proximity to the coast. – The average maximums in December to March are the highest recorded temperatures, 26°C, and the minimum, 6°C, occurs in June. – The mean temperature is approximately 23°C in January and 12°C in June.
Rainfall	The monthly average rainfall and days of rain measured at the Port Macquarie Airport Station from 2020 to 2023 showed: – No discernible seasonal pattern of rainfall. – That the highest rainfall occurs in autumn and summer, though there is also high rainfall in October. – The highest number of days with rain also occur during this time. Minima occur in winter (June and August), which also represent the lowest number of days with rain.
Stability class	Atmospheric stability is a calculated metric that determines whether air will have a tendency to rise or will resist vertical motion. The categories range from A to F, where A is very unstable (air is very likely to rise) and F is stable (air has little vertical movement). Categories are determined according to the surface wind speed, incoming solar radiation, and nighttime cloud cover. Stability classes were calculated from the measurements at the Bureau's AWS at Port Macquarie Airport from 2020-2023. It was identified that Class F (very stable) conditions occur most frequently (34% of the observations), and Class A (very unstable) occur the least frequently (<1%).



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Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Sensitive receptors - air quality

FIGURE 14.1

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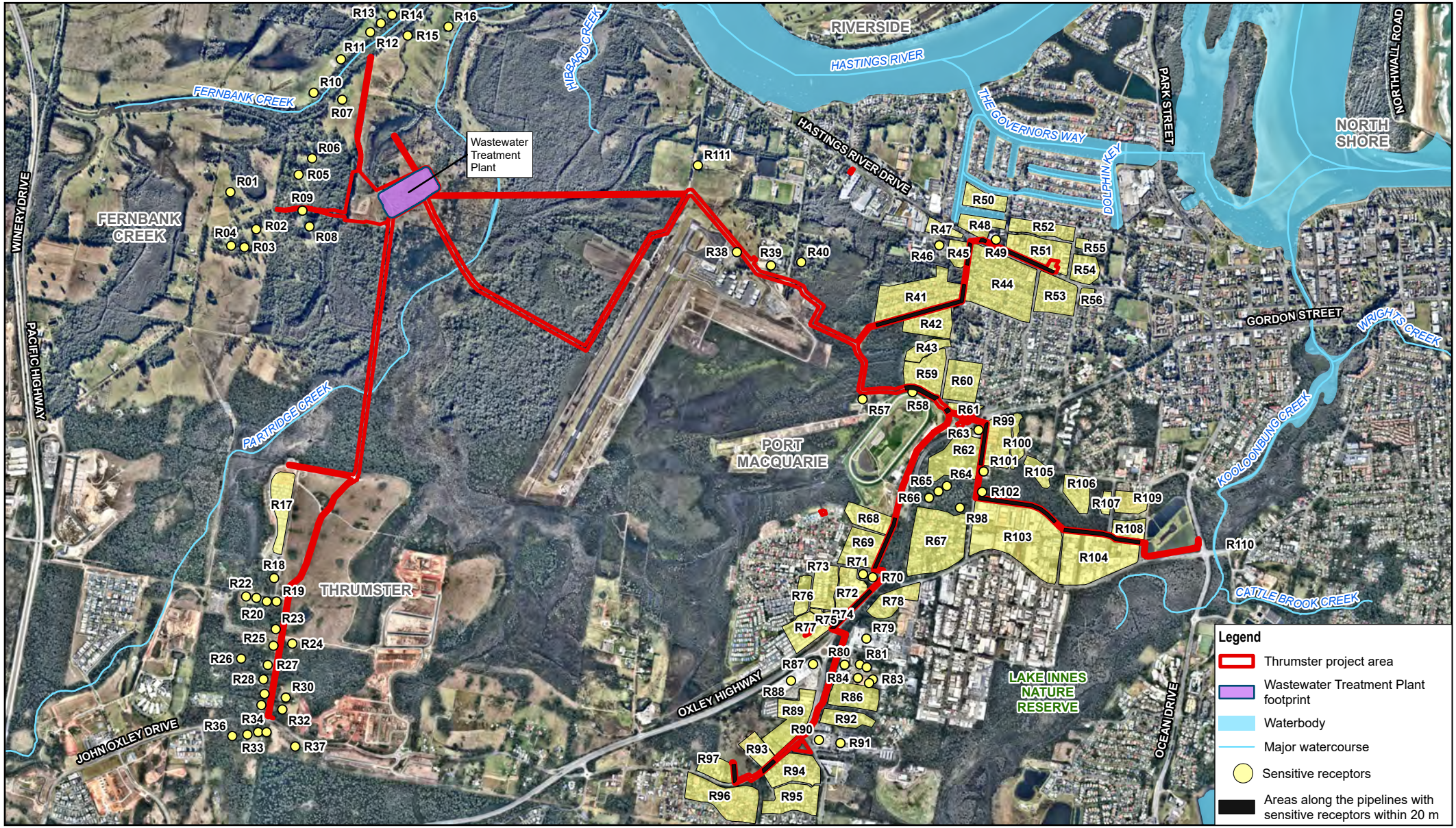

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Environmental Impact Statement

Sensitive receptors within 20 metres of pipeline – air quality

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 14.2

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14.2.3 Background air quality

14.2.3.1 Available observations

A summary of the ambient air quality data recorded at the Port Macquarie air quality monitoring station (AQMS) located approximately 3.5 kilometres southeast of the WWTP site, is provided in Table 14-4.

Annual average concentrations of both $PM_{2.5}$ and PM_{10} were both elevated in 2019 and 2020 due to bushfires in the state. Data from the more recent years (2021-2023) show better air quality and may be due to higher than average rainfall and minimal major bushfire events.

Annual average PM_{10} and $PM_{2.5}$ concentrations are below their respective air quality goals of 25µg/m^3 and 8µg/m^3 for 2020 to 2023.

Table 14-4 Summary of available background air quality data recorded by the Port Macquarie AQMS

Pollutant	Averaging Period	Concentration (µg/m^3)				
		2019	2020	2021	2022	2023
PM_{10}	Maximum 24 hour average	479.7	250.1	32.0	26.8	36.6
	Annual average	23.4	13.5	10.2	8.5	11.5
$PM_{2.5}$	Maximum 24 hour average	441.9	220.4	14.6	9.7	30.6
	Annual average	15.0	6.1	4.3	3.1	4.9

14.2.3.2 Facilities reporting to the NPI

The National Pollutant Inventory (NPI), operated under the *National Environment Protection (National Pollutant Inventory) Measure 1998*, provides publicly available information about emissions of 93 pollutants throughout Australia. Facilities that exceed prescribed threshold values are required to report their emissions to the NPI on a yearly basis.

A review of the area surrounding the project site indicated there are three facilities within five kilometres of the WWTP site. These are described in Table 14-5.

Table 14-5 Facilities reporting to the NPI

Facility Name	Activity	Emissions	Distance and direction from project
Air BP Port Macquarie	Petroleum Product Wholesaling	Total volatile organic compounds	2.3 km southeast
Origin Port Macquarie LPG Terminal	Storage and distribution of LPG	Total volatile organic compounds	4.8 km southeast
Sancrox Quarry Wauchope	Quarrying of aggregate - drilling, blasting, crushing and screening processes	Carbon monoxide, sulphur dioxide, total volatile organic compounds, particulate matter	2.9 km southwest

The pollutants emitted from these facilities do not overlap with those anticipated from construction or operation of the WWTP, therefore cumulative impacts are not expected to occur.

14.3 Potential impacts – construction

14.3.1 Construction emissions

Contamination in excavated soils or the presence of acid sulfate soils (ASS) can lead to emissions of odour during construction. Reference to ASS mapping shows areas of both high and low probability of occurrence of ASS along segments 1, 2, 3, 4 and the beginning of segment 5 (refer to Chapter 15 (Soils and contamination)).

Additionally, several portions of pipeline segments are surrounded by the wetlands of Patridge Creek and Fernbank Creek (refer to Chapter 7 (Water quality and hydrology)). Construction in these areas where a high probability of ASS occurs has risk of releasing contaminants (predominantly hydrogen sulphide) that have the potential to cause odour impacts.

Any odours would be localised and temporary and would be minimised by controlling the amount of exposed soil or sediment. Odour mitigation measures are specified in Section 14.5 to manage potential emissions of odour.

14.3.1.1 Construction of the WWTP

As noted in Section 14.2.1, the nearest receptors to the WWTP site are located over 250 metres west. Therefore, a detailed construction assessment was not required for this part of the construction as per the IAQM guidance (refer to Technical Report 8 – Air Quality Assessment).

The scale and intensity of the proposed construction activities would be the highest at the WWTP site and dust emission magnitude was found to be higher at the WWTP than the pipeline routes. For the WWTP, emission magnitudes associated with demolition was small, earthworks and construction were found to be medium and track out was determined the largest contributor to potential dusk emissions.

Construction activities are considered a low risk for dust soiling and human health impacts, associated with the emission of particulate matter (refer to Section 14.1.2.4). Risks posed by dust impacts during construction on ecological receptors was identified to be medium, as an area of terrestrial ecology of medium sensitivity is located within 20 metres of the WWTP.

With the implementation of the management and mitigation measures identified in Section 14.5, risk to sensitive receptors is considered low.

14.3.1.2 Construction of the pipelines

Receptor sensitivity associated with the proposed construction activities would be the highest along identified receptor catchments of the pipeline route (refer to Figure 14-1). Several high sensitivity receptors were identified within 20 metres and 50 metres from the proposed pipelines. These receptors are shown in Figure 14-2, and specified in Technical Report 8 – Air Quality Assessment and were identified to be most susceptible to any potential dust soiling effects and health effects associated with particulate matter emissions associated with construction activities. The dust emission magnitudes associated with the pipeline for earthworks and construction were found to be small, whilst trackout was found to be medium. Sensitive receptors within 20 metres of the pipelines were identified to be at most at risk of dust impacts during all stages of construction.

The implementation of the management and mitigation measures identified in Section 14.5 would reduce the identified risks to low risk.

14.3.2 Construction risk determination

The main risks identified during construction activities were associated with the potential dust soiling, human health and ecological impacts as a result track-out dust emissions. Table 14-6 outlines the air quality matrix determined for the construction of the project.

As stated in Section 14.3.1.2, sensitive receptors within 20 metres of the pipelines are at most risk of dust impacts during all stages of construction. Specific mitigation measures are proposed to further minimise the risk of dust impacts at receptor locations during construction works and additional measures are proposed (Section 14.5) in areas along the pipelines which are within 20 metres of sensitive receptors.

Although these areas have been identified as having slightly increased risk of dust impacts, impacts to all receptors were determined to be short-lived due to the transient nature of the works. Construction works would move on from any one location within a few days, therefore impacts are expected to be short term and minimal in nature.

Table 14-6 Risk matrix for dust impacts during construction

Project component	Impact	Risk			
		Demolition	Earthworks	Construction	Track-out
WWTP	Dust soiling	Negligible	Low	Low	Medium
	Human health	Negligible	Low	Low	Low
	Ecological	Low	Medium	Medium	Medium
Pipeline	Dust soiling	N/A	Low	Low	Medium
	Human health	N/A	Low	Low	Medium
	Ecological	N/A	Low	Low	Medium

14.4 Potential impacts – operation

14.4.1 Pumping stations operational odour

As described in Chapter 3 (Project description), two SPSs would be connected to enable the proposed WWTP to accept raw sewage from the Thrumster, Sancrox and diversions from the Port Macquarie wastewater network. The operation of these SPSs, and future SPSs, has the potential to cause odour impacts on the surrounding environment.

The design and operation of the SPSs would be in accordance with relevant Hunter Water Corporation design manuals, which have been developed in recognition that SPSs are typically located in proximity to sensitive receptors. These design manuals provide specifications to minimise potential odour emissions. As the SPSs associated with the project would be designed and operated in accordance with relevant standards and guideline manuals (refer to Technical Report 8 – Air Quality Assessment) odour impacts on the surrounding environment are anticipated to be minimal. Additional mitigation measures have been identified and are provided in Table 14-7 to ensure potential operational odour impacts are minimised.

14.4.2 WWTP operational odour

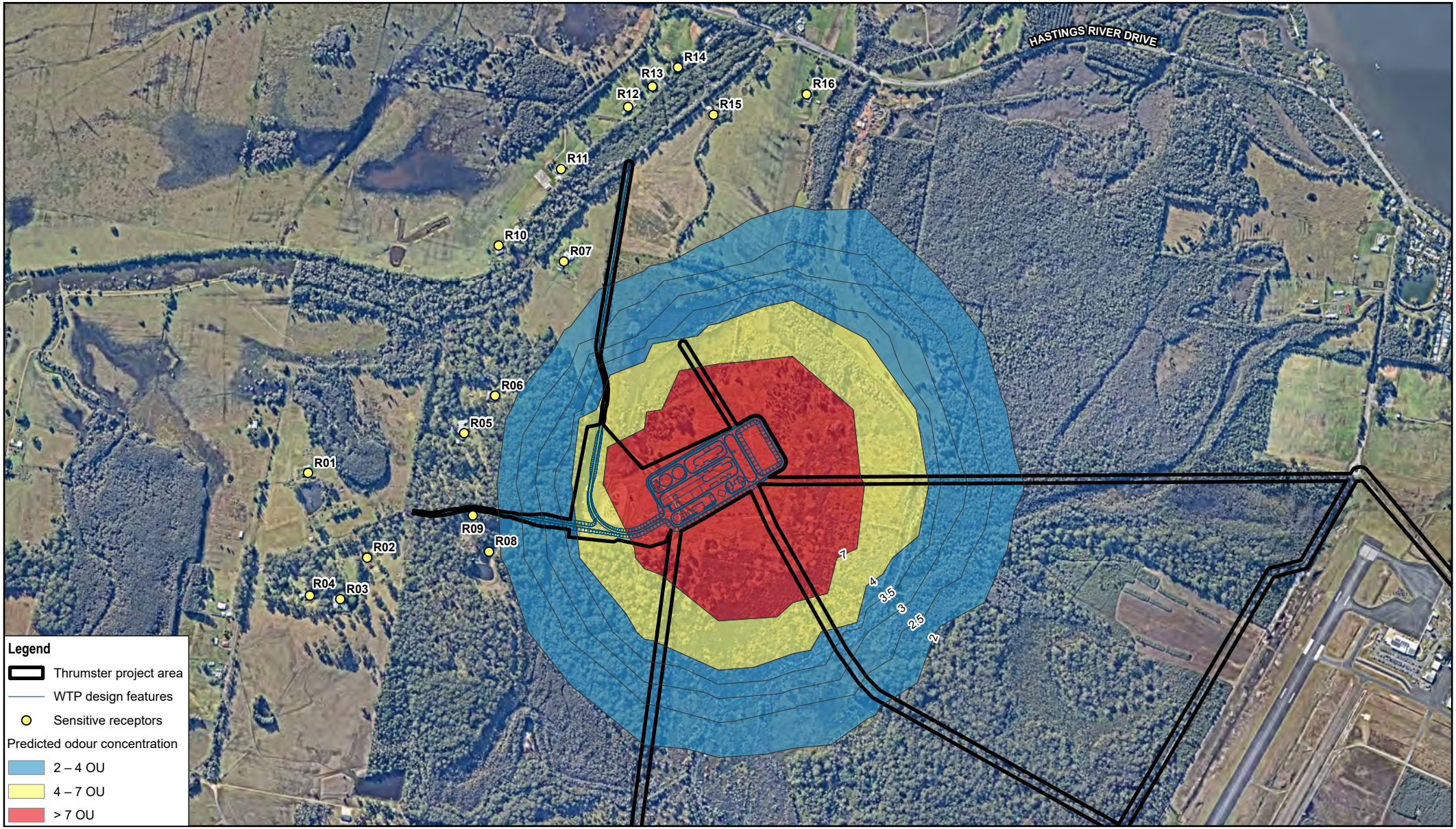
The operation of the WWTP has the potential to produce odour emissions associated with the receival and treatment of effluent, and the associated use of chemicals. The potential odour impacts associated with the operation of the proposed WWTP have been identified in accordance with a further detailed assessment within the AQIA due to the proximity of sensitive receptors, as per NSW EPA requirements detailed in Section 14.1.2.4.2.

The scenarios (detailed in Section 14.1.2.4.2) were modelled to assess the effectiveness of an OCU on predicted odour emissions and identified that no exceedances of the criteria are predicted at nearby sensitive receptors, as shown in Figure 14-3 (scenario1), Figure 14-4 (scenario 2) and Figure 14-5 (scenario 3). The results indicate that odour capture and an OCU would not be needed in order to achieve the odour criteria of 4 OU at the nearest sensitive receptors. Covering the inlet works would help ensure odour from the site is as low as reasonably practicable.

Further detail regarding methodology, the scenarios modelled, estimated emissions, and predicted odour concentration to assess WWTP operational odour impacts is provided in Technical Report 8 – Air Quality Assessment.

Due to the nature of the odour emitted, and the distance to the nearest receptors, odour impacts are expected to be minimal. Odour emissions from the project are not expected to materially contribute to regional or global air pollution.

Additional mitigation measures have been identified and are provided in Table 14-7 to ensure potential operational odour impacts are minimised.



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Environmental Impact Statement

WWTP operation - predicted odour concentration for scenario 1

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 14.3

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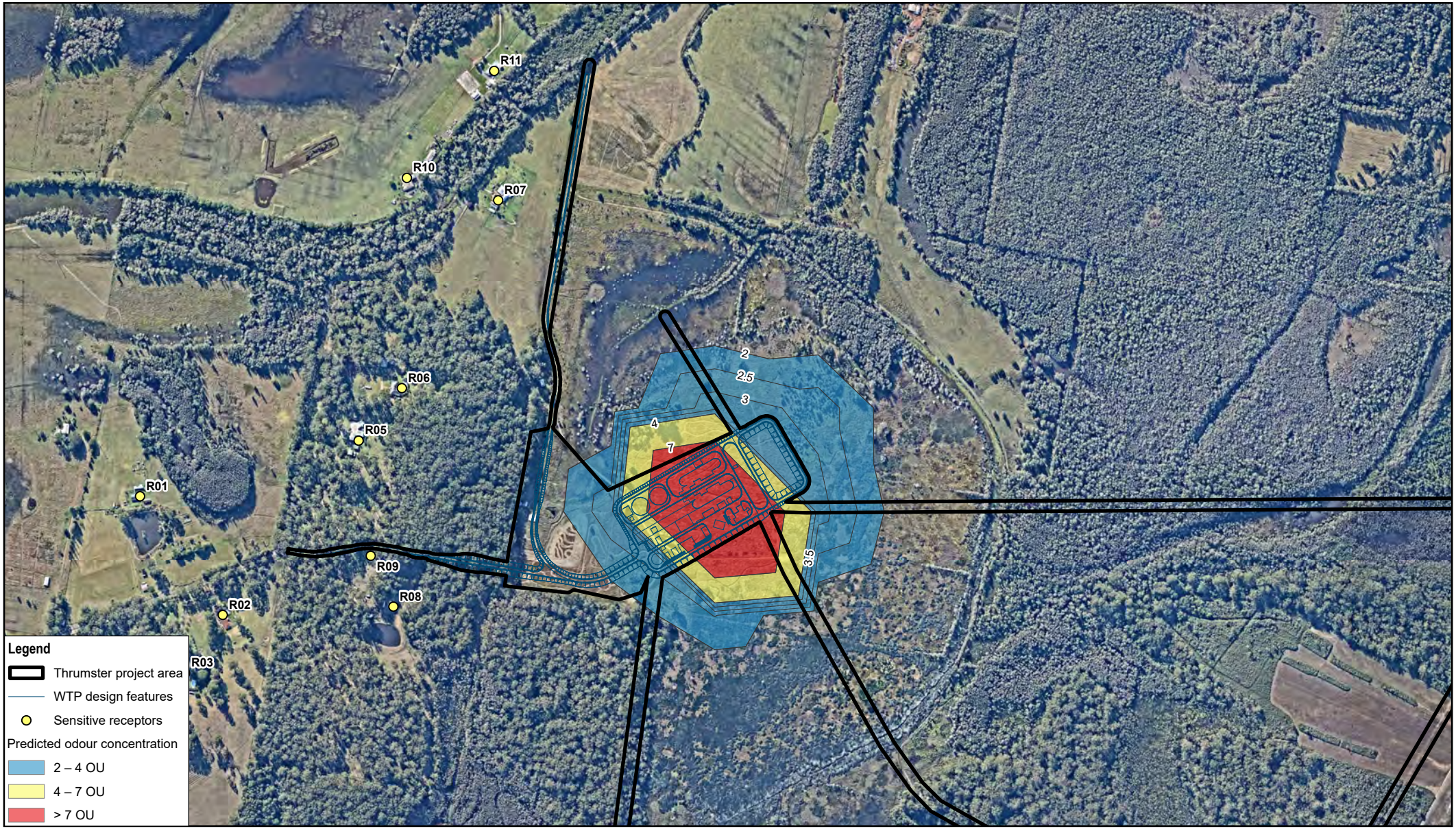

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Environmental Impact Statement

WWTP operation - predicted odour concentration for scenario 2

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 14.4

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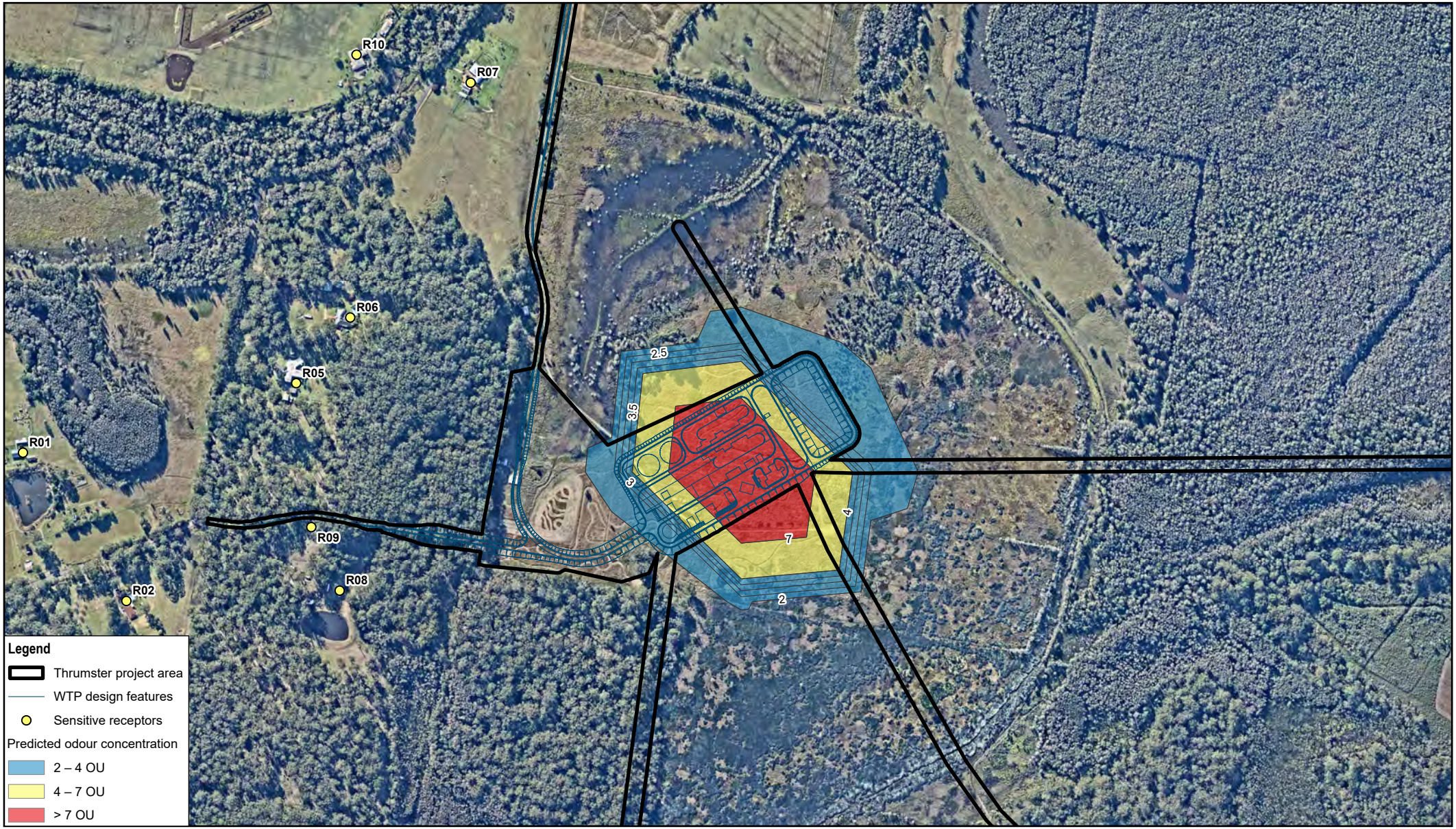

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Thrumster Wastewater Scheme
Environmental Impact Statement

WWTP operation - predicted odour concentration for scenario 3

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 14.5

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14.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise air quality impacts of the project are detailed in Table 14-7.

Table 14-7 Air quality impact mitigation and management measures

ID	Impacts	Environmental safeguard	Responsibility	Timing
AQ1	Dust	Prepare a dust control protocol that forms part of the Construction Environmental Management Plan (CEMP) to detail management measures, a method for recording dust complaints and monitoring requirements.	Contractor	Construction
AQ2	Dust	On days with forecast and actual high winds (i.e., over 10 m/s) reduce work effort accordingly if windblown dust is observed to be leaving the work area along the pipeline.	Contractor	Construction
AQ3	Dust, exhaust emissions	Plant and equipment should be maintained in good condition to minimise ignition risk, spills and air emissions that may cause nuisance.	Contractor	Construction
AQ4	Dust	Regularly water spraying of exposed areas.	Contractor	Construction
AQ5	Dust	Long term stockpile seeding.	Contractor	Construction
AQ6	Dust	Covering of long and medium term stockpiles and of all stockpiles in high wind periods.	Contractor	Construction
AQ7	Dust	Covering of truck loose material loads.	Contractor	Construction
AQ8	Dust	If the works are creating levels of dust which may significantly impact on residential amenity, the works should be modified or stopped until the dust hazard is reduced to an acceptable level.	Contractor	Construction
AQ9	Dust	On days with high background dust levels (due to fire or offsite dust events for example), increase dust mitigation in the form of watering or reduce dusty construction activities.	Contractor	Construction
AQ10	Dust	Revegetate and regularly water all disturbed areas as soon as practicable.	Contractor	Construction
AQ11	Dust	During construction in higher risk areas (areas within 2 m of the sensitive receptors, shown in Figure 14-1), conduct a daily inspection along all adjacent receptors for evidence of: – Dust deposition on residential private property including cars, letterboxes or balconies. – Evidence of mud or dirt tracked onto roadways. – The worksite adjacent receptors to check stockpiles are covered or the surface is sufficiently moist.	Contractor	Construction
AQ12	Dust	During construction in higher risk areas (areas within 20 m of the sensitive receptors, shown in Figure 14-1) implement additional watering (>2 litres/m^3/hr) when dust is being generated and winds are blowing towards the receptors.	Contractor	Construction
AQ13	Odour	Establish 24 hour emergency maintenance agreements with equipment manufacturers to limit the impact of equipment failures.	Council	Operation
AQ14	Odour	If elevated odour is observed during operation, undertake investigations to identify the source and minimise emissions. Record investigations and actions taken to minimise odour emissions in a log.	Council	Operation

15. Soils and contamination

This chapter provides a detailed summary of the assessment of the potential soils and contamination impacts of the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides proposed mitigation and management measures. The full assessment is provided in Technical Report 9 – Soils and Contamination Preliminary Site Investigation (GHD, 2024).

15.1 Assessment approach

15.1.1 Legislation and policy context

The following key national and state legalisation, guidelines and policies considered as part of the Soils and Contamination Assessment (SCA) included:

– *Contaminated Land Management Act 1997* (CLM Act).
– *Protection of the Environment Operation Act 1997* (POEO Act).
– *Protection of the Environment Operations (General) Regulation 2009.*
– *Protection of the Environment Operations (Waste) Regulation 2014.*
– *State Environmental Planning Policy (Resilience and Hazards) 2021.*
– Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Land (NSW EPA 2020).
– Contaminated Land Guidelines: Sampling Design Part 1 – Application (NSW EPA 2022d).
– National Environment Protection Measure (Assessment of Site Contamination) (NEPC 1999) as amended May 2013.
– Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management (CLM) Act 1997 (NSW EPA 2015).

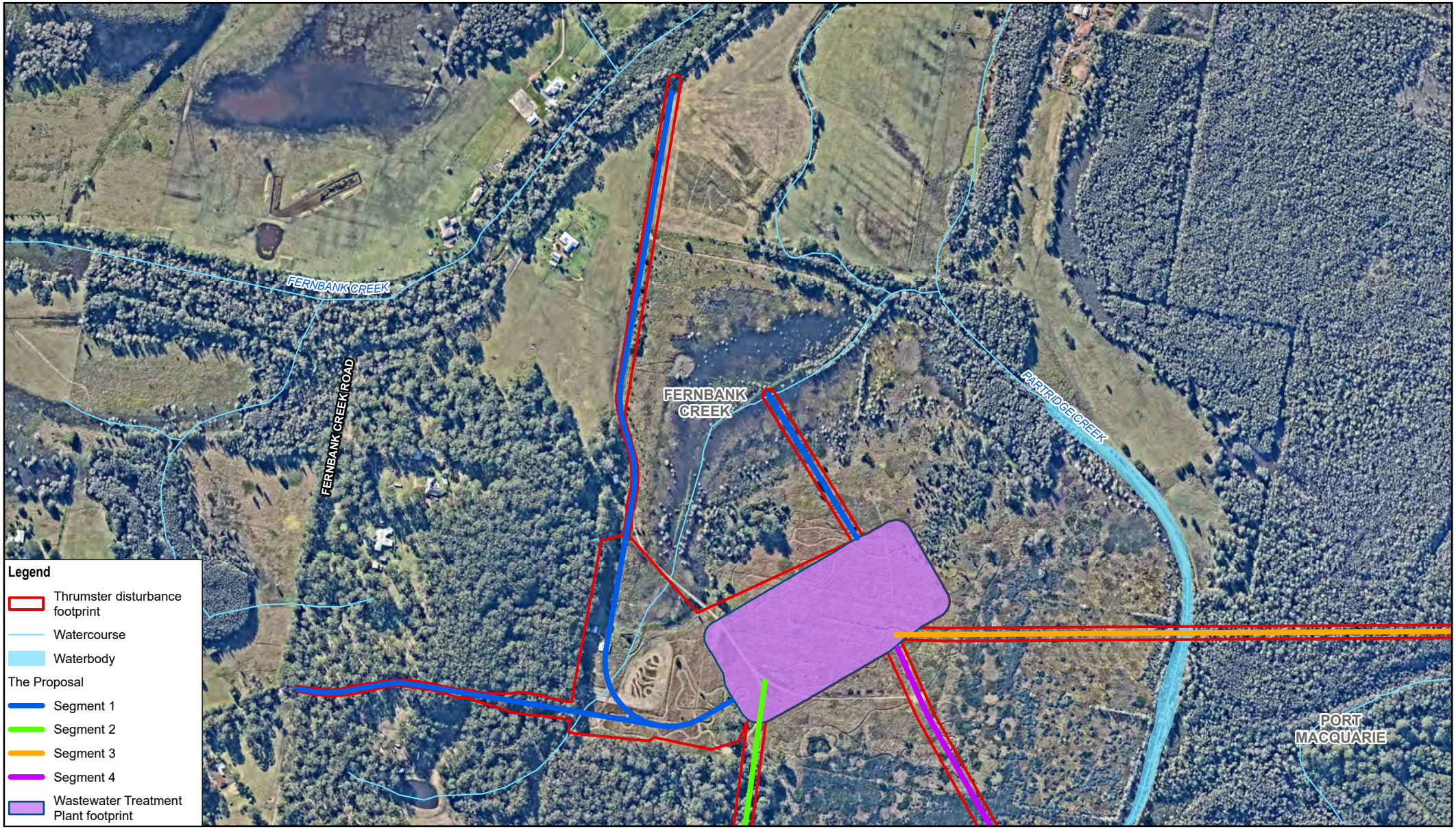
15.1.2 Methodology

The following key tasks were undertaken:

– Review of relevant legislation, policy, and guidelines to address the SEARs and agency requirements.
– Desktop assessment comprising review of existing information, aerial photography, and previous ground investigation reports. The review is used to identify current environmental conditions of the project area and potential sources of contamination.
– Site inspections carried out on 25, 26 and 28 September 2023 and 27 March 2024 to confirm the findings of the background desktop assessment. The inspections involved the observation and recording of terrain, surface condition, topography, vegetative cover, drainage pathways, contaminated land risk areas and surrounding land uses.
– Preparation of a preliminary Conceptual Site Model (CSM) identifying potential sources, contaminants of potential concern (COPC), pathways and receptors.
– Identification of mitigation measures to eliminate or minimise these impacts.

To aid with the assessment, the SCA divided the project into seven segments as shown in Figure 15-1.

The proposed location for the WWTP including the recycled water plant, main access road, flood-proof, all-weather access road, and the emergency discharge line are included in Segment 1. Segment 2-7 include sections of the recycled water main, power and communications lines, proposed effluent return, proposed sewer rising main and the SPSs. A detailed site description of each segment is provided in Technical Report 9 – Soils and Contamination Preliminary Site Investigation. For the SCA, the project area was the project area.



Sheet Index

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Assessment segments
Segment 1

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 15.1a

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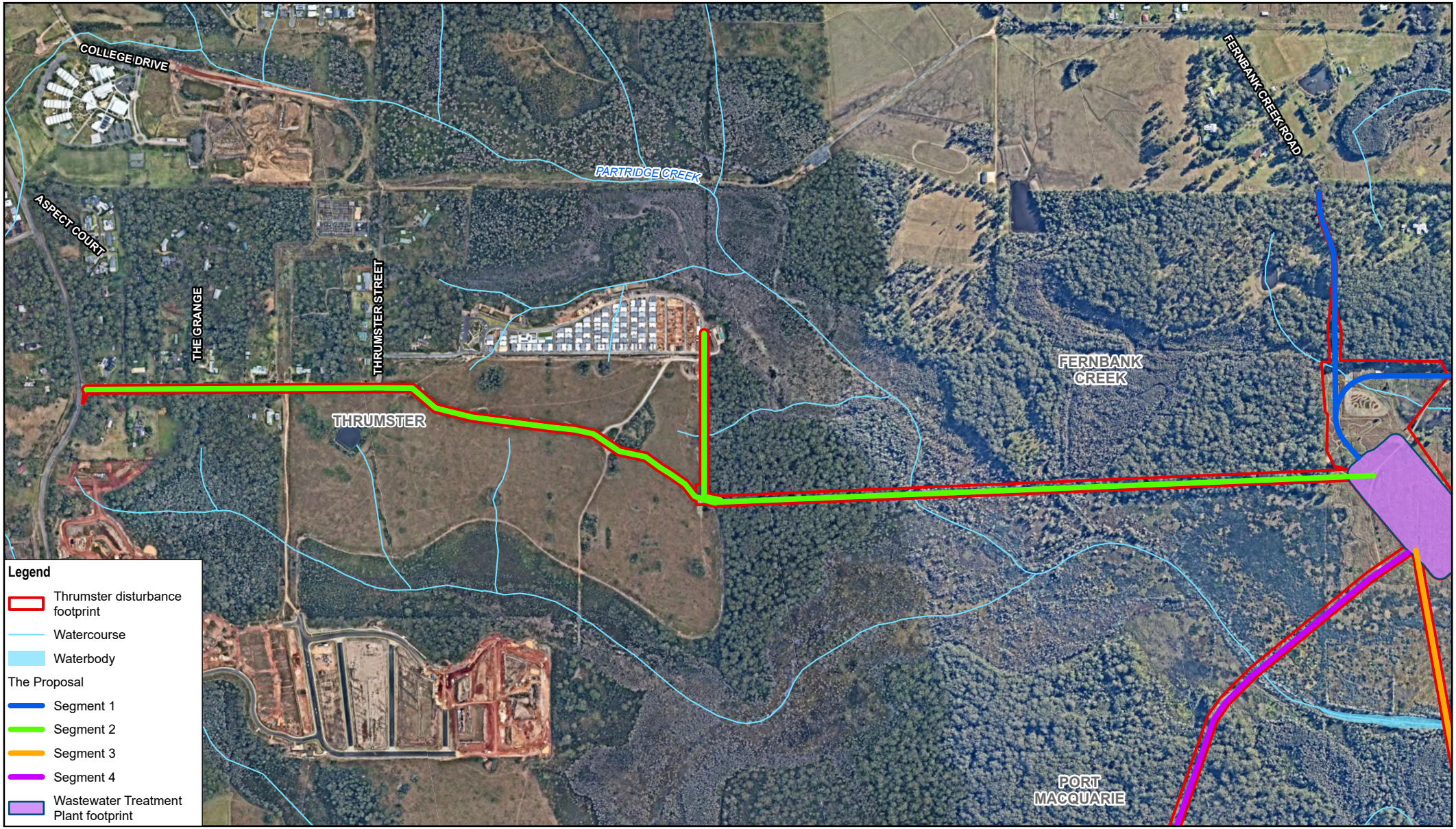

Sheet Index

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Assessment segments
Segment 2

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 15.1b

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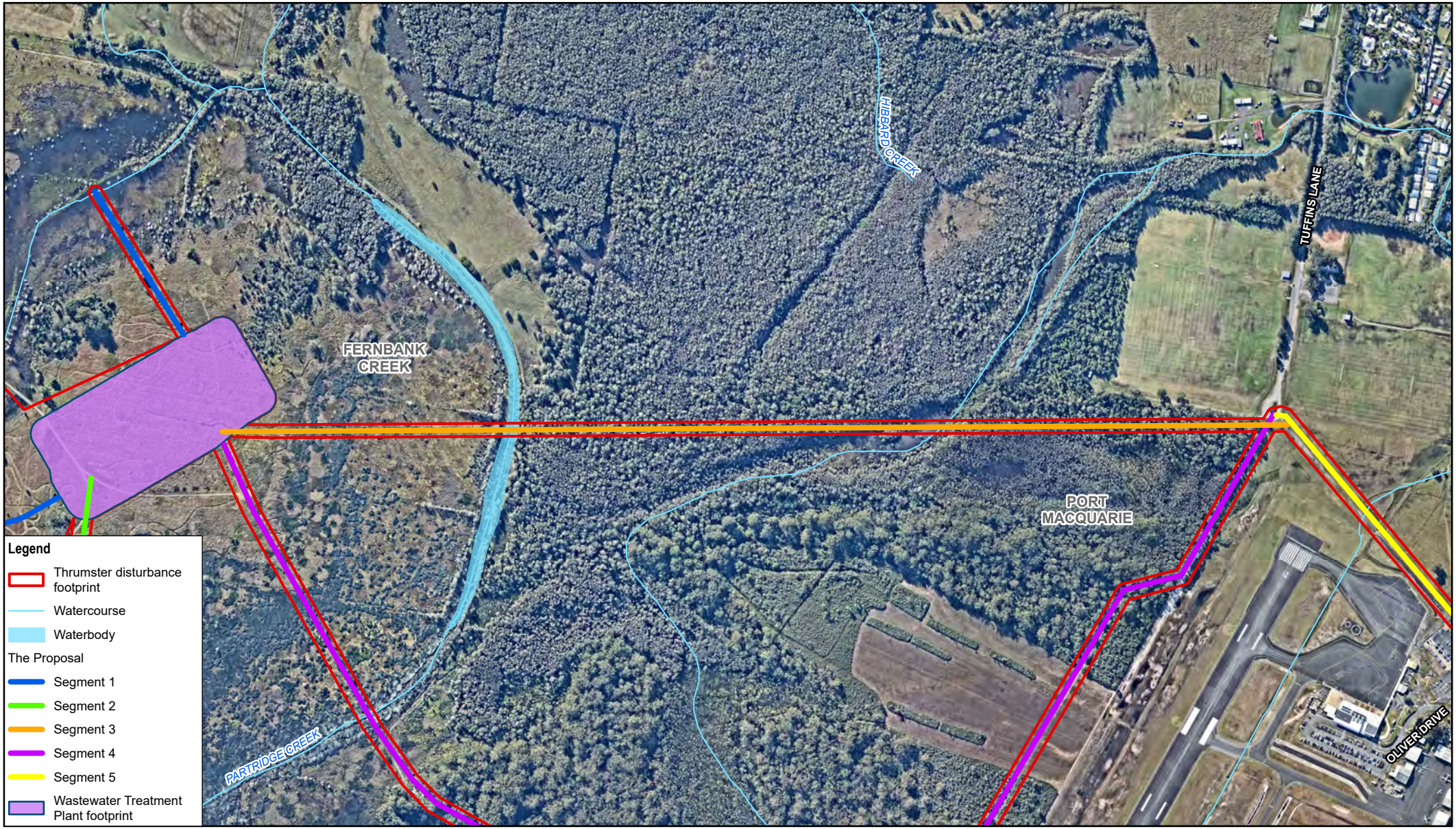
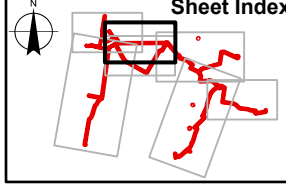


Sheet Index



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 56

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Assessment segments
Segment 3

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 15.1c

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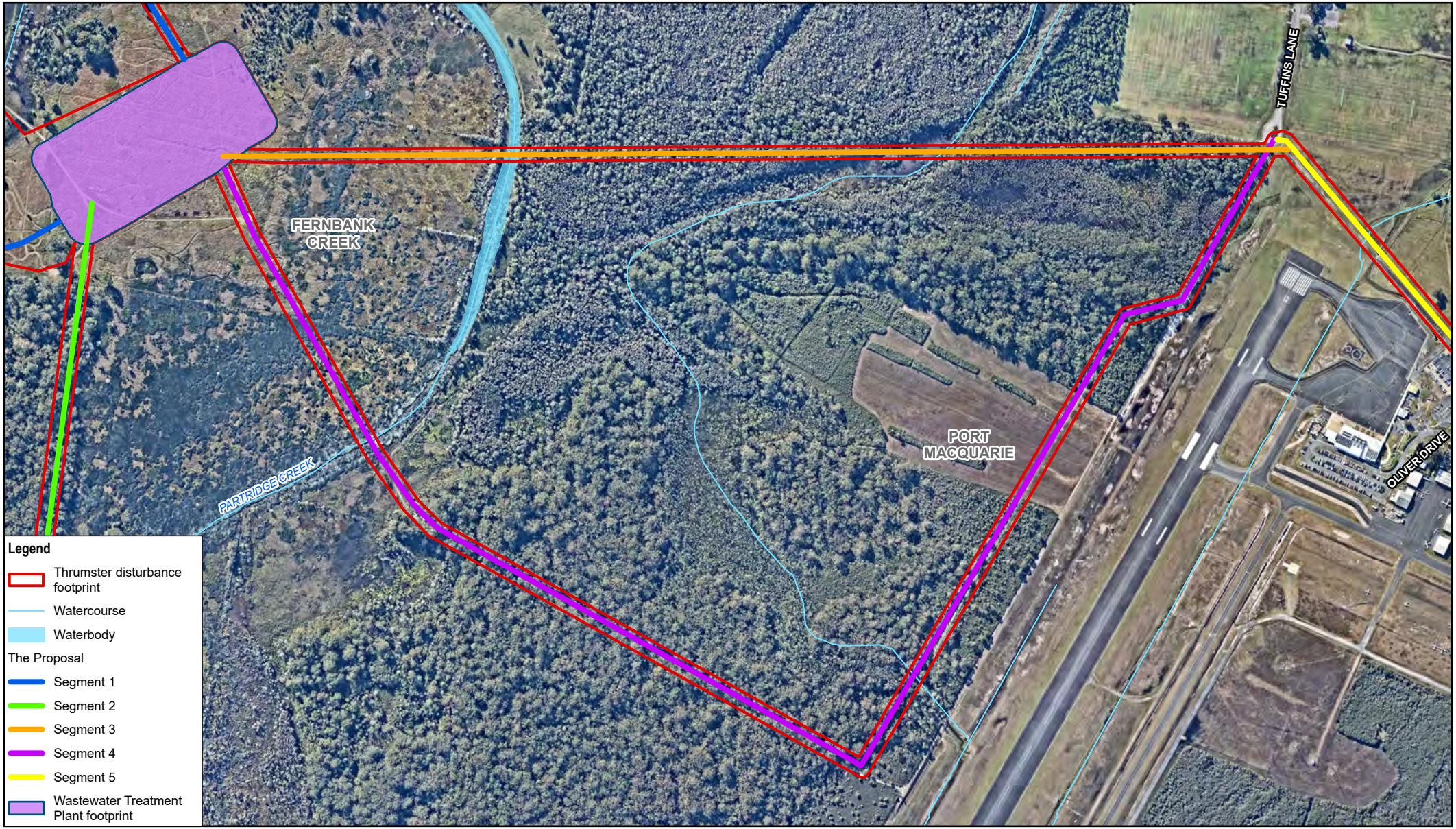
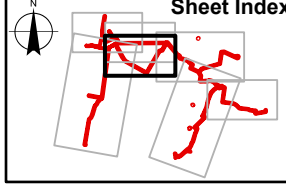


Sheet Index



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 56

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Assessment segments
Segment 4

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 15.1d

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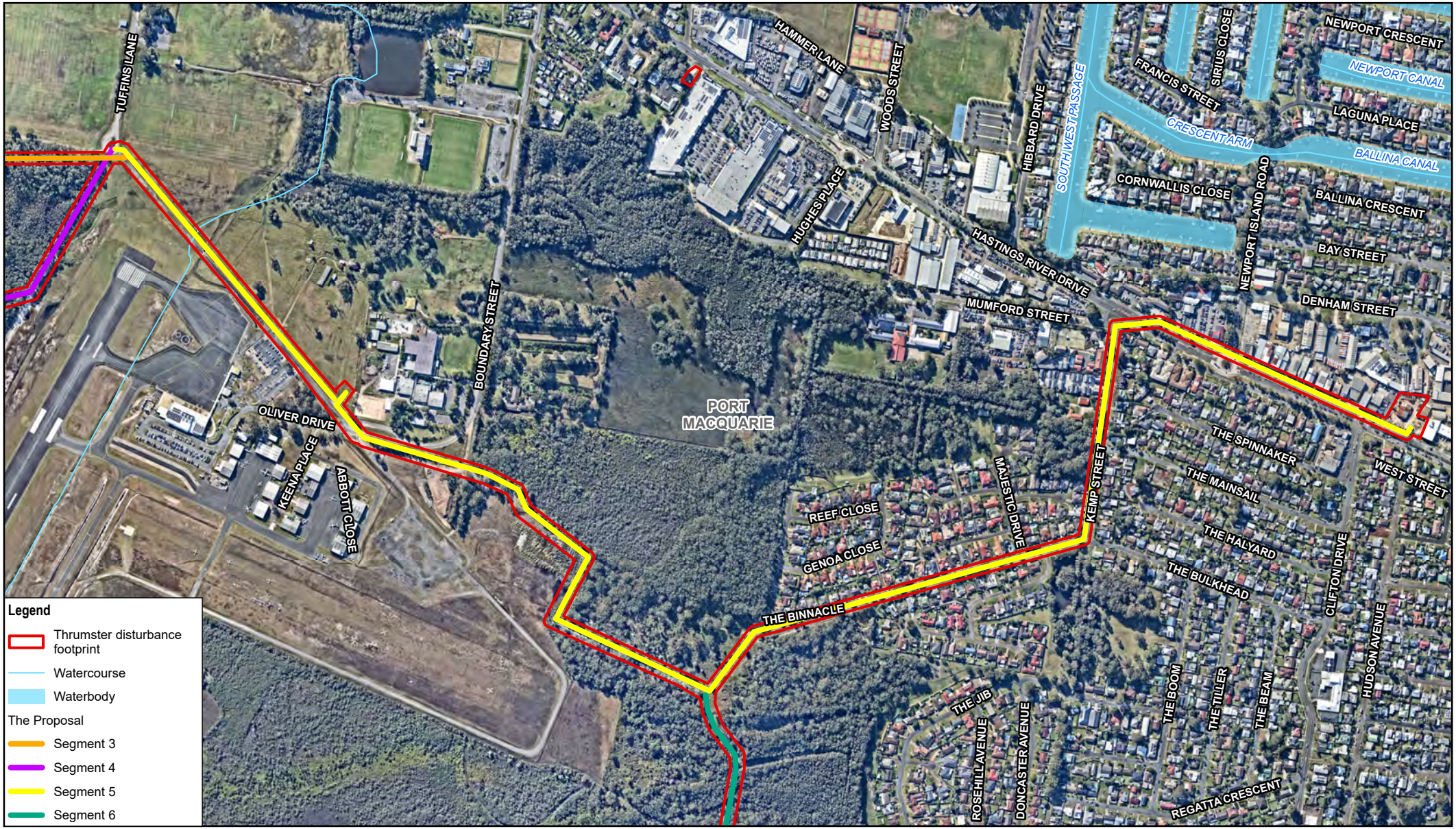
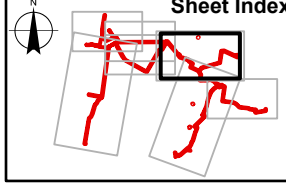


Sheet Index



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Assessment segments Segment 5

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 15.1e

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Sheet Index

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. 12611129
Revision No. 0
Date 22/07/2024

Assessment segments
Segment 6

FIGURE 15.1f

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Sheet Index

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. 12611129
Revision No. 0
Date 22/07/2024

Assessment segments
Segment 7

FIGURE 15.1g

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Print date: 22 Jul 2024 - 11:13

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/12/2023. Created by: fmackay

15.2 Existing environment

15.2.1 Topography

The topography of the project is widely variable and is summarised as follows:

- **Segments 1, 3 and 4** – These segments are located in a relatively flat area with elevation <10mAHD. These segments contain extensive swamp areas of low relief (0 - 3°) and an elevation <2 mAHD (Coffey, 2008a).
- **Segment 2** – This segment is located in an area between <10mAHD to 20mAHD. The first 1.6 kilometres of the segment (from the WWTP) are in area <10mAHD. Some rises and falls between 10 mAHD to 20 mAHD are then located further south of the segment, with the elevation rising up along Thrumster Street to a maximum elevation of 20 mAHD.
- **Segment 5** – This segment is relatively flat with elevation <10 mAHD, with portions of the segment along the Binnacle to Hastings River Drive having an elevation between 4 to 6 mAHD.
- **Segment 6** - This segment is located in an area between <10 mAHD to 20 mAHD. The elevation of the area generally rises to the east (from the racecourse towards Oxley Highway). Along the segment, rises and falls on the elevation of the segment from north to south are present.
- **Segment 7** – This segment is located in an area between <10 m AHD to 30 mAHD. The first 0.3 kilometres of the segment rises from 10 mAHD to a maximum elevation of 18 mAHD towards Oxley Highway, and then continue to decrease in elevation up to 2 mAHD towards Kooloonbung Creek.

15.2.2 Geology and soils

The different geological and soil units identified within each segment are detailed in Technical Report 9.

Due to the complex geology, varying topography, and climate influences there is a diverse range of soil types across the project area. Reference to the NSW Surface Geology Maps indicates that the subsurface geology along the proposed WWTP and pipeline routes varies between several geological units. These include Alluvial backswamp deposits, Alluvial fan deposits, Alluvial floodplain deposits, Alluvial levee/overbank deposit, Coastal deposits, Estuarine tidal-delta flat, Karikeree Metadolerite, Thrumster Slate, Touchwood Formation, and the Watonga Formation.

The predominant soils underlying the project area according to the Australian Soil Classification (CSIRO 2021) comprise podosols, hydrosols, ferrosols, kurosols, and kandosols. Specific features of soils relevant to the project area, and those identified within each segment, are described in further detail in Technical Report 9 – Soils and Contamination Preliminary Site Investigation.

15.2.3 Naturally occurring asbestos

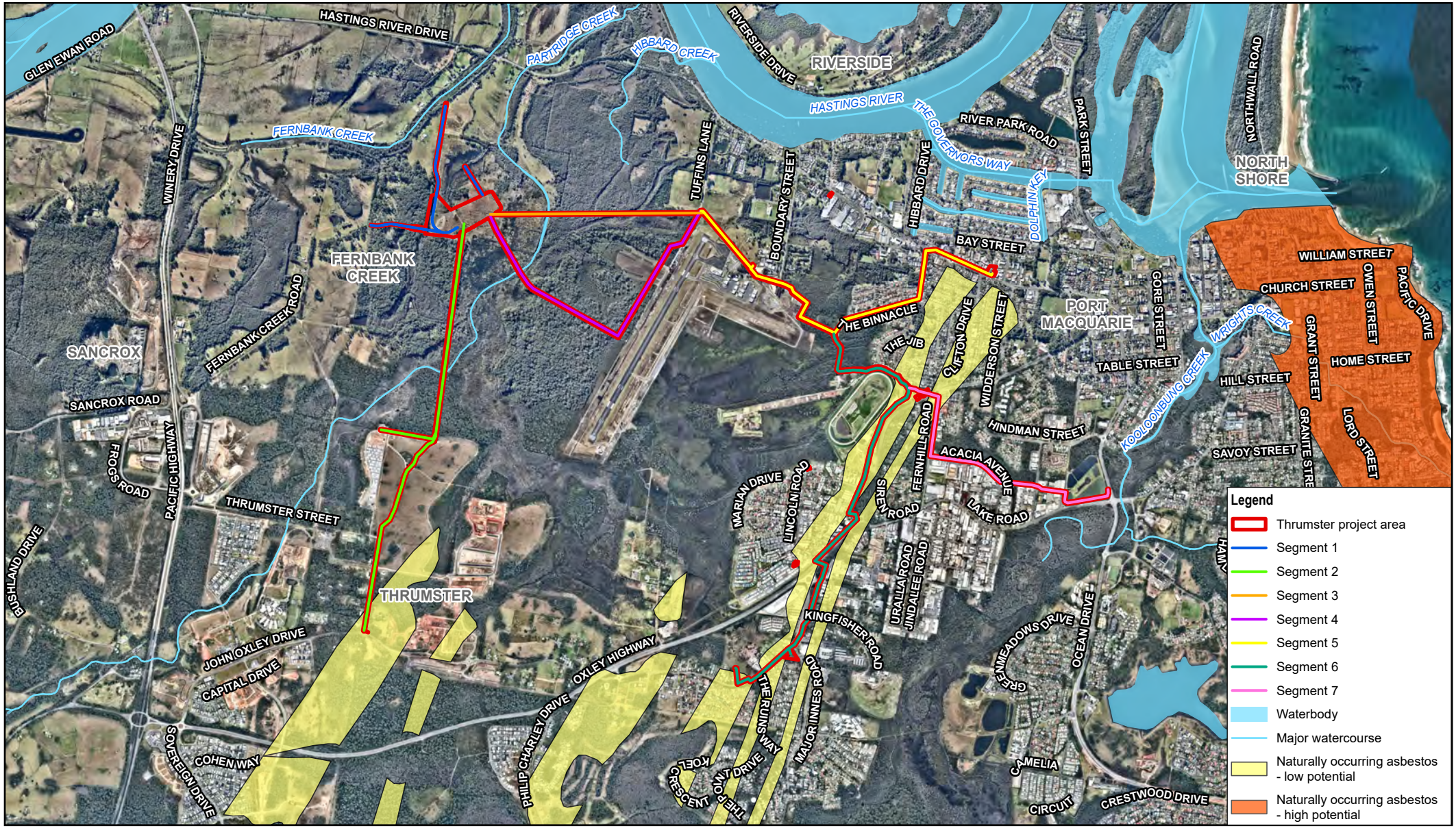
Naturally occurring asbestos (NOA) refers to the mineral component found in certain types of soils or rock formations, as opposed to asbestos present in commercial products, mining or processing operations.

A review of the online NSW NOA map shows that that there is an area of low asbestos potential located in portions of Segments 2, 6 and 7 as presented in Figure 15-2.

15.2.4 Acid sulfate soils

ASS and potential ASS are naturally occurring soils containing iron sulfides. When disturbed or exposed to air, these soils can release acid and potentially threaten built structures, flora and fauna.

A review of Acid Sulfate Risk Maps shows areas of high and low probability occurrence of ASS throughout the project area. The majority of the WWTP and its compound are mapped within an area with low probability of ASS occurrence. The ASS high probability of occurrence is mapped throughout portions of segments 1 to 5 shift between areas of both high and low probability of ASS occurrence. Segments 6 and 7 contain the lowest sections of low probability of ASS occurrence and areas of no known occurrence. The ASS potential for each segment is presented on Figure 15-3.



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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Naturally occurring asbestos

FIGURE 15.2

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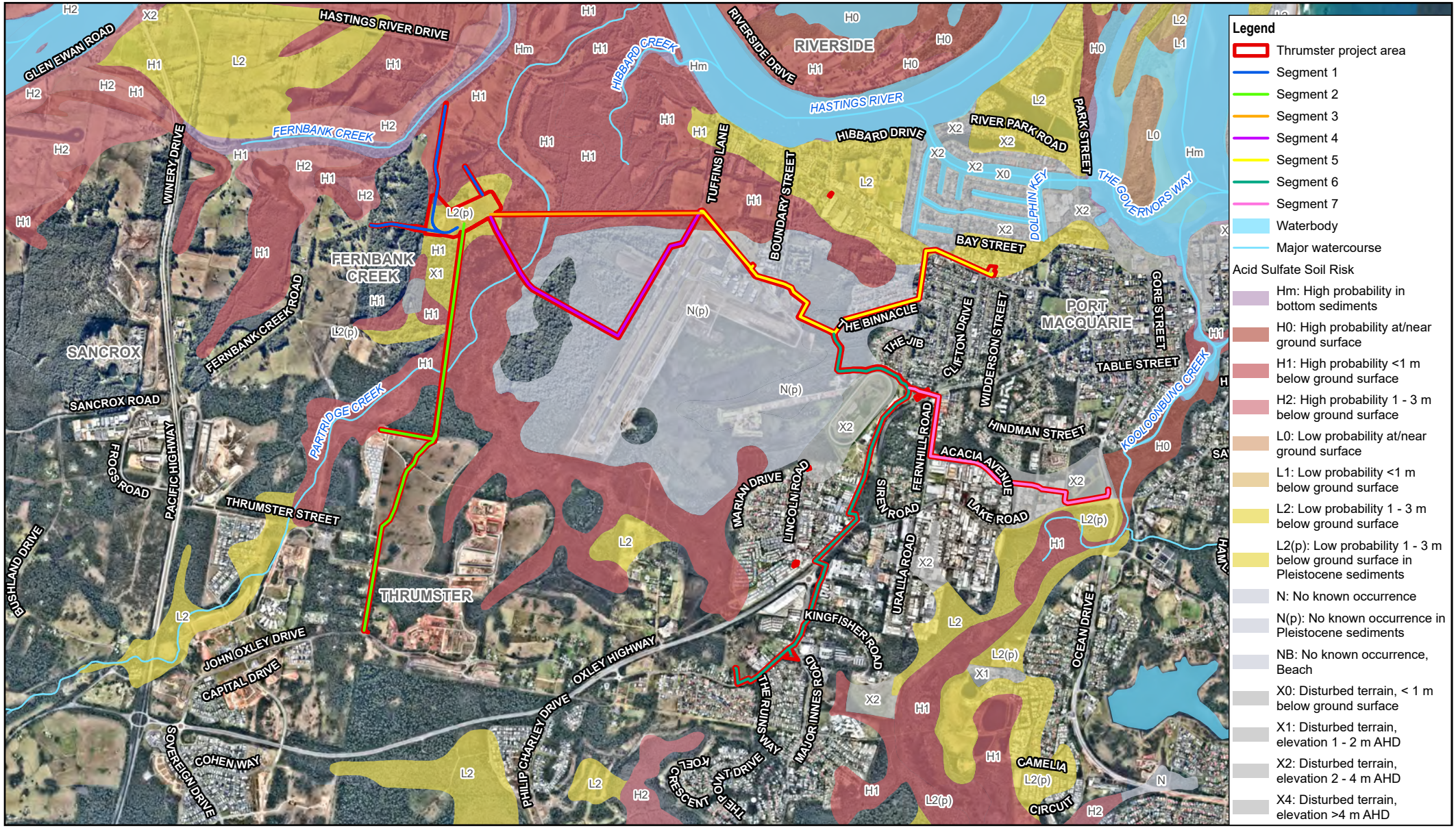

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Kilometres

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GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Acid Sulfate Soils Risk probability map

FIGURE 15.3

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Print date: 22 Jul 2024 - 11:15

Data source: NSW Government: DPE Acid Sulfate Soil Risk, 2022; PMHC: Infrastructure data, 2024; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

15.2.5 Contamination

15.2.5.1 Historical land uses

Based on the review of historical aerial photographs, the area where the WWTP is located (Segments 1, 3 and 4 and portions of Segment 2) has always been part of the wetlands of Partridge Creek and Fernbank Creek with very little development. The Port Macquarie Airport was operational as early as the 1950's based on the presence of the runway in early aerial imagery. Other areas assessed as part of the SCA Preliminary Site Investigation (PSI) were rural properties or densely vegetated until residential and commercial/industrial development began in the 1960s. Since then, continued development has occurred with some larger agricultural and rural properties now converted to high-density residential and commercial/industrial land use. The immediate area surrounding portions of Segment 2 and Segment 5, 6 and 7 predominantly consists of residential and commercial/industrial land use, with some scattered rural and agricultural properties. Further detail regarding historical observations in each segment is provided in Technical Report 9 – Soils and Contamination Preliminary Site Investigation.

15.2.5.2 Contaminant sources

The EPA record of notices for the Port Macquarie-Hastings LGA did not reveal any documented contaminated sites to date within or in the immediate vicinity of the project area. A search of the datasets maintained by NSW EPA including notices under the CLM Act and Protection of the Environment Operations (POEO) Act Environment Protection Licence (EPL) Register was carried out.

A search of the contaminated land record of notices identified 11 sites within three kilometres of the project area that have been notified to the EPA as summarised below in Table 15-1.

Table 15-1 Contaminated land record of notices (within 3 kilometres radius of the project)

Organisation	Address	Type	Status	Distance from project
Air BP Avgas Facility	Oliver Drive, Port Macquarie	Other Petroleum	Regulation under CLM Act not required	Within 200 m south of Segment 5
Caltex Service Station	92 Hastings River Drive, Port Macquarie	Service Station	Regulation under CLM Act not required	160 m north-west of Segment 5
Former Mobil Service Station	Corner Oxley Highway and Major Innes Drive, Port Macquarie	Service Station	Regulation under CLM Act not required	20 m north-east of Segment 6
Coles Myer	43 John Oxley Drive, Port Macquarie	Service Station	Regulation under CLM Act not required	70 m east of Segment 6
Former Mobil Depot	211 Lake Road, Port Macquarie	Other Petroleum	Regulation under CLM Act not required	270 m south of Segment 7
Caltex Service Station	12-14 Bolwarra Road, Port Macquarie	Service Station	Regulation under CLM Act not required	680 m south of Segment 7
Port Macquarie Council Depot	Koala Street, Port Macquarie	Unclassified	Regulation under CLM Act not required	750 m south-east of Segment 7
Caltex Service Station	112-114 Gordon Street, Port Macquarie	Service Station	Regulation under CLM Act not required	1.4 km north-east of Segment 7
Shell Coles Express Port Macquarie Service Station	121 Gordon Street, Port Macquarie	Service Station	Regulation under CLM Act not required	1.4 km north-east of Segment 7
Car Park	28 Hayward Street, Port Macquarie	Other industry	Regulation under CLM Act not required	1.5 km north-east of Segment 7
Caltex Port Macquarie Service Station	29 Lord Street, Port Macquarie	Service Station	Regulation under CLM Act not required	2.3 km north-east of Segment 7

A search of the POEO license register identified three premises with a current or previous POEO licence in a three kilometre radius from the project as summarised below in Table 15-2. Additional sites with surrendered and lapsed licences within three kilometres of the sites can be found in Technical Report 9.

Table 15-2 POEO licence register (within 3 kilometre radius of the project)

Organisation	Address	Activity	Distance and direction from closest water routes
Port Marina Pty Limited	18 PARK Street, Port Macquarie	Boat construction/maintenance (general)	900 m north-east of Segment 5
Port Macquarie Wastewater Treatment Plant / Port Macquarie Hastings Council	John Fraser Place, Port Macquarie	Sewage treatment processing by small plants	500 m south-east of Segment 7
Port Macquarie Hastings Council	Kingfisher Road, Port Macquarie	Waste Management Facility including recovery of general waste and waste storage	700 m east of Segment 6

A search of the Waste Management Facilities Database (Department of Agriculture, Water and Environment) showed that there are currently four existing waste management facilities within a three kilometre radius from the proposed WWTP, clear water reservoir and trunk main route locations as summarised below in Table 15-3.

Table 15-3 Waste management facilities (within 3 kilometre radius of the project)

Organisation	Address	Type	Status	Distance from project
Bridle Concrete Resources Pty Limited	Kingfisher Road, Port Macquarie	Other Waste Facility	Operational	70 m east of Segment 6
Coles Supermarket	43 John Oxley Drive, Port Macquarie	Soft Plastic Drop-off Facility	Operational	60 m east of Segment 6
Port Macquarie Transfer Station	70 Kingfisher Road, Port Macquarie	Transfer Station	Operational	700 m east of Segment 6
Harvey Norman	140 Lake Road, Port Macquarie	E-waste Drop off facility	Operational	450 m south of Segment 7
Woolworths Supermarket	3 Bay Street, Port Macquarie	Soft Plastic Drop-off Facility	Operational	700 m northeast of Segment 5

15.2.5.3 Contamination sources

The following potential contamination sources and contaminants of potential concern associated with each source were identified by the preliminary CSM and are summarised below in Table 15-4. The preliminary CSM drew together historical data, specific and regional geological and hydrogeological information, and findings from the site inspection to identify the potential contamination sources, in addition to migration and exposure pathways and sensitive receptors for the site (refer to Section 15.3).

Table 15-4 Potential contamination sources

Segment	Location along segment	Source	Potential Contaminants of Concern
Potential sources intersecting and adjacent the different segments			
1	Wetlands surrounding areas of the proposed WWTP and associated facilities	Presence of low to high probability ASS	ASS

Segment	Location along segment	Source	Potential Contaminants of Concern
	Shed located within 20 m west of the proposed access road	Several containers (with oils, lubricants, pesticides, etc) and wastes were found in the shed Shed building materials	Heavy metals, polycyclic aromatic hydrocarbon (PAH), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN), phenols, asbestos, organochlorine pesticides (OCPs), organophosphate pesticides (OPPs)
	Residential and shed area located within the proposed compound	Building materials	Asbestos containing materials, lead based paints
	Select locations along segment	Illegal dumping of various wastes	Asbestos, heavy metals, PAH, TRH, BTEXN, and polychlorinated biphenyls (PCBs)
	Select locations along segment	Use of herbicides and pesticides along the project for pest and weed control	OCPs, OPPs, arsenic and lead
2	Electrical substation located 314m west of Segment 2 (potentially up-gradient)	Potential spills and leaks from use of the site, maintenance and fuelling	Heavy metals, PAH, TRH, BTEXN, phenols, OCPs, OPPs, PCBs
	Former horticultural site located 300m west of Segment 2 (potentially up-gradient)	Potential use of pesticides and herbicides during operation	OCPs, OPPs, arsenic and lead, nutrients, pH
	Select locations along segment	Illegal dumping of various wastes	Asbestos, heavy metals, PAH, TRH, BTEXN, and PCBs
	Existing bitumen and road base materials along Thrumster Street	Impacts associated with the existing bitumen and road base materials (historical materials may be coal tar based) Historical fill from unknown sources	Heavy metals, PAH, TRH, BTEXN, phenols, asbestos, OCPs, OPPs and PCBs
	Select locations along segment 2	There is a low probability of presence of NOA in some locations along the segment	NOA
	Final sections of Segments 3 and 4 near intersection with Tuffins Ln	Presence of low to high probability ASS	ASS
	Select locations along segment	Fill materials from unknown sources in highway/road construction, and other residential and commercial developments, including potential historical mining leases	Heavy metals, PAH, TRH, BTEXN, phenols, asbestos, OCPs, OPPs and PCBs
	Select locations along segment	Potential use of herbicides and pesticides adjacent the project areas for pest and weed control	OCPs, OPPs, arsenic, and lead
3, 4	Former Waste Management Site (located west, and intersects some portions of Segments 3 and 4)	Leaching of and disposal of materials associated with waste storage and treatment facility	Asbestos, heavy metals, PAH, TRH, BTEXN, OCPs, OPPs, PCBs and PFAS
	Port Macquarie Airport located west of the segments	Potential historical use of aqueous firefighting foams	PFAS
	Firing range located approximately 650m south of Segment 4 (potentially up-gradient)	Use of ammunitions in the area	Lead

Segment	Location along segment	Source	Potential Contaminants of Concern
	Final sections of Segments 3 and 4 near intersection with Tuffins Ln	Presence of low to high probability ASS	ASS
	Select locations along segment	Illegal dumping of various wastes	Asbestos, heavy metals, PAH, TRH, BTEXN, and PCBs
	Select locations along segment	Potential use of herbicides and pesticides along the project for pest and weed controls	OCPs, OPPs, arsenic, and lead
5	Council pump station and former scrap yard and fuel storage (located at the end of the segment)	Potential spills and leaks from use of the site, maintenance and fuelling Impacts associated with the storage of scrap materials onsite	Heavy metals, PAH, TRH, BTEXN, OCPs, OPPs, PCBs
	Port Macquarie Airport located adjacent south of Segment 5 (potentially up-gradient)	Potential historical use of firefighting foams Potential spills and leaks from use of the site, maintenance and fuelling	PFAS, PAH, TRH, BTEX
	Residential property with large industrial shed used for fuel storage. Located 1.8 km south of Segment 5 (potentially up-gradient)	Potential spills and leaks from use of the site as a fuel storage facility	PAH, TRH, BTEX, heavy metals
	Firing range located approximately 1 km south of the segment (potentially up-gradient)	Use of ammunitions in the area	Heavy metals
	Former scrap yard located 30 m north of one of the SPS compounds located along Hastings River Dr)	Impacts associated with the storage of scrap materials onsite	Heavy metals
	Former horticultural site located approximately 50 m south of the segment (potentially up-gradient)	Potential use of pesticides and herbicides during operation	OCPs, OPPs, arsenic and lead
	Former Bus depot located 50 m north of the segment	Potential spills and leaks from use of the site, maintenance and fuelling	PAH, TRH, BTEXN
	Select locations along segment	Illegal dumping of various wastes	Asbestos, heavy metals, PAH, TRH, BTEXN, and PCBs
	Existing bitumen and road base materials	Impacts associated with the existing bitumen and road base materials (historical materials may be coal tar based) Historical fill from unknown sources	Heavy metals, PAH, TRH, BTEXN, phenols, asbestos, OCPs, OPPs and PCBs
	Select locations along segment	Potential use of herbicides and pesticides along the project for pest and weed control	OCPs, OPPs, arsenic and lead
6	Former horticulture site located adjacent (south) of a portion of the segment (potentially upgradient)	Potential use of pesticides and herbicides during operation	OCPs, OPPs, arsenic and lead, nutrients, pH
	Chemical storage facility located adjacent west of the segment along John Oxley Dr	Potential spills and leaks due to reported unsatisfactory storage of chemicals	Heavy metals, PAH, TRH, BTEX, phenols, OCPs, OPPs and PCBs

Segment	Location along segment	Source	Potential Contaminants of Concern
	Former service station located adjacent east of segment 6 along John Oxley Dr	Potential spills and leaks from use of the site, maintenance and fuelling	PAH, TRH, BTEXN, heavy metals, OCPs, OPPs
	Select locations along segment 6	There is a low probability of presence of NOA in some locations along the segment	NOA
	Select locations along segment	Illegal dumping of various wastes	Asbestos, heavy metals, PAH, TRH, BTEXN, and PCBs
	Existing bitumen and road base materials	Impacts associated with the existing bitumen and road base materials (historical materials may be coal tar based) Historical fill from unknown sources	Heavy metals, PAH, TRH, BTEXN, phenols, asbestos, OCPs, OPPs and PCBs
	Select locations along segment	Use of herbicides and pesticides along the project for pest and weed control	OCPs, OPPs, arsenic and lead
7	Former horticulture sites located adjacent of the segment	Potential use of pesticides and herbicides during operation	OCPs, OPPs, arsenic and lead
	Former Waste Management Site within Lake Innes Nature Reserve with the closest part located 100 m south (potentially upgradient of Segment 7)	Leaching of and disposal of materials associated with waste storage and treatment facility	Asbestos, heavy metals, PAH, TRH, BTEXN, OCPs, OPPs, PCBs and PFAS
	Former service stations located between 200 to 1000 m south of the segment (potentially upgradient of Segment 7)	Potential spills and leaks from use of the site, maintenance and fuelling	PAH, TRH, BTEXN, heavy metals, OCPs, OPPs
	Select locations along segment 7	There is a low probability of presence of NOA in some locations along the segment	NOA
	Select locations along segment	Illegal dumping of various wastes.	Asbestos, heavy metals, PAH, TRH, BTEXN, and PCBs
	Existing bitumen and road base materials	Impacts associated with the existing bitumen and road base materials (historical materials may be coal tar based) Historical fill from unknown sources	Heavy metals, PAH, TRH, BTEX, phenols, asbestos, OCPs, OPPs and PCBs
	Select locations along segment	Use of herbicides and pesticides along the project for pest and weed controls	OCPs, OPPs, arsenic and lead

Based on the results of the desktop assessment, the overall likelihood for significant chemical contamination to be present in the project area is considered to be low. There is a high probability of encountering ASS during construction along Segments 1, 2, 3, 4 and beginnings of Segment 5. There is also low NOA potential located in portions of Segment 2, 6 and 7.

It is considered that the risks from disturbance of potential contaminated soils within the project can be managed during the proposed works, by implementation of the mitigation measures identified in Section 15.5.

15.2.5.4 Exposure pathways

In addition to the potential contaminants of concern identified (refer to Section 15.2.5.3), the preliminary CSM also identified exposure pathways by which current and future receptors could be exposed to the potential sources of contamination. However, it is unknown if the identified pathways are actively present.

The identified exposure pathways are:

– Direct contact (including ingestion) with potentially contaminated soil or groundwater.
– Inhalation of potential contaminants in soil, if disturbed (particularly asbestos if present).
– Volatilisation to indoor or outdoor air and subsequent inhalation of potential hydrocarbon impacts from soil or groundwater.
– Lateral migration of potential contaminants via surface water run-off to impact surface water (Fernbank Creek, Partridge Creek, Kooloonbung Creek and Hastings River).
– Vertical and horizontal migration of potential contaminants within the groundwater (where present).

15.2.6 Potential receptors

The existing key population profile of the project area and its surrounds were assessed to identify potential receptors when considering potential impacts from exposure to contaminants (refer to Section 15.3 and Section 15.4). The potential receptors included:

– Current occupants of the project (e.g. workers)
– Intrusive maintenance workers during project construction
– Visitors to the project (e.g., members of the public - trespassers)
– Future workers on the project and associated infrastructure (commercial/industrial)
– Current and future occupants of surrounding properties (e.g., residents, workers, and visitors)
– Recreational users of water bodies
– Offsite groundwater usage
– Flora and fauna within the proposed project and surrounding land
– Surface water systems throughout the proposed project including Fernbank Creek, Partridge Creek, Kooloonbung Creek and Hastings River
– Groundwater beneath the proposed project and associated infrastructure

15.3 Potential impacts – construction

15.3.1 Soil risks

15.3.1.1 Soil erosion and sediment transport

The construction of the project would involve vegetation removal, excavation and ground disturbance activities that would potentially impact soil surfaces resulting in erosion and sedimentation. The movement of plant and equipment within unsealed areas may also result in potential erosion and sedimentation. If not adequately managed, the potential impacts to soils may include:

– Erosion of soil surfaces and stockpiled materials
– Dust generation
– Increased sediment loads entering nearby waterways
– Soil compacts leading to reduced productivity and impacts on drainage

The proposed location of the WWTP including the recycled water plant and portions of the recycled water main, return effluent pipeline to Kooloonbung Creek and sewer rising mains are in an area surrounded by the wetlands of Patridge Creek and Fernbank Creek. These hydrological features increase erosion, sediment transport, and runoff susceptibility during construction. The majority of the excavation would be associated with the construction of the water main, recycled water main, sewer main, power and communications and return effluent pipeline components, with a large amount being constructed using open trenching methods (as described in section 3.3). To minimise the area of soil disturbed and exposed to erosion, these components would be constructed in segments at various stages to allow reinstatement to occur progressively. Horizontal direction drilling (HDD) would be utilised at eight locations (refer to Chapter 3 (Project description) and Figure 3-7) to avoid disrupting sensitive environmental areas and minimise soil erosion.

15.3.1.2 Acid sulfate soils and NOA

The presence of ASS were identified with areas of both high and low probability along segments 1, 2, 3, 4 and the beginning of segment 5. The exposure of ASS to oxygen during ground disturbance can lead to the generation of sulfuric acid.

As detailed above in section 15.3.1.1, HDD would be undertaken in areas of environmental sensitivity whereby trenching is deemed unsuitable. HDD is an alternative method of installation involving minimal disturbance of soil and due to no open trenching or dewatering required and can effectively exclude oxygen from soil during service installation minimising potential impacts associated with ASS disturbance. It is considered that the potential impacts associated with ASS can be managed through the implementation of HDD in areas of high ASS probability in conjunction with the mitigation measures detailed in Section 15.5.

There is also low NOA potential located in portions of Segment 2, 6 and (refer to Section 15.2.3). A map illustrating the location of the identified NOA areas is provided in Technical Report 9 – Soils and Contamination Preliminary Site Investigation. It is considered that the risks associated with disturbing NOA in these areas can be managed by the implementation of the mitigation measures detailed in Section 15.5.

15.3.2 Contamination risks

The construction of the project may encounter contaminated sources associated with surrounding activities and historical land uses. There is potential for diffuse or isolated chemical contamination to be encountered during construction, which include:

- Potential for various anthropogenic wastes associated with residences, waste dumps, or due to illegal dumping in various locations along the project footprint.
- Potential presence of asbestos containing materials and lead based paints in the building materials of the residential and shed structures.
- Spills or leaks from agricultural equipment or from historical mining activities.
- Use of herbicides and pesticides for weed spraying and chemicals associated for weed control or horticultural activities.
- Fill materials from unknown sources during the construction of the airport, racecourse, highway/road construction, and other residential and commercial/industrial developments, including potential historical mining leases.
- Spills/leaks from petroleum hydrocarbon use and storage (diesel and premium unleaded) within 1 kilometre of the roadways adjacent the project and identified offsite service stations.
- Potential spills and leaks due to reported unsatisfactory storage of chemicals located adjacent west of the segment along John Oxley Drive.
- Use of land adjacent the project as roadways with accumulation and runoff containing fuel and oil residues potentially directed to road verges and drainage lines (isolated to areas adjacent to roads).
- Wastes from the former Waste Management Site within the Lake Innes Nature Reserve, former waste management facilities located in the current location of the airport and scrap yards in several locations.
- Potential historical use of aqueous firefighting foams at the Port Macquarie Airport.
- Use of ammunitions in the firing range.

Based on the results of the desktop assessment, the overall likelihood for significant chemical contamination to be present along the proposed project is considered to be low. It is considered that the risks from disturbance of potential contaminated sources within the project can be managed during the proposed works, by implementation of the proposed mitigation measures outlined in Table 15-5.

15.4 Potential impacts – operation

15.4.1 Soil erosion and sediment transport

During operation, there would be minimal exposed topsoil close to waterways. As a result, there is likely to be little or no risk of soil erosion and subsequent transport of sediment into nearby receiving waterways. Soil erosion and associated sediment transport near waterways may occur as a result of vehicle use on unsealed access tracks for general maintenance of the pipeline components which intersect areas of Fernbank Creek, Partridge Creek, Hastings River and Kooloonbung Creek.

Any potential impacts from soil erosion and sediment transport would be managed through mitigation measures through mitigation measures outlined in Section 15.5, in addition to the management plans to be prepared outlined in Table 15-5.

15.4.2 Contamination risks

If not managed appropriately, the storage and use of chemicals during operation and maintenance of the project have the potential to cause localised soil and/or groundwater contamination arising from vehicle accidents, leaks and spills, which may migrate through runoff. The risk of soil and groundwater contamination resulting in environmental impacts would be increased in areas close to sensitive receptors, such as national parks, nature reserves, waterways and other environmental management areas. These risks would be minimised through the implementation of mitigation measures included in Table 15-5.

15.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise soil and contamination impacts of the project are detailed in Table 15-5.

Table 15-5 Soil and contamination impact mitigation and management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
SC1	Contaminated Soil Management Plan (CSMP)	Development of a Contaminated Soil Management Plan (CSMP) to manage any contamination encountered during the construction of the project and to ensure the completed works are suitable for the intended land use.	Council/ contractor	Pre-construction
SC2	Further contamination delineation	Provision for further detailed assessment where appropriate to confirm the conclusions of this preliminary assessment and to determine whether any specific remediation or management of areas is required. The further assessment should be based on the following: – Potential areas and types of contamination identified in this assessment. – The potential for exposure to workers and to end-users based respectively on the nature of the proposed construction works and the final design of the project.	Council/ contractor	Pre-construction

ID	Impact	Environmental safeguard	Responsibility	Timing
SC3	Contamination exposure	Appropriate management controls to minimise the potential for exposure of contamination to workers and recreational users within the project both during and post construction. Description of appropriate excavation, validation, management and/or disposal requirements for potentially contaminated materials, if identified by further assessment or encountered during the construction of the project.	Council/ contractor	Pre-construction
SC4	Assessment protocols	Sampling and analysis requirements for assessment of potential contaminated soils for re-use or for waste classification prior to offsite disposal.	Contractor	Construction
SC5	Contingency plans	Contingency plans including unexpected finds protocols for potentially contaminated soils (if encountered) including landfill or anthropogenic waste and PACMs.	Council/ contractor	Pre-construction
SC6	NOA Management Plan	Development of an NOA Management Plan to provide a framework for safely working with NOA encountered during the construction and operation of the project.	Council/ contractor	Pre-construction
SC7	Acid Sulfate Management Plan	An Acid Sulfate Soil Management is to be implemented for pipe infrastructure installations during excavation works.	Contractor	Construction
SC8	Documentation	Any future contamination reports should be prepared and reviewed by an appropriately qualified environmental consultant.	Council/ contractor	Pre-construction

16. Waste and chemicals management

This chapter provides a detailed summary of the assessment of the potential waste and chemical impacts of the project. It describes the existing environment, assesses potential construction and operation impacts of the project, and provides proposed mitigation and management measures.
The full assessment is provided in Technical Report 10 – Waste and Chemicals Assessment (GHD, 2024).

16.1 Assessment approach

16.1.1 Legislation and policy context

The NSW Environment Protection Authority (EPA) is the primary regulator of waste and pollution in NSW. The EPA regulates the transport and disposal of hazardous waste, and works with industry to find sustainable solutions to minimise the amount of waste going to landfill. In NSW, acts and regulations govern waste management. Anyone who handles, stores, transports, processes, recycles or disposes of waste must follow these rules to minimise harm to human health and the environment.

The plans, policies and guidelines for waste management that were considered include:

– *Environmental Planning and Assessment Act 1979 (EP&A Act).*
– *Waste Avoidance and Resource Recovery Act 2001 (WARR Act).*
– *Protection of the Environment Operations Act 1997 (POEO Act).*
– *Work Health and Safety (WHS) Act 2011.*
– *Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation).*
– *The Work Health and Safety Regulation 2017.*
– NSW Waste and Sustainable Materials Strategy 2041 Stage 1: 2021-2027.
– NSW Circular Economy Policy Statement: Too Good to Waste.
– Waste Classification Guidelines: Part 1 Classifying (NSW EPA 2014) and Addendum (NSW EPA, 2016).
– Port Macquarie-Hastings Council Development Control Plan (DCP) 2013 (Port Macquarie-Hastings Council, 2021).

16.1.2 Methodology

The assessment of potential impacts associated with waste and chemical substances during construction and operation of the project involved:

– Reviewing the relevant legislation, policies and guidelines in relation to waste and chemical management.
– Identifying the potential waste generating activities during construction and operation.
– Identifying and assessing the chemical substance to be used during the operation processes.
– Estimating the identified waste streams and quantities.
– Classifying the identified waste streams in accordance with relevant legislation and guidelines.
– Developing management measures to help ensure that all wastes generated during both construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.
– Developing management measures to ensure safe handling of chemical substances.

Waste and chemical types and quantities identified in the EIS are indicative and were identified for the purpose of determining potential waste and chemical management measures.

16.2 Existing environment

Existing waste sources in the Port Macquarie-Hastings LGA primarily includes waste from agricultural, industrial and domestic waste.

Cairncross Waste Management Facility (EPL 11189) approximately 10 kilometres north of the project area on Telegraph Point Road, is the primary waste management facility. In addition to its landfill, it also includes a Waste Transfer Station, Organics Resource Recovery Facility (EPL 13120) and Material Recovery Facility (EPL 20708). These facilities can accept the following waste streams:

– Concrete, brick and asphalt
– General solid waste (non-putrescible)
– General solid waste (putrescible)
– Asbestos waste

16.3 Potential impacts – construction

16.3.1 Waste generation and management

The project has been designed, as far as practicable, to minimise the generation of waste through project planning and design which minimises excavation, a construction methodology that minimises open excavations for the pipeline and prioritising reuse of material, where practicable. Key activities with the potential to generate construction waste are summarised in Table 16-1. The primary types and quantities of waste generated by the project would vary throughout construction and the quantities included in Table 16-1 are indicative only.

Table 16-1 Key waste stream and classification - construction

Activity	Waste streams that may be produced	Estimated quantity	Likely classification of waste streams	Potential disposal / recycling	Potential destinations
Operation of construction site amenities	General waste (such as plastic film wrap, cable reels, and metal straps/bands, polystyrene and other packaging waste, etc.) and food and other organic waste	33 L/day	General solid waste (non-putrescible) General solid waste (putrescible)	Landfill	Cairncross Waste Management Facility
	Recyclables (such as paper and cardboard, containers (plastic, glass, metals)	250 L/day	General solid waste (non-putrescible)	Recycle (off-site separation)	Cairncross Materials Recovery Facility
	Wastewater (grey water and sewage)	5 kL/day	Liquid waste	Off-site disposal	Port Macquarie WWTP
	Electrical and electronic waste	Minimal	General solid waste (non-putrescible)	Landfill	Cairncross Waste Management Facility
Site preparation including green waste clearing, earthworks, establishment of compounds,	Green waste	50.42ha	General solid waste (non-putrescible)	Re-use on-site Recycle (separate collection from site)	Cairncross Organic Resource Recovery Facility
	Spoil (VENM/ENM)	14,804m^3	General solid waste (non-putrescible)	Re-use on-site	Reused as fill in Thrumster Wastewater Scheme

Activity	Waste streams that may be produced	Estimated quantity	Likely classification of waste streams	Potential disposal / recycling	Potential destinations
and installation/ relocation of services	Spoil (contaminated soils)	Minimal	Restricted waste, hazardous waste and/or special waste	Landfill	Cairncross Waste Management Facility
Construction of the project including building works, installation of equipment, paved areas, driveways, office and utilities	General building and construction waste (concrete, asphalt, metals, mechanical equipment, plasterboard, cables and electrical wiring, glass, packaging materials, etc.)	Minimal	General solid waste (non-putrescible)	Reuse on-site Recycle (off-site separation)	Cairncross Waste Management Facility
	Waste from vehicle/plant equipment maintenance and operation of vessels (such as adhesives, lubricants, waste fuels and oils, chemicals, engine coolant, batteries, tyres, etc.)	Minimal	General solid waste (non-putrescible) – drained oil filters (mechanically crushed), rags and oily rags (only if they contain non-volatile petroleum hydrocarbons and no free liquids) Restricted waste, hazardous waste	Landfill	Cairncross Waste Management Facility

Minor quantities of other waste streams such as other construction materials (e.g. asphalt, aggregate, timber formwork), offcuts and cables may also be generated. The potential impacts of waste generated from the project during construction, if not managed appropriately, are summarised in Table 16-2.

Table 16-2 Potential impacts associated with waste generation - construction

Aspect of waste management	Potential impacts
Generation of waste, including dredging, excavation and handling	– Dust from excavation, handling and movement of waste. – Erosion and sedimentation due to runoff from exposed surfaces. – Generation of turbid plumes and mobilisation of contaminants or release of turbid or contaminated waters. – Disturbance of seabed sediments and dispersal of suspended sediments. – Mobilisation of ASS, where present. – Sediment laden/contaminated runoff and leachate generation, which if located close to receiving waterbodies, could impact water quality and aquatic ecosystems. – Noise from plant and equipment movement. – Human health risks due to handling of contaminated soils and hazardous materials, such as asbestos, lead paint, etc.
Storage and segregation of waste	– Odours and dust from stockpiling/storage of wastes. – Human health risks due to storage of contaminated soils and hazardous materials, such as asbestos, lead paint, etc. – Sediment laden/contaminated runoff and leachate generation, which if located close to receiving waterbodies could impact water quality and aquatic ecosystems. – Waste build up from irregular or disrupted collections. – Cross contamination of soils due to improper segregation and storage. – Attracting pests and disease vectors.

Aspect of waste management	Potential impacts
Waste transportation	– Dust from loading waste onto vehicles and movement of waste on haul roads. – Road traffic noise from waste collection vehicles and movement of spoil. – Traffic generated by haulage of waste to reuse/disposal facilities. – Odours from loading waste onto vehicles and movement of waste collection vehicles to disposal or recycling facilities. – Mud tracking on road from waste collection vehicles. – Unlawful transport and disposal. – Incorrect classification of waste materials.
Non-classified or incorrectly classified waste transport and disposal	– Regulatory non-compliance. – Contamination of receiving facility. – Contamination of soils, groundwater and/or surface water. – Unlicensed waste contractors transporting waste.
Unlicensed waste contractors transporting waste	– Regulatory non-compliance. – Potential illegal dumping of waste. – Potential for disposal at unlawful unlicensed receival sites.

The nominated waste storage area for the proposed WWTP would be located west of the WWTP to allow access for collection trucks to pick up the skip bins, the indicative area is shown in Figure 3-1. The compound has been cleared and has adequate area to contain the bins and turning space for waste collection activities. Waste generated by construction staff and subcontractors would be stored in receptacles in the site office and crib room before transferred to the waste storage areas for collection.

The proposed approach to managing construction waste to facilitate segregation and prevent cross contamination is summarised in Table 16-3. In response to the potential impacts identified in Table 16-2, the mitigation measures proposed are detailed in Section 16.5.

Table 16-3 Management approach for construction waste

Waste type	Management
Spoil (ENM/VENM)	– The project would use all suitable spoil onsite for construction fill. There would be minimal surplus spoil generation from the project. The WWTP is located in flood prone land and an elevated fill pad is required to be constructed to mitigate flooding impacts.
Spoil (contaminated soils)	– Any actual or suspected contaminated soils would be classified in accordance with the Waste Classification Guidelines (NSW EPA, 2014). Once classified, the soil would be managed, transported and disposed of in accordance with the requirements for the relevant classification. This includes transport by an authorised contractor and disposal at an appropriately licensed facility that is lawfully able to receive the classification of waste. A Contaminated Soil Management Plan (CSMP) would be developed to manage any contamination encountered during the construction of the project and to ensure the completed works are suitable for the intended land use. Detailed can be found in the Soils and Contamination Preliminary Site Investigation Report.
Green waste	– Clearing would be minimised by placing temporary infrastructure in areas that have been previously cleared, degraded or have naturally lower above ground biomass. – Areas to be cleared would be marked to reduce incidental clearing. – As far as practicable, cleared material would be chipped, mulched, and stockpiled for reuse on-site as part of rehabilitation or landscaping works. Materials with special habitat value, such as hollow-bearing logs or trees, would be selectively removed for reuse, or placed in nearby bushland. – If unable to be reused on site, the material would be removed for off-site reuse in accordance with The Mulch Order 2016 or sent for recycling at a suitably licensed facility. – Priority weeds would be disposed of in accordance with relevant guidelines / requirements.

Waste type	Management
General building and construction waste (concrete, asphalt, timber, scrap metals, cable and packaging materials etc) and redundant utilities waste (wiring and piping)	– General building and construction waste would be classified in accordance with the Waste Classification Guidelines (NSW EPA 2014) and directed to a waste management facility that is lawfully permitted to accept that type of waste. – General building and construction waste would be managed in accordance with the waste hierarchy. – Where space constraints permit, waste would be segregated and stockpiled on site, with materials such concrete, metals and asphalt separated and sent to a construction and demolition waste recycling facility. Other recyclable materials would be sent for recycling as a mixed waste stream. – Opportunities for take back agreements in procurement would be identified e.g. packaging and pallets, etc.
Food and other organic waste	– Putrescible waste would be stored in designated bins and collected by an authorised contractor for disposal to a suitably licensed facility.
General waste (such as paper and cardboard, containers (plastic, glass, metals), pellets, plastic film wrap, cable reels, and metal straps/bands, polystyrene and other packaging waste etc)	– Labelled and colour coded receptacles would be provided at the construction site offices for general waste from construction personnel to ensure source separation of recyclable materials and residual landfill waste. These wastes would be collected on a regular basis by authorised and appropriately licensed waste collection contractors for offsite recycling or disposal.
Electrical and electronic waste	– Electrical and electronic waste would be segregated and sent for recycling to a suitably licensed facility.
Waste from vehicle/plant equipment maintenance (such as adhesives, lubricants, waste fuels and oils, chemicals, engine coolant, batteries, tyres etc)	– Waste from construction vehicle and plant maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for disposal off site. Any potentially hazardous waste would be stored separately in clearly labelled receptacles and disposed of in accordance with its waste classification. – Waste oil and oil filters would be stored in separate recycling bins and collected by an authorised contractor, and recycled off site, where feasible. – Tyres would be collected by an authorised contractor for recycling at a facility licensed to receive tyres (including tyre pieces).
Wastewater (grey water and sewage)	– Wastewater generated by the construction staff would be treated by a package wastewater treatment system and tankered offsite for disposal at a suitably licensed facility.

16.3.2 Chemical management

The chemicals likely to be used during construction are detailed in Table 16-4. It is assumed that during construction, minimal storage of chemicals would occur, and no stockpiling (just in-time use).

The potential impacts associated with the use of these chemicals during construction are detailed in Table 16-4.

Table 16-4 Potential impacts associated with chemical management – construction

Proposed chemical	Potential impact
Spray paint	– Inhalation of fumes may cause respiratory issues – Skin and eye irritation – Environmental pollution if not properly managed
LPG	– Flammable and explosive – Inhalation leading to dizziness and asphyxiation
Acetylene (welding)	– Highly flammable and explosive – Can cause asphyxiation in confined spaces
Oxygen (welding)	– Supports combustion, increasing fire risk – Overexposure can lead to respiratory issues

Proposed chemical	Potential impact
Paint (oil based considered worst case)	– Contains volatile organic compounds (VOCs) – Harmful if inhaled or ingested – Environmental pollution
Solvents	– Inhalation and skin exposure causing health issues – Environmental pollution
Epoxy resins	– Skin and eye irritation – Inhalation of vapours causing respiratory issues
Cleaning products	– Inhalation and skin exposure causing health issues – Environmental pollution
Diesel (C1)	– Flammable and combustible – Inhalation causing respiratory issues
General oils and lubricants (C2)	– Environmental pollution – Skin exposure causing irritation
Sealants / joint fillers	– Inhalation and skin exposure causing irritation – Environmental pollution
Detergent	– Skin and eye irritation – Environmental pollution

Mitigation measures identified in response to each potential impact are provided in Section 16.5. SafeWork NSW provides guidelines and codes of practice that offer practical guidance on complying with WHS regulations. This includes specific guidance on managing hazardous chemicals in the workplace. WHS regulations and SafeWork NSW guidelines should be followed at all times.

16.4 Potential impacts – operation

16.4.1 Waste generation and management

Table 16-5 lists the key waste streams that may be produced from operational activities, and their likely classifications.

Table 16-5 Key waste streams and quantities and classification - operation

Activity	Waste streams that may be produced	Likely classification of waste streams	Estimated quantity
Process	Dewatered sludge	General solid waste (non-putrescible), to be confirmed by sampling and testing	3,522 kg DS/d peak flow
	Recycled water	Liquid waste	42 L/s peak flow
	CIP Waste	Liquid waste	60 – 600 L per wash
	Effluent	Liquid waste	575 L/s peak flow
General operation and maintenance (including offices and amenities)	Chemical storage packaging	General solid waste (non-putrescible), hazardous waste	Minimal
	General waste (such as paper and cardboard, containers (plastic, glass, metals), pellets, plastic film wrap, and other packaging waste, etc) including food and other organic waste	General solid waste (non-putrescible) General solid waste (putrescible)	Minimal
	Wastewater (grey water and sewage)	Liquid waste	Minimal
	Electrical and electronic waste	General solid waste (non-putrescible)	Minimal

Activity	Waste streams that may be produced	Likely classification of waste streams	Estimated quantity
	Lubricants, oils, chemicals	General solid waste (non-putrescible) – drained oil filters (mechanically crushed), rags and oily rags (only if they contain non-volatile petroleum hydrocarbons and no free liquids) Restricted waste, hazardous waste	Minimal

The potential impacts associated with aspects of waste generation during operation are summarised in Table 16-6.

Table 16-6 Potential impacts associated with waste generation - operation

Aspect of waste management	Potential impacts
Storage and segregation of waste	– Odours and dust from storage of wastes – Sediment laden/contaminated runoff and leachate generation, which if located close to receiving waterbodies could impact water quality and aquatic ecosystems – Waste build up from irregular or disrupted collections – Cross contamination of waste due to improper segregation and storage – Attracting pests and disease vectors
Waste transportation	– Road traffic noise from waste collection vehicles – Traffic generated by haulage of waste to reuse/disposal facilities – Odours from loading waste onto vehicles and movement of waste collection vehicles to disposal or recycling facilities – Unlawful transport and disposal – Incorrect classification of waste materials
Non-classified or incorrectly classified waste transport and disposal	– Regulatory non-compliance – Contamination of receiving facility – Contamination of soils, groundwater and/or surface water – Unlicensed waste contractors transporting waste
Unlicensed waste contractors transporting waste	– Regulatory non-compliance – Potential illegal dumping of waste – Potential for disposal at unlawful unlicensed receival sites

The proposed approach to managing operation waste is detailed below in Table 16-7. In response to the potential impacts identified above in Table 16-6, mitigation measures are proposed and detailed in Section 16.5.

Table 16-7 Management approach for operational waste

Waste type	Management
Dewatered sludge	Dewatered sludge would be treated and stored appropriately to ensure it does not cause impacts on air quality, land and water. The dewatered sludge would be transferred to horizontal screw conveyor for transfer offsite in trucks. The material would be transported to the Cairncross Organic Resource Recovery Facility for reuse in composting.
Recycled water	The recycled water would be pumped offsite for use in the Thrumster Area 13 dual reticulation network and used for onsite toilet flushing.
Effluent	Treated effluent would be stored in tanks and pumped to Kooloonbung Creek.
CIP waste from the membrane trains	Material collected from the membrane trains would be stored in in the CIP pumping station which is designed to have the same volume as one membrane train. The CIP waste is transported back into the process for treatment. Note that membrane CIP cleans would not occur during peak flow periods.
Food and other organic waste	Food and other organic waste would be stored in designated bins and collected by an authorised contractor for disposal to a suitably licensed facility.

Waste type	Management
Wastewater (grey water and sewage)	Wastewater would be circulated to the head of the plant at the commencement of operation.
General waste (such as paper and cardboard, containers (plastic, glass, metals), pellets, plastic film wrap, and other packaging waste etc)	General waste would be managed in accordance with the waste hierarchy. Labelled and colour coded receptacles would be provided at the administration/control building and workshop/warehouse for general waste from operational personnel to ensure source separation of recyclable materials and residual landfill waste. These wastes would be collected on a regular basis by authorised and appropriately licensed waste collection contractors for offsite recycling or disposal.
Electrical and electronic waste	Electrical and electronic waste would be segregated and sent for recycling to a suitably licensed facility.
Lubricants, oils, chemicals	Waste from any workshop or maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for disposal off site. Any potentially hazardous waste or chemicals would be stored separately in clearly labelled receptacles and disposed of in accordance with its waste classification. Waste oil and oil filters would be stored in separate recycling bins and collected by an authorised contractor, and recycled off site, where feasible.

16.4.2 Chemical management

Table 16-8 outlines the key chemical substances that would be used during operation, and storage measures. Chemicals would be managed in accordance with Managing Risks of Hazardous Chemicals in the Workplace 2022 (SafeWork NSW 2023).

Table 16-8 Operation chemicals storage

Proposed chemical	Delivery type	Delivered state	Storage	Comments
Alum	Bulk tanker	Liquid	2 x 50 m^3 tanks	Forty days storage at peak average design rates and full chemical phosphorus removal. 20 days working volume per tank.
Sodium hydroxide	Bulk tanker	Liquid	2 x 25 m^3 tanks	Forty nine days storage at peak average design rates.
Sodium Hypochlorite	1 m^3 Intermediate Bulk Container (IBC)s	Liquid	3 m^3 tank 2 x 1 m^3 IBC additional storage allowance can be stored in bund	Additional IBCs can be stored in the bunded area. Ten weeks of storage without CIP cleans.
Citric acid	1 m^3 IBCs	Liquid	3 m^3 tank 2 x 1 m^3 IBC additional storage allowance can be stored in bund	Additional IBCs can be stored in the bunded area. Only required every three to six months. Citric acid would be transferred manually by the operator to the storage and dosing tank using the fixed transfer pump.
Chlorine gas	92 kg drums	Liquified gas	3 x drums	Thirty seven days storage time Two drums are connected at any one time, draw off occurs from a single drum only. Both drums are fitted with an automatic changeover. The third is a cold spare.
Dewatering polymer	Bulk powder trucks / IBCs	Powder	2 x IBCs	Forty days storage at average dose conditions Deliveries would be transferred to a polymer storage tank via a duty only loading pump.

Regular training of personnel and proper labelling of chemicals would be undertaken throughout the operation to ensure the safe handling of chemicals. An emergency response plan would also be developed prior to operation. A dedicated bunded area for the storage tank and dosing pumps and road bund for bulk delivery tanker parking has been proposed in the design to prevent any spills from entering into the stormwater. The chemical delivery bund area would be equipped with safety shower, eyewash, and hose reel facilities for local use. The potential impacts associated with chemical management during operation are summarised below in Table 16-9. Chemical storage onsite is also shown in Figure 3-4.

Table 16-9 Potential impacts associated with chemical management - operation

Proposed chemical	Potential impacts	Safety measures
Alum	Alum could irritate the skin, eyes, and respiratory system.	Alum would be stored in a well-ventilated area, and handled with appropriate PPE.
Sodium hydroxide	Contact with sodium hydroxide could cause skin corrosion or irritation and serious eye damage or irritation.	Sodium hydroxide would be stored in a well-ventilated area, and handled with appropriate PPE.
Sodium Hypochlorite	Contact with sodium hypochlorite could cause severe skin burns and eye damage, and respiratory irritation.	Sodium hypochlorite would be stored in a well-ventilated area, and handled with appropriate PPE.
Citric acid	Ingestion could cause gastrointestinal irritation with nausea, vomiting diarrhea. Inhalation could cause respiratory tract irritation and prolonged skin contact could cause severe irritation.	Polymer should be handled with appropriate PPE, and workers should be trained on safe handling procedures.
Chlorine gas	Chlorine gas is highly toxic and could cause severe respiratory and ocular irritation. Exposure to high concentrations could lead to respiratory distress and even death.	Chlorine gas would be stored in a well-ventilated area, and specialised PPE, such as gas masks, should be used.
Dewatering polymer	Exposure to polymer could cause skin and eye irritation.	Polymer should be handled with appropriate PPE, and workers should be trained on safe handling procedures.

16.5 Mitigation and management measures

All waste generated during construction would be managed using circular economy principles and the waste hierarchy approach of avoidance and reuse before consideration is given to disposal (Figure 16-1).

The waste hierarchy approach prioritises waste avoidance and minimisation and recycling above disposal. Waste minimisation and resource recovery strategies would be investigated and prioritised as part of the overall construction phase of the project.

Figure 16-1 Waste management hierarchy

All wastes would also be managed in accordance with the waste provisions contained within the POEO Act and other relevant legislative and policy requirements, as defined by the instruments, policies, and guidelines. Should waste be found to be unsuitable for reuse or recycling, disposal methods would be selected based on the classification of the waste material in accordance with the Waste Classification Guidelines (NSW EPA 2014). The Waste Classification Guidelines provide direction on the classification of waste, specifying requirements for management, transportation and disposal of each waste category.

Further details regarding waste management can be found in Technical Report 10.

The management and mitigation measures that would be implemented to minimise impacts associated with waste and chemicals of the project, in addition to those detailed in Table 16-3 and Table 16-7, are detailed in Table 16-10.

Table 16-10 Waste and chemical impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
WC1	Waste generation	Ensure that detailed design includes measures to minimise excess waste generation. Include a focus on optimising earthworks design to minimise excess spoil volumes and maximise the reuse of material on site and minimising the WWTP construction footprint. Pipe and pump wells will be retained and relined to reduce construction waste.	Council / contractor	Detailed design
WC2	Waste classification	Classify waste in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014) and manage in accordance with the POEO Act and associated regulations.	Contractor	Construction and operation
WC3	Emergency response	Prepare an emergency response plan prior to construction of the project, detailing hazardous materials, emergency procedures, resources, activation of the plan, reporting and termination of an emergency, etc.	Contractor	Pre-construction, construction
WC4	Construction waste	Prepare a Construction Waste Management Plan (CWMP) prior to construction of the project. Adopt the circular economy principles and the waste hierarchy contained in the *Waste Avoidance and Resource Recovery Act 2001*. Detail processes, responsibilities, and measures to manage waste and resource use, and minimise the potential for impacts during construction.	Contractor	Pre-construction, construction

ID	Impact	Environmental safeguard	Responsibility	Timing
WC5	Chemical storage	Prepare a Chemical Storage and Management Plan prior to operation of the project, detailing the safe handling procedures, labelling requirements, training and responsibilities. Prepare an emergency response plan would be developed prior to the operation, outline hazardous materials, emergency procedures, resources, activation of the plan, reporting and termination of an emergency, etc.	Contractor / Council	Operation
WC6	Operational waste	Prepare an Operation Waste Management Plan prior to operation of the project. Adopt the circular economy principles and the waste hierarchy contained in the *Waste Avoidance and Resource Recovery Act 2001*. Detail processes, responsibilities, and measures to manage waste and resource use and minimise the potential for impacts during operation.	Contractor / Council	Operation
WC7	Sludge management	Ensure dewatered sludge is stored properly in covered areas to minimise the risk of odour, runoff and potential contamination.	Council	Operation

17. Noise and vibration

This chapter provides a detailed summary of the assessment of noise and vibration potential impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures.
The full assessment is provided in Technical Report 11 – Noise and Vibration Impact Assessment (GHD, 2024).

17.1 Assessment approach

17.1.1 Legislation and policy context

The potential noise and vibration impacts resulting from construction and operation of the project were assessed in line with the following key policy guidelines and standards:

– Construction Noise and Vibration Guideline (TfNSW 2022).
– Interim Construction Noise Guideline (NSW DECC 2009) - used to establish standard construction working hours, identify noise management levels (NMLs) for construction of the project, assess construction noise impacts on sensitive receptors, and develop feasible and reasonable mitigation measures.
– Noise Policy for Industry (NSW EPA 2017).
– NSW Road Noise Policy (NSW DECCW 2011).
– Assessing Vibration: a technical guideline (NSW EPA 2006) - used to assess vibration impacts on sensitive receptors.
– Construction Noise and Vibration Strategy (TfNSW 2019).
– British Standard BS 5228.2-2:2009.
– British Standard BS 7385-2:1993.
– German Standard DIN 4150-3:2016.

17.1.2 Methodology

Study area

The study area for the Noise and Vibration Impact Assessment (NVIA) comprised a two-kilometre buffer around the project area which is defined in Chapter 1 (Introduction).

The study area was established to capture areas potentially impacted by noise and vibration from the project. Where impacts from traffic noise were predicated due to construction traffic or traffic diversions beyond this two-kilometre buffer, the study area also included relevant roads.

Key tasks

The key tasks for the NVIA included:

– Identifying the noises and vibration study area based on the extent of impacts.
– Identifying and classifying all potential noise and vibration sensitive receivers within the noise and vibration study area from the construction and operation of the project.
– Conducting ambient noise monitoring at representative locations in the noise and vibration study area.
– Processing the monitored data in accordance with the relevant guidelines to determine the ambient environment and NMLs and noise trigger levels for the project.
– Modelling the construction and operation activities of the project to predict noise and vibration levels at surrounding sensitive receivers.
– Assessing the likely airborne noise impacts.

– Assessing the likely construction and operation road traffic noise levels.
– Assessing the likely operational noise impacts.
– Assessing the likely vibration impacts at sensitive receivers during construction.
– Comparing the predicted noise levels to the current NMLs and noise trigger levels to determine the likely level of impact.
– Identifying mitigation measures to minimise and manage any predicted noise and vibration impacts.

Monitoring approach

An ambient noise survey was conducted to characterise and quantify the existing acoustical environment in the area surrounding the project site. The ambient noise monitoring consisted of continuous, unattended noise logging and operator attended noise surveys. Unattended noise monitoring was undertaken from 16 November 2023 to 30 November 2023. Attended monitoring was undertaken at each monitoring location for 15 minutes during the day to determine the character and relative contribution of noise sources. The operator attended noise surveys help to identify noise sources and the character of noise in the area to supplement and assist in in interpretation of the unattended monitoring results. Noise measurements were conducted with reference to AS 1055-2018 Acoustics –Description and Measurement of Environmental Noise and the Noise Policy for Industry (NPI).

17.1.3 Assessment criteria

The criteria used to assess predicted noise and vibration impacts during construction and operation of the project are described below.

17.1.3.1 Construction noise

Noise management levels

In accordance with the Interim Construction Noise Guidelines (ICNG) (NSW EPA 2009) the relevant Noise Management Levels (NMLs) (the noise levels above which management measures are required to be considered) are set with reference to the time of day and rating background levels (RBLs). The NMLs for residential sensitive receptors are provided in Table 17-1.

The Construction Noise and Vibration Guideline (CNVG) (TfNSW 2022) recommended the same standards hours as the ICNG however also defines Out-of-Hours Work (OOHW) periods and how to set criteria and potential noise mitigation measures for noise and vibration impacts experienced during construction works.

Table 17-1 NMLs for residential sensitive receptors

Time of day	Applicable noise management level ($L_{Aeq\ 15\ min}$)
Standard construction hours: – 7:00 am to 6:00 pm Monday to Friday – 8:00 am to 1:00 pm Saturday – No work on Sundays or public holidays	RBL + 10 dB
Outside standard construction hours (out of hours work): – OOHW Period 1 • Monday to Saturday 6:00 pm to 10:00 pm (evenings) • Saturday 7:00 am to 8:00 am and 1:00 pm to 10:00 pm (day and evening) • Sunday and public holidays 8:00 am to 6:00 pm (days) – OOHW Period 2 • Monday to Saturday 10:00 pm to 7:00 am (nights) • Sundays and public holidays 6:00 pm to 8:00 am (nights)	RBL + 5 dB

The project specific NMLs that apply to nearby sensitive receptors which have been determined in accordance with the ICNG and using the results from the noise monitoring, are presented in Table 17-2.

Table 17-2 Project specific NMLs

Receptor Type (Monitoring Location)	Construction noise management levels, $L_{Aeq\ (15min)}$				
	Standard construction hours		Outside standard construction hours		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential – NCA 3 (CT_03)	49	75	44	41	41[3]
Residential – NCA 4 (CT_04)	46	75	41	41[3]	38
Residential – NCA 5 (CT_05)	52	75	47	46	39
Residential – NCA 6 (CT_06)	45[2]	75	40	40	37
Commercial	70 (external)				
Industrial	75 (external)				
Educational Facility	55 (external)[1] or 45 (internal)				
Place of worship	55 (external)[1] or 45 (internal)				

Notes:

1. External noise management level is based on a 10 dB noise reduction through an open window.
2. The measured background noise levels were below minimum background noise levels recommended in the NPI, minimum RBLs have been adopted as per NPI (Section 2.3).

Construction traffic noise criteria

The CNVG (TfNSW 2022) states that if a quantitative assessment is required, construction related traffic noise objectives should be based on the guidance contained in the Road Noise Policy (RNP) (NSW DECCW 2011).

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments (in this case the construction area), any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘without construction’ scenario.

Ground-borne noise

Ground-borne noise is the noise radiated into a room caused by structural vibration (for example) cause by underground works. Ground-borne noise has significant low frequency components and tends to be more noticeable compared with airborne noise.

As no work of this nature is proposed, ground-borne noise due to construction activities was not assessed further in the NVIA.

17.1.3.2 Construction vibration

Ground-borne vibration

Operation of plant and machinery can be a source of vibration emissions. The resultant vibration can be transmitted into adjacent buildings and structures via the intervening ground. If the levels of vibration are sufficiently high, it may result in adverse impacts to human comfort or the damage of physical structures such as dwellings. The human comfort and structural damage impacts are assessed against different criteria, with the effects of vibration on human comfort having a lower threshold. To determine reasonable criteria for the assessment of potential ground-borne vibration impacts the study adopted:

– EPA’s Assessing Vibration: a technical guideline (AVTG) (NSW EPA 2006) to establish ground-borne assessment criteria to assess human comfort impacts.

– BS 6472-1:1992 Evaluation of human exposure to vibration in buildings (1–80 Hz) to establish ground-borne vibration assessment criteria to evaluate the effects of short-term vibration on structures.

Human comfort

Guidance in relation to acceptable vibration levels for human comfort are provided in EPA's Assessing Vibration: a technical guideline (AVTG) (NSW EPA 2006). Typically, construction works generate ground vibration of an intermittent nature. To assess the potential impacts to human comfort from vibration, the vibration dose value (VDV) metric was adopted for both the construction and operational vibration assessments.

The VDV criteria for sensitive receptors were adopted from the AVTG for sources of intermittent vibration, such as construction works. The vibration guideline advises that activities should be undertaken to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied to control vibration, the maximum values may be used if they can be justified.

Table 17-3 Acceptable vibration dose values for intermittent vibration

Location	Daytime VDV (m/s$^{1.75}$)		Night-time VDV (m/s$^{1.75}$)	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:

1. Daytime is 7:00 am to 10:00 pm and night-time is 10:00 pm to 7:00 am.

Structural damage due to vibration

Structural damage is regarded as minor in nature; it is readily repairable and does not affect a building's structural integrity. If there is no significant risk of damage, then structural damage is not considered a risk. The vibration levels adopted are related to transient vibration which does not give rise to resonant responses in structures and low-rise buildings.

The CNVG (TfNSW 2022) references German Standard DIN 4150-3:2016 Structural Vibration – *Part 3: Effects of vibration on structures for the assessment of damage to structures that are of intrinsic value.* The DIN 4150-3 criteria are presented in Table 17-4.

Table 17-4 Guideline values for short term vibration on structures – DIN 4150-3

Line	Type of structure	Guideline values for velocity, vi(t) (1) [mm/s]		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20-40	40-50
2	Dwellings and buildings of similar design and/or occupancy	5	5-15	15-20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example listed buildings under preservation order)	3	3-8	8-10

17.2 Existing environment

The existing noise environment varies across the project area due to the change between urban and rural environment. Common noise and vibration sources are generally associated with major road traffic and local traffic.

17.2.1 Sensitive receptors

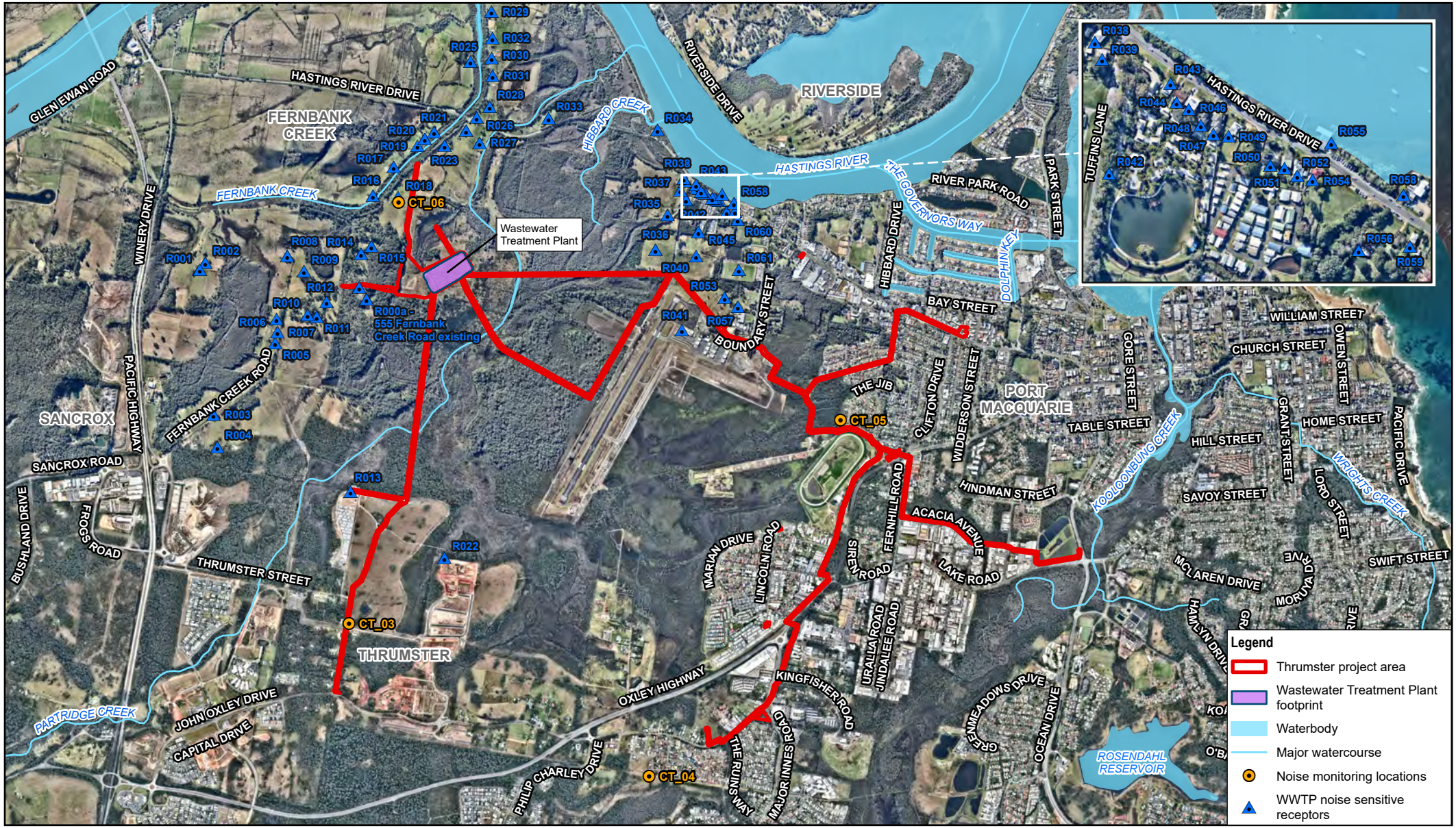
Potentially sensitive receptors are those that may be affected by changes in noise and vibration levels within the study area. Consistent with the adopted standards and guidelines, sensitive receptors in the study area include:

- Residences.
- Educational facilities.
- Hospital and medical facilities.
- Places of worship.
- Passive and active recreational areas such as parks, sporting fields, golf courses (note that these recreational areas are only considered sensitive when they are in use or occupied) .
- Commercial or industrial premises.

The sensitive receptors to the project area were used for modelling and assessment purposes, based on aerial photography, and are shown in Figure 17-1. A list of these receptors, their address and type are provided in Technical Report 11 – Noise and Vibration Assessment.

17.2.2 Noise catchment areas

Noise catchment areas (NCAs) have been defined to classify groups of sensitive receptors that are likely to have similar existing noise environment and experience similar impacts from the construction and operation of the project. This was determined through reference to aerial imagery and land use maps and verified during the noise monitoring. The NCAs are displayed in Figure 17-2.



Paper Size ISO A4

0 0.35 0.7 1.05 1.4

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

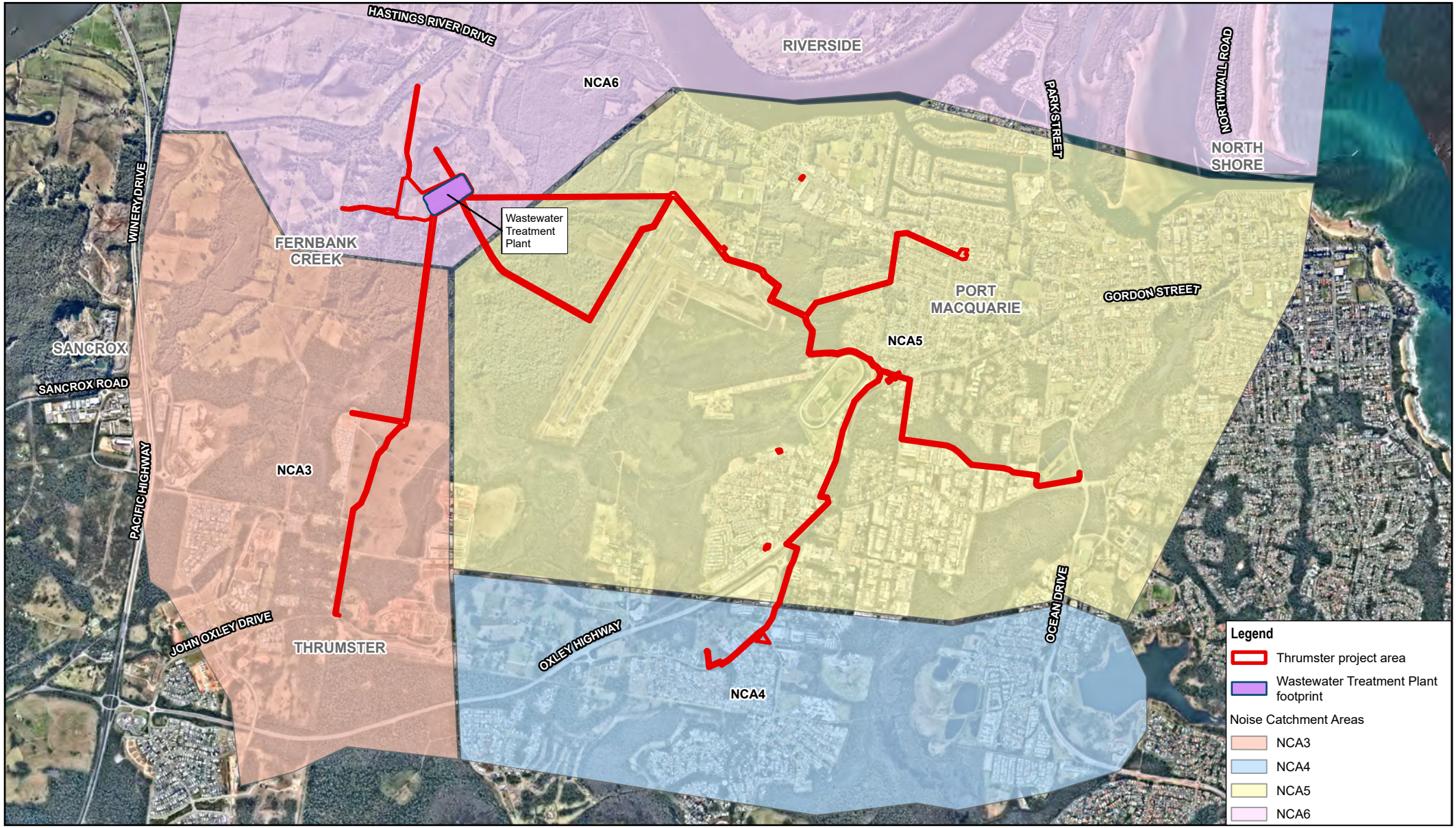
Sensitive receptors and noise monitoring locations

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 17.1

N:\AU\Newcastle\Projects\22\12587218\GIS\Maps\12611129_Thrumster_EIS.aprx
Print date: 22 Jul 2024 - 11:12

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay



Paper Size ISO A4

0 0.35 0.7 1.05 1.4

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Noise catchment areas

FIGURE 17.2

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Print date: 22 Jul 2024 - 11:12

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

17.3 Potential impacts – construction

Construction of the project would generate noise and vibration at nearby receptors. The potential impacts would vary depending on the intensity and location of construction activities, the type of plant and equipment used, RBLs, topography and weather condition. The key construction activities that were assessed are provided in Table 17-5.

Table 17-5 Construction stages

ID	Stage
CS01	Mobilisation and site establishment / Demobilisation and surface rehabilitation WWTP
CS02	Civil works WWTP
CS03	WWTP infrastructure construction
CS04	Pipeline installation - trenching
CS05	Pipeline installation - under boring
CS06	Laydown areas
CS07	Testing and commissioning
CS08	Access road construction

The potential impacts associated with construction would occur within the recommended standard construction hours as detailed in Section 17.1.3.1. However, some construction activities may occur outside the recommended standard construction hours, which may include:

– Work determined to comply with the relevant noise management level at the nearest sensitive receptor.
– The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons.
– Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm.
– Situations where agreement is reached with affected receptors.
– Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.

17.3.1 Construction noise

In order to identify potential construction noise impacts, the NVIA has predicted construction noise levels at the sensitive receptors within the study area with consideration to the acoustic requirements of the Interim Construction Noise Guideline. These predictions assume that the items of equipment generating noise are all operating at maximum capacity simultaneously at the closest distance between the construction works and the receptor.

Construction noise contours presented in Technical Report 11 – Noise and Vibration Assessment indicate that the WWTP and pipeline construction noise levels are predicted to exceed the NML's. However, during any given period, the construction plant and equipment is assumed to operate at maximum sound levels only for brief stages, whilst other activities would not require full power and would therefore produce lower sound levels. Additionally, it is highly unlikely that all construction equipment would be operating at their maximum sound levels at any one time. Therefore, it should be noted that the predicted noise levels informing the potential impacts are deemed highly conservative than the actual noise levels, which are considered to likely be lower.

The linear nature of pipeline construction would result in noise impacts being of relatively short duration for any affected receiver. Pipeline construction is expected to typically proceed in segments of 50 to 100 metres per day so any individual receiver would be impacted for only a short duration. Prior planning to the use of high noise generating equipment and minimising exposure time would help to reduce potential impacts onto residences.

The potential noise and vibration impacts associated with the construction of the project include associated traffic noise (addressed in Section 17.3.2) and construction vibration (addressed in Section 17.3.3).

17.3.2 Construction traffic noise

Potential impacts associated with construction traffic noise were identified for noise generated from additional light and heavy vehicle movements, arriving, and departing from the site. As detailed in Chapter 3 (Project description), the WWTP would be accessed via Hastings River Drive and Fernbank Creek Road.

Change in road traffic levels was considered along these routes due to construction of the of the WWTP are presented in Table 17-6 to Table 17-13.

Table 17-6 Change in road traffic noise levels due to construction traffic - Fernbank Creek Road south of Hastings River Drive

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	13	0	21	0	40
	Southbound	12	1	51	0	
Additional traffic	Northbound	12	22	110	22	
	Southbound	110	22	12	22	
Change in noise levels		**9.2**		**5.9**		

Table 17-7 Change in road traffic noise levels due to construction traffic - Hastings River Drive east of Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Eastbound	162	11	363	8	80
	Westbound	195	13	540	2	
Additional traffic	Eastbound	8	0	77	0	
	Westbound	77	0	8	0	
Change in noise levels		**0.6**		**0.4**		

Table 17-8 Change in road traffic levels due to construction traffic - Hastings River Drive west of Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Eastbound	146	11	344	8	80
	Westbound	183	12	488	2	
Additional traffic	Eastbound	34	22	4	22	
	Westbound	4	22	34	22	
Change in noise levels		**2.4**		1.4		

Table 17-9 Change in road traffic noise levels due to construction traffic - Hastings River Drive east of Winery Drive

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Eastbound	153	11	333	8	80
	Westbound	184	12	490	1	
Additional traffic	Eastbound	34	22	4	22	
	Westbound	4	22	34	22	
Change in noise levels		**2.3**		**1.5**		

Table 17-10 Change in road traffic noise levels due to construction traffic - Winery Drive north of Hastings River Drive

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	197	13	300	1	80
	Southbound	140	8	295	7	
Additional traffic	Northbound	2	15	17	15	
	Southbound	17	15	2	15	
Change in noise levels		**1.7**		**1.3**		

Table 17-11 Change in road traffic noise levels due to construction traffic - Winery Drive south of Hastings River Drive

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	54	9	55	1	80
	Southbound	28	4	206	0	
Additional traffic	Northbound	17	7	2	7	
	Southbound	2	7	17	7	
Change in noise levels		**2.3**		**1.6**		

Table 17-12 Change in road traffic levels due to construction traffic - Winery Drive north of Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	60	9	56	1	50
	Southbound	31	3	213	0	
Additional traffic	Northbound	17	7	2	7	
	Southbound	2	7	17	7	
Change in noise levels		**0.1**		-1.2		

Table 17-13 Change in road traffic noise levels due to construction traffic - Wanbuyn Drive south of Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	93	21	141	2	60
	Southbound	50	3	51	2	
Additional traffic	Northbound	17	7	2	7	
	Southbound	0	0	0	0	
Change in noise levels		**0.9**		1.1		

The results indicate that the construction of the WWTP and pipeline are predicted to result in relative increases in road traffic noise levels less than 2 dBA. These changes are compliant with the guidance contained in the RNP (DECCWQ 2011).

However, road traffic noise levels along the following roads are predicted to increase by more than 2 dBA:

– Fernbank Creek Road
– south of Hastings River Drive
– Hastings River Drive west of Fernbank Creek Road
– Hastings River Drive east of Winery Drive
– Winery Drive south of Hastings River Drive

As the noise level increases to the closest receptors at these locations would be more than 2 dBA, receptors would qualify for consideration of noise mitigation under the Transport for New South Wales Noise Mitigation Guideline (2022). The potential impacts to the sensitive receptors within proximity to these areas are addressed in Table 17-14 below. Further detail is provided in Technical Report 11 – Noise and Vibration Assessment.

Table 17-14 Construction noise traffic impacts at affected sensitive receptors

Road	Receptor	Potential impact summary
Fernbank Creek Road south of Hastings River Drive	The following sensitive receptors are located closest to this section of Fernbank Road and are shown in Figure 17-1: – 358 Fernbank Creek Road – 403 Fernbank Creek Road – 461 Fernbank Creek Road	These receptors are predicted to experience a noise level increase that would exceed the controlling criterion of 55 dBA for residences affected by additional traffic on local roads. The identified mitigation measures in Section 17.5 would be implemented as a minimum to manage and minimise construction related traffic impacts at these receptor locations.
Hastings River Drive west of Fernbank Creek Road	The closest residential receptor at this section of Hastings River Drive is located at 4 Oakes Crescent (refer to Figure 17-1).	The predicted increases to road traffic levels at this receptor would be below the controlling criterion of 60 dBA for residencies affected by additional traffic on existing freeways, arterial and sub-arterial roads. Road traffic noise levels associated with construction traffic are also predicted to be below the controlling criterion at other sensitive receivers along this section of Hasting River Drive as they are located further away from the road.
Hastings River Drive east of Winery Drive	The closest residential receiver to this section of Hasting River Drive is located at 371 Fernbank Creek Road (refer to Figure 17-1).	The predicted increases road traffic levels at this receptor would be greater than the controlling criterion of 60 dBA for residencies affected by additional traffic on existing freeways, arterial and sub-arterial roads. The identified mitigation measures in Section 17.5 would be implemented as a minimum to manage and minimise construction related traffic impacts at these receptor locations.

Road	Receptor	Potential impact summary
Winery Drive south of Hastings River Drive	The closest residential receiver to this section of Winery Drive is located at 7 Glen Ewan Road, Sancrox (refer to Figure 17-1).	The predicted increases to road traffic levels at this receptor would be below the controlling criterion of 60 dBA for residences affected by additional traffic on existing freeways, arterial and sub-arterial roads. Road traffic noise levels associated with construction traffic are also predicted to be below the controlling criterion at other sensitive receivers along this section of Winery Drive as they are located further away from the road.

17.3.3 Construction vibration

Potential impacts associated with construction vibration were identified for structural damage, human comfort and perception, and damage to utilities associated with ground-borne vibration produced from equipment during construction. To assess these potential impacts and their extent, the potential vibration levels due to the construction works at various distances were established and measured against relevant standards and guidelines, such as buffer distances.

The predicted vibration levels due to the construction works at various distances are shown below in Table 17-15. The potential impacts associated with construction vibration in this section have been identified as a result of an assessment of these levels against buffer distances from relevant standards and guidelines.

Table 17-15 Predicted construction vibration levels

Vibration source	Distance to Source/Peak Particle Velocity (mm/s)			
	10 m	20 m	50 m	100 m
Roller	6.0	3.4	1.7	1.0
Dozer	4.0	2.3	1.1	0.6
Excavator	2.5	1.4	0.7	0.4
Backhoe	1.0	0.6	0.3	0.2

These levels have been sourced from the Environmental Noise Management Manual ((NSW Roads and Traffic Authority [NSW RTA] 2001), British Standard BS 5228-2: 2009 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration and the Construction Noise and Vibration Strategy ST-157/4.1 (TfNSW 2019). The exact details of the operation of equipment which generates vibration would be defined during the construction planning phase of the project. Therefore, a range of construction sources were used in order to establish values to be used as a screening method and assess potential impacts.

17.3.3.1 Potential for structural damage

Predicted safe working buffer distances were calculated based on advice given in BS 7385-2:1993 Evaluation and measurement for vibration in buildings. These distances comply with the cosmetic damage, standard dwelling and heritage building structural damage criteria against typical vibration values and are listed in Table 17-16. In accordance with advice given from the applied criterion, if these values are complied with, damage that reduces the serviceability of the building would not occur.

Table 17-16 Vibration buffer distances - structural damage

Activity	Structural damage		
	Heritage building/structure DIN 4150-3 criteria (2.5 mm/s) – long term vibration	Heritage building/structure DIN 4150-3 criteria (3.0 mm/s) – short term vibration	Standard dwellings DIN 4150-3 criteria (5.0 mm/s)
Roller	30 m	24 m	13 m
Dozer	18 m	15 m	9 m

Activity	Structural damage		
	Heritage building/structure DIN 4150-3 criteria (2.5 mm/s) – long term vibration	Heritage building/structure DIN 4150-3 criteria (3.0 mm/s) – short term vibration	Standard dwellings DIN 4150-3 criteria (5.0 mm/s)
Excavator	10 m	9 m	7 m
Backhoe	6 m	5 m	4 m

No sensitive receptors in proximity to the proposed WWTP were identified within the structural damage safe working distances for any criteria or activity. However, a future residential development (not yet constructed) located at 555 Fernbank Creek Road was identified to potentially experience vibration levels above the structural damage safe working distances.

This may occur during the construction of the flood-proof, all-weather access road (refer to Chapter 3 (Project description)). Additionally, during pipeline trenching construction, residential and non-residential receivers that are nearby may potentially experience vibration levels above the structural damage safe working distances. Liaison with the landowner regarding easement for flood-proof, all-weather access road is currently underway.

Prior planning to the use of any vibration generating equipment were considered to help to reduce potential impacts onto residencies in conjunction with the implementation of identified mitigation measures (see Section 17.5).

17.3.3.2 Potential for human comfort and perception

Predicted safe working buffer distances were calculated based on *BS 5228-2:2009 Code of practice for noise and vibration on construction and open sites – Part 2: Vibration and the Assessing Vibration: A Technical Guideline.* These buffer distances comply with the human comfort, and human perception criteria for residential receptors and non-residential receptors respectively and are presented below in Table 17-17 and Table 17-18.

Table 17-17 Vibration buffer distances - human comfort and person, residential Receptors

Equipment	Human comfort criteria (1.0 mm/s)	Human comfort based on AVTG vibration dose value ($m/s^{1.75}$)			
		Day preferred value 0.2 $m/s^{1.75}$	Day maximum value 0.4 $m/s^{1.75}$	Night preferred value 0.13 $m/s^{1.75}$	Night maximum value 0.26 $m/s^{1.75}$
Roller	94 m	212 m	90 m	156 m	66 m
Dozer	57 m	128 m	54 m	94 m	40 m
Excavator	32 m	71 m	30 m	53 m	22 m
Backhoe	10 m	23 m	10 m	17 m	9 m

Table 17-18 Vibration buffer distances - human comfort and perception, non-residential Receptors

Equipment	Human comfort criteria (1.0 mm/s)	Human comfort based on AVTG vibration dose value ($m/s^{1.75}$)			
		Day preferred value 0.4 $m/s^{1.75}$	Day maximum value 0.8 $m/s^{1.75}$	Night preferred value 0.4 $m/s^{1.75}$	Night maximum value 0.8 $m/s^{1.75}$
Roller	94 m	90 m	38 m	39 m	17 m
Dozer	57 m	54 m	23 m	24 m	10 m
Excavator	32 m	30 m	13 m	13 m	8 m
Backhoe	10 m	10 m	7 m	7 m	5 m

Potential impacts associated with ground-borne vibration were identified to occur at sensitive receptors in proximity to the proposed WWTP, where they might experience vibration levels above human comfort criteria during the access road construction activities. Additionally, residential and non-residential sensitive receptors in proximity to the pipeline components were identified to potentially experience vibration levels above human comfort criteria during any trenching construction activities. Prior planning to the use of any vibration generating equipment were considered to help to reduce potential impacts onto residencies in conjunction with the implementation of identified mitigation measures (see Section 17.5).

17.3.3.3 Potential vibration damage to utilities

The potential impacts associated with vibration damage to utilities would be identified during the detailed design and construction phase. For the purposes of the NVIA, safe working buffer distances to comply with vibration criteria for underground assets were identified (refer to Technical Report 11 - Noise and Vibration Assessment).

A Before You Dig (BYD) survey would be done prior to construction work commencing on site to locate all utilities. Once the location of utilities is known, due care would be taken to avoid the use of vibration intensive equipment within the identified buffer areas. Less vibration intensive equipment should also be sourced prior to commencing work.

17.4 Potential impacts – operation

The potential noise and vibration impact associated with the operation of the project have been identified and are addressed throughout this section. They include:

– Noise impacts due to the operation of the WWTP
– Operational traffic impacts
– Operational vibration impacts

In order to determine operational noise generated and the associated potential impacts, the following assumptions were made:

– All fixed plant items are assumed to operate at full load and full rated speed.
– All fixed plant items are assumed to operate 24 hours per day.
– All fixed plant items modelled as point sources at height of building they’re housed within.

Prevailing meteorological conditions were also considered for operational noise predictions and can be found in Technical Report 11.

17.4.1 Operation of WWTP

Results from the overall predicted noise levels from the operation of the WWTP are presented in Technical Report 11 and indicate that:

– During calm conditions, predicted noise levels are compliant with project noise trigger levels at all sensitive receptors.
– During prevailing wind conditions, predicted noise levels are compliant with project noise trigger levels at all sensitive receptors.
– During temperature inversion conditions, predicted noise levels are compliant with project noise trigger levels at all sensitive receptors.

Although the NVIA identified that operational plant and usage would result in compliant noise levels, it was noted that onsite noise testing should be undertaken during the commissioning phase to determine if any annoying characteristics are present and whether additional noise mitigation measures are required.

Additionally, in accordance with assessing operational plant and usage impact, potential impacts associated with sleep disturbance were also analysed. It was identified that noise sources generated at night are equal to or less than the results from the predicted noise levels (refer to Technical Report 11 - Noise and Vibration Assessment). The results indicate that during worst case temperature inversion conditions, predicted noise levels are not predicted to disturb sleep at all sensitive receptors. Therefore, potential sleep disturbance impacts generated as a result of operational noise is considered highly unlikely.

17.4.2 Operation of pump stations

Operational noise levels from pump stations were predicted at the sensitive receptors within the study area (see Figure 17-1) with consideration to the acoustic requirements of the NPI. Due to the large extent of the project area and large number of sensitive receptors, predicted noise levels at individual receptors was not provided. The results are presented in Technical Report 11 and indicate that during worst-case temperature inversion conditions, predicted noise levels are compliant with project noise trigger levels at all sensitive receptors. However, as noted in section 17.4.1, onsite noise testing is recommended to be undertaken during the commissioning phase to determine if any annoying characteristics are present and whether additional noise mitigation measures are required. Additionally, as per section 17.4.1, potential sleep disturbance impacts generated as a result of operational noise produced by the pump stations were found to be highly unlikely.

17.4.3 Operational traffic noise

Once fully operational, it is anticipated that four full time employees would be required to manage the onsite operations at the WWTP. Further details regarding operational traffic are provided in Chapter 13 (Traffic and transport). Change in road traffic noise levels due to the operation of the WWTP are presented in Table 17-19 and Table 17-20.

Table 17-19 Change in road traffic noise levels due to operational traffic – Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Northbound	13	0	21	0	80
	Southbound	12	1	51	0	
Additional traffic	Northbound	0	0	4	0	
	Southbound	4	0	0	0	
Change in noise levels		**0.5 dBA**		0.2 dBA		

Table 17-20 Change in road traffic noise levels due to operational traffic – Hastings River Drive east of Fernbank Creek Road

Scenario	Direction	AM Peak		PM Peak		Speed
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles	
Existing traffic	Eastbound	162	11	363	8	80
	Westbound	195	13	540	2	
Additional traffic	Eastbound	0	0	4	0	
	Westbound	4	0	0	0	
Change in noise levels		**0.0 dBA**		**0.0 dBA**		

The results indicate that the relative increases in road traffic noise levels associated with the operation of the WWTP are predicted to be less than 0.5 dBA and are therefore compliant with relevant guidance (NSW DECCW 2011).

17.4.4 Operational vibration impacts

No operational vibration impacts are anticipated given that the nearest sensitive receptors to the WWTP are over 500 metres away and the pipelines would be buried underground.

17.5 Mitigation measures

Management and mitigation measures that would be implemented to minimise noise and vibration impacts of the project are detailed in Table 17-21.

Table 17-21 Noise and vibration impact management measures

ID	Impact and Action required	Environmental safeguard	Responsibility	Timing
Airborne noise/Ground-borne noise and vibration				
NV1	Implement stakeholder consultation measures	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receptors at least seven days prior to commencement of relevant works. In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis: – Project specific website – Project Infoline – Construction response line – Email distribution list – Web-based surveys – Social media – Community and stakeholder meetings – Community based forums (if required by approval conditions)	Contractor/ Council	Pre-construction
NV2	Register of noise and vibration sensitive receptors	A register of most affected noise and vibration sensitive receptors (NVSRs) would be kept on site. The register would include the following details for each NVSR: – The address of the receptor – Category of receptor (e.g., Residential, Commercial, etc.) – Contact name and phone number The register may be included as part of the Project's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.	Contractor	Pre-construction
NV3	Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction
NV4	Construction respite period	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work.	Contractor	Construction

ID	Impact and Action required	Environmental safeguard	Responsibility	Timing
		No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.		
NV5	Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: – All relevant project specific and standard noise and vibration mitigation measures. – Relevant license and approval conditions. – Permissible hours of work. – Any limitations on noise generating activities with special audible characteristics. – Location of nearest sensitive receptors. – Construction employee parking areas. – Designated loading/unloading areas and procedures. – Site opening/closing times (including deliveries). – Environmental incident procedures.	Contractor	Pre-construction, construction
NV6	Update Construction Environmental Management Plans	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.	Contractor	Pre-construction, construction
Source measures				
NV7	Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking, and loading/unloading areas to minimise reversing movements within the site.	Contractor	Pre-construction, construction
NV8	Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, where piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques in lieu of sheet piling, will have significant noise and vibration benefits.	Contractor	Construction
Airborne noise				
NV9	Behavioural practices	– No swearing of unnecessary shouting or loud stereo/radios on site. – No dropping of materials from height, throwing of metal items and slamming of doors. – No excessive revving of plant and vehicle engines. – Controlled release of compressed air.	Contractor	Pre-construction, construction
NV10	Maximum noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound pressure levels compliant with the allowable noise levels in Appendix C of CNVG.	Contractor	Pre-construction, construction
NV11	Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used onsite unless compliant with the allowable noise levels in Appendix C of CNVG.	Contractor	Construction

ID	Impact and Action required	Environmental safeguard	Responsibility	Timing
NV12	Use and siting of plant	– Simultaneous operation of noise plant within discernible range of a sensitive receptor is to be avoided. – The offset distance between noise plant and adjacent sensitive receptors is to be maximised. – Plant used intermittently to be throttled down or shut down. – Noise-emitting plant to be directed away from sensitive receptors.	Contractor	Pre-construction, construction
NV13	Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles.	Contractor	Pre-construction, construction
NV14	Minimise disturbance arising from delivery of goods to construction sites	– Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receptors. – Select site access points and roads as far as possible away from sensitive receptors. – Dedicated loading/unloading areas to be shielded if close to sensitive receptors. – Delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible.	Contractor	Construction
NV15	Construction related traffic	– Schedule and route vehicle movements away from sensitive receptors and during less sensitive times. – Limit the speed of vehicles and avoid the use of engine compression brakes. – Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.	Contractor	Construction
NV16	Silencers on mobile plant	Where possible reduce noise from mobile plant through additional fittings including: – Residential grade mufflers. – Damped hammers such as “City” Model Rammer Hammers. – Air Parking brake engagement is silenced.	Contractor	Construction
NV17	Prefabrication of materials off-site	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.	Contractor	Pre-construction, construction
NV18	Engine compression brakes	– Limit the use of engine compression brakes at night and in residential areas. – Ensure vehicles are fitted with and maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission’s ‘Inservice test procedure’ and standard.	Contractor	Pre-construction, construction
Path controls				
NV19	Shield stationary noise sources such as pumps, compressors, generators, fans etc.	Stationary noise sources would be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.	Contractor	Pre-construction, construction, operation

ID	Impact and Action required	Environmental safeguard	Responsibility	Timing
NV20	Shield sensitive receptors from noisy activities	Use structures to shield residential receptors from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.	Contractor	Pre-construction, construction, operation
NV21	Additional mitigation measures	Where impacts from construction noise are unavoidable and it is not feasible to achieve the construction noise objectives, additional measures such as letter box drops and phone calls are proposed in line with Table 6.3 in Technical Report 11 – Noise and Vibration Assessment.	Council/ contractor	Pre-construction, construction

18. Land use and property

This chapter provides an assessment of the potential impact of the project on land use and property. It describes existing land uses in the project site, assesses the impacts of construction and operation on land uses and properties, and provides measures to mitigate and management the impacts identified. The full assessment is provided in Technical Report 13 – Land Use and Property Impact Assessment (GHD, 2024).

18.1 Assessment approach

18.1.1 Legislative and policy context

Key legislation considered as part of the assessment of land use and property impacts included:

– *Port Macquarie-Hastings Local Environmental Plan 2011* establishes the land use zones and objectives applicable to the Port Macquarie-Hastings local government area, which have been considered as part of the assessment of impacts.
– *Biosecurity Act 2015* – provides for a framework for the prevent, elimination and minimisation of biosecurity risks on public and private land in NSW.
– *Crown Land Management Act 2016* – provides management principles for Crown land in NSW and acquisition requirements.
– *National Parks and Wildlife Act 1974* – provides for the establishment and management of protected areas in NSW. Protected areas include national parks, nature reserves, wilderness areas, Aboriginal areas or state conservation areas. The project intersects Lake Innes Nature Reserve. The potential impacts are discussed in Sections 18.3.6.

18.1.2 Methodology

The approach to assessment of land use and property impacts involved an overall land use and property impact assessment as well as a more specific assessment of agricultural land impacts and biosecurity risks due to the importance of this land use within the project footprint.

Developing new wastewater infrastructure can change the use of the land on which it is proposed to be located on. For most of the project site, the main change would be predominantly surrounding the area of the new WWTP, new access road and around the new sewer pump stations. The sewer rising mains, recycled water mains and electricity supply cables, after construction, would be buried and only require maintenance activities during operation. Assessing the potential impacts on land use and properties broadly involves considering existing and potential future land uses in the vicinity of the project and determining how these land uses may change as a result of the project, both temporarily during construction and permanently during operation.

The assessment has taken into account the projects indicative land requirements, based on the land with the potential to be affected by the project's construction and operation footprints. The land requirements have been based on the design work undertaken to date and would continue to be refined as the design is further developed.

The area for the assessment is focussed mainly on the project area (as described in Chapter 3 (Project description)) and includes consideration of land surrounding the project site with the potential to be affected by the projects land requirements.

The land use and property impact assessment involved:

– Reviewing, identifying and mapping land use in the study area, based on a desktop review of spatial data, aerial photography and relevant environmental planning instruments.
– Reviewing the existing environment with regard to existing properties and land uses around the project.
– Reviewing the legislation and policy context.

– Reviewing engagement outcomes to date relating to property and land use issues.
– Reviewing potential future property and land use changes.
– Analysing data sources to quantify impacts.
– Assessing the potential impacts on properties including those that would need to be acquired to construct and operate the project.
– Identifying mitigation measures to avoid, minimise and manage impacts on property and land use.
– Assessing potential impacts on land use and property based on the project footprint by applying the *Land Use Conflict Risk Assessment Guide* (DPI, 2011a).
– Identifying mitigation and management measures to minimise the potential impacts identified.

18.2 Existing environment

A description of the project site for the purpose of the EIS is provided in Chapter 2 (Strategic context) and Chapter 3 (Project description). This section provides an overview of existing land uses (including land use zoning under the relevant environmental planning instrument) within and immediately surrounding the project site, property and ownership, land use classification and biosecurity risks. Future land use planning, including key strategic planning, development directions for the study area, is described in Chapter 2 (Strategic context).

18.2.1 Existing land uses

Land use around the WWTP is a mixture of rural residential, environmental management (coastal wetland), and transport infrastructure (Port Macquarie Airport). The pipeline routes cover recreational land use, Crown Land (Port Macquarie Racecourse and Rifle Range), local roads, and current or future urban residential land use. New pipelines for sewer, returned effluent, and recycled water rising mains would generally be located within utility easements and road reserves, passing through a number of different land uses.

The WWTP site would be located within a cleared and unoccupied area currently owned by PMHC and zoned RU1 Primary Production under the PMHLEP 2011. The land was formerly used for agricultural purposes including cattle grazing, prior to being purchased by PMHC in 2000. A series of drainage channels were constructed in the 1970s through the flat low-lying areas in the northern part of Thrumster land.

The proposed sewer rising main, utilities, effluent and recycled water pipeline infrastructure routes would be located in road reserves and utility easements and would be located adjacent to natural environment, recreational, rural and residential land uses.

Other key land uses within and adjacent to the project site include:

– Lake Innes Nature Reserve, located south within the locality of the proposed pipeline infrastructure routes.
– Port Macquarie Airport, located approximately one kilometre east of the proposed WWTP site.
– The WWTP site is surrounded predominantly by the Partridge Creek, located immediately north, east and south of the proposed WWTP site, along with smaller areas of native forest and agricultural areas.
– Hastings River, located approximately 1.5 kilometres north of the proposed WWTP site
– Thrumster Business Park, located approximately 2.5 kilometres south of the proposed WWTP site, and 65 metres east of the recycled water route off Thrumster Street.
– Port Macquarie Clay Target Club, located approximately 700 metres south west of the proposed sewer rising main pipeline and 2.5 kilometres south east of the proposed WWTP site.
– Port Macquarie Race Club, located directly south of a portion of the sewer rising main route and approximately 3.2 kilometres of the proposed WWTP site.
– Rural and residential land uses located along the recycled water route from the WWTP south following Thrumster St and John Oxley Drive.
– Rural, residential, commercial and recreational land uses located along the sewer rising main route following the Oxley Highway and John Oxley Drive, and along the return to Kooloonbung Creek route following Fernhill Rd to Acacia Ave.
– Suburban and sensitive land uses including houses along Fernbank Creek Rd.

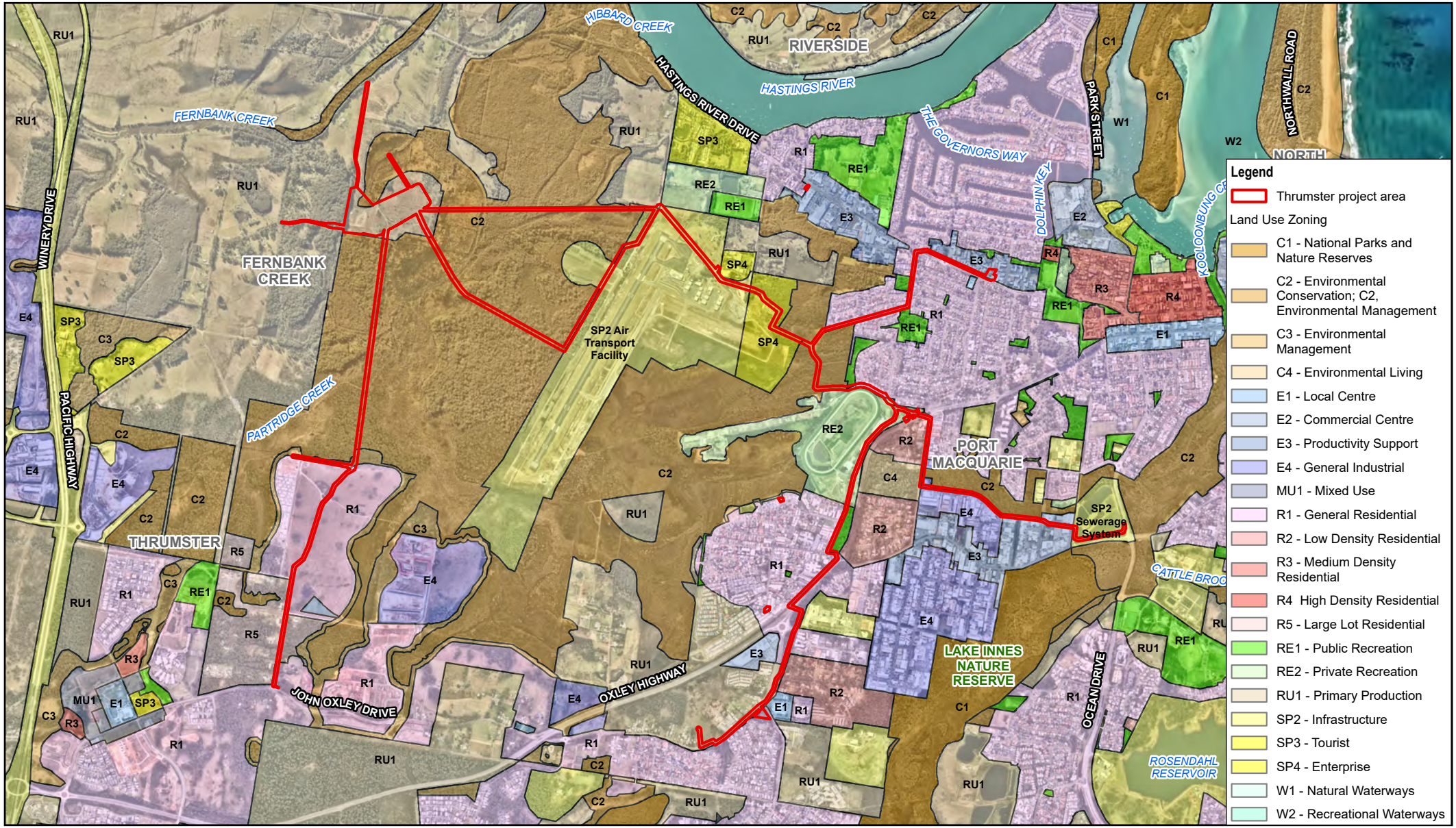
– Major roadways which the pipeline routes would traverse includes the Oxley Highway and Hastings River Drive. The project also intersects numerous regional and local roads. Chapter 13 (Traffic and transport) and Technical Report 7 - Traffic and Transport Assessment provides further detail on transport infrastructure within the project site and the project's interaction.
– Utilities infrastructure, such as water supply, stormwater drainage, wastewater, electricity, gas and telecommunications, are located within the project area. These include critical utilities such as high voltage transmission lines, high pressure gas and wastewater mains that form a critical function in the respective utility supply. Most of these utilities within/close to the project are located within the road reserve and/or utility easement.

18.2.2 Land zoning

Land use zoning for the project site is in accordance with the *Port Macquarie-Hastings Local Environmental Plan 2011*. Land use zoning is shown in Figure 18-1 and summarise in Table 18-1.

Table 18-1 Land use zones within the project footprint

LEP land use zone	Approximate area within project footprint (ha)	Proportion of the project footprint (%)
B5 Business Development	1.227	2.23
B7 Business Park	1.674	3.04
C2 Environmental Conservation	14.485	26.32
C3 Environmental Management	0.759	1.38
C4 Environmental Living	0.179	0.33
IN1 General Industrial	0.905	1.64
R1 General Residential	9.346	16.98
R2 Low Density Residential	0.629	1.14
R5 Large lot Residential	0.656	1.19
RE1 Public Recreation	0.416	0.76
RE2 Private Recreation	2.386	4.34
RU1 Primary Production	16.931	30.76
SP2 Infrastructure	5.449	9.90
Total	55.042	100



Paper Size ISO A4

0 0.3 0.6 0.9 1.2

Kilometres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Land use zoning

FIGURE 18.1

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Print date: 22 Jul 2024 - 11:12

Data source: NSW Government: DPE Land Use Zoning, 2023; PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

18.2.3 Property and ownership

There is a wide range of property infrastructure within the project area including residential dwellings, commercial industries and rural properties. Chapter 3 (Project description) of the EIS identify properties within the project area.

Crown land

The following areas identified as Crown land is located within the project area:

- Crown reserve running from Patridge Creek Rd, situated between Lot 14, DP1139180 to the east and Lot 2, DP1140746 to the west. This would be used for the access road to the WWTP.
- Port Macquarie Racecourse (R610027): a portion of the sewer rising main, water main and return effluent to Kooloonbung Creek pipeline route would traverse along Lady Nelson Drive. Additionally, the sewer rising main would traverse further in this Crown Reserve south adjacent to the Oxley Highway.
- Public recreation Crown land reserve (R88520): a portion of the sewer rising main would traverse along Kemp Street, which is identified as a crown road, and directly adjacent to an uncleared parcel of land identified as a crown reserve.
- SPS23 upgrade would be located within a portion of Crown land reserve 'Hamilton Green' (R210112) located directly off Hastings River Drive.
- A portion of the return effluent to Kooloonbung Creek pipeline route would intersect land identified as crown roads south of Lot 103 and 104, DP754434, and the crown reserve 'Port Macquarie Sewerage Treatment Plan (R210029) from Barton Crescent following adjacent to Lake Road before reaching Ocean Drive.

Native title

At the time of preparing the EIS, no land within the project footprint was found to be the subject of an application or determination made under the *Native Title Act 1993*. In addition, no Aboriginal land claims made under the *Aboriginal Land Rights Act 1983* have been identified within the project footprint.

Land use classification

The land use within the project area is outlined in Table 18-2 and provides a comparison with the Port Macquarie-Hastings LGA. The project area is primarily located within land use classified as grazing modified pastures (23%), transport and communication (19%), grazing native vegetation (15%) and marsh/wetland (15%). The overall project area accounts for 0.015% of all land within the Port Macquarie-Hastings LGA.

Table 18-2 Land use within the LGA and project area

Main land use	LGA (Ha)	Percent of LGA	Project area (ha)	Percent of project area	Percent of project area in LGA
1.1.0 Nature conservation	89,163	24.2%			
1.2.0 Managed resource protection	305	0.1%			
1.3.0 Other minimal use	75,056	20.4%	6.64	12%	0.002%
2.1.0 Grazing native vegetation	44,583	12.1%	8.47	15%	0.002%
2.2.0 Production native forestry	63,358	17.2%			
3.1.0 Plantation forests	13,829	3.8%			
3.2.0 Grazing modified pastures	52,525	14.3%	12.64	23%	0.003%
3.3.0 Cropping	144	0.0%			
3.4.0 Perennial horticulture	1,031	0.3%			
3.5.0 Seasonal horticulture	34	0.0%			
3.6.0 Land in transition	145	0.0%			
4.2.0 Grazing irrigated modified pastures	22	0.0%			

Main land use	LGA (Ha)	Percent of LGA	Project area (ha)	Percent of project area	Percent of project area in LGA
4.4.0 Irrigated perennial horticulture	4	0.0%			
5.1.0 Intensive horticulture	14	0.0%			
5.2.0 Intensive animal production	159	0.0%			
5.3.0 Manufacturing and industrial	154	0.0%			
5.4.0 Residential and farm infrastructure	8,067	2.2%	2.96	5%	0.001%
5.5.0 Services	1,210	0.3%	4.63	8%	0.001%
5.6.0 Utilities	6	0.0%			
5.7.0 Transport and communication	4,492	1.2%	10.51	19%	0.003%
5.8.0 Mining	97	0.0%			
5.9.0 Waste treatment and disposal	66	0.0%	0.91	2%	0.0002%
6.1.0 Lake	3,619	1.0%			
6.2.0 Reservoir/dam	48	0.0%			
6.3.0 River	8,085	2.2%	0.03	0.05%	0.0000%
6.5.0 Marsh/wetland	1,857	0.5%	8.27	15%	0.002%
Total	**368,074**	**100.0%**	**55.04**	**100%**	**0.015%**

Private land

The proposed flood-proof access road for the WWTP site would traverse private land, located at 555 Fernbank Creek Road on Lot 10, DP1089078. Council has liaised with the landowner regarding acquisition for an easement through this property for the purpose of flood-proof access road to the WWTP.

18.2.4 Biosecurity risks

Biosecurity risks to agriculture within the agricultural study area are associated with the presence and spread of weeds, pest animals and plant and animal diseases.

The following biosecurity risks have been identified from desktop review, engagement with representatives from LLS, council and landowners within the project area:

If a new pest or disease becomes established, it can affect agricultural properties through increased costs (for monitoring, production practices, additional chemical use and labour), reduced productivity (in yield and/or quality) or loss of markets.

Farms generally prepare an on-farm biosecurity plan based on industry guidelines such as those available on the website: farmbiosecurity.com.au. The guidelines include risk assessments and control option to minimise impacts. The major biosecurity risk from this project relate to the movement of people, vehicles and machinery, with the risks occurring at both construction and operation phases.

18.3 Potential impacts - Construction

18.3.1 Property and ownership impacts

The project would require the use of land both temporarily and permanently. While the permanent land requirements would commence during construction, these impacts would be long-term and relate to the operation and maintenance of the new infrastructure.

The land requirements are estimated based on the current design and the land that is expected to be occupied by the project site. The permanent and temporary land requirements are summarised below.

18.3.2 Permanent land requirements

A right of access easement is required through Lot 10, DP1089078 (private land) for the flood-proof access road to the WWTP.. Council have begun negotiations with the private property owner to obtain a right of access easement. Further detail regarding land acquisition is provided in Section 3.

No other permanent land acquisition is required to facilitate the project.

18.3.3 Temporary land requirements

The project would also require access to some land temporarily during the construction phase. Areas would be temporarily required to:

– Establish key construction infrastructure (refer to Chapter 3 (Project description))
– Provide access to construction area
– Facilitate manoeuvring of construction plant and machinery
– Lay down of material, site compounds and temporary amenities

Overall, impacts on property ownership during construction would be considered minor due to the relatively short-term impacts on landowners. It is expected that potential impacts would be minimised through compensation provided via leases and landowner agreements. Land temporarily used for construction would be rehabilitated in consultation with the affected landowners and returned as soon as practicable at the completion of construction.

For the areas Crown Land that would be affected by the project, a licence or easement would be separately sought for the construction and operation of the project over Crown Land.

18.3.4 Other property impacts

Construction is unlikely to substantially restrict movements of landowners and other users within the project area for the duration of construction. Particularly during construction of the sewer rising mains, recycled water mains, discharge pipelines and power supply cables access to properties may be restricted temporarily for certain activities, however these activities would be short-term and undertaken in consultation with landowners and/or relevant property managers.

Access and egress to and from the residence along Fernbank Creek Road is expected to be maintained for the duration of construction activities.

Any properties subject to changes would be provided with alternative access. While there is likely to be some temporary disruption to properties during construction, construction of the rising main would be intermittent and would be constructed in sections. As such, potential impacts would be short-term and limited to the construction phase. The potential impacts on property access during construction is assessed as being minor.

18.3.5 Biosecurity impacts

The productivity and profitability of agricultural production depends in part on the management of pests and diseases, including the prevention of incursion of pests and diseases onto properties. Biosecurity is a term that is commonly used for such management and the set of measures adopted to protect a property from the entry and spread of pests, diseases and weeds.

The *Biosecurity Act 2015* provides a framework for the prevention, elimination and minimisation of biosecurity risks. The General Biosecurity Duty under the Act provides a general obligation on people to be aware of their surroundings and take action to prevent the introduction and spread of pests, diseases, weeds and contaminants.

The project would result in the increased movement of vehicles and people to, around and within the project area during construction. This may result in the spread of weed seeds which could be transported through and within the site on clothing and via vehicle wheels and undercarriages.

Potential biosecurity risks and measures that may mitigate these risks would be included in the Construction Environmental Management Plan (CEMP) and would detail measures to minimise the potential for biosecurity risk during construction in accordance with the General Biosecurity Duty and *Biosecurity Act 2015* and the regional weed management plans. Council would also continue to fulfil their obligations under the General Biosecurity Duty during operation for all lands that remain under their control. Additional protocols to minimise biosecurity risks are outlined in the mitigation measures in Section 18.5.

18.3.6 Impacts on National Parks

The project would not traverse through land identified as a National Park or Wildlife Service Estate. The nearest national park is Lake Innes Nature Reserve located approximately 840 metres from the closest site, which is the proposed compound site at the junction of Major Innes Rd and John Oxley Dr.

As such, no impacts on Lake Innes Nature Reserve are anticipated to occur as a result of the project.

18.3.7 Crown land

Formal easement applications for affected sections of Crown land would be undertaken in accordance with the *Crown Land Management Act 2016*.

18.3.8 Other land use impacts

The approach to design development included a focus on avoiding and/or minimising the potential for impacts during key phases of design. As described in Chapter 2 a site location, project corridor and alignment options assessment process were undertaken to identify the preferred option. This process considered a range of factors, including potential impacts on land use and properties. The project location and design has been, and would continue to be, refined to minimise land use and property impacts and enhance benefits as far as practicable, including:

– Maximising the use of existing corridors and easements.
– Modifying the alignment where an alternative route, which met the project objectives with lower potential impacts, is available.
– Refining the design to minimise land requirements and associated need for property acquisition.

Other impacts during construction include impacts associated with loss of amenity. Properties close to the project site may experience changes in amenity when construction occurs close to their property. Construction may result in the following impacts, which could affect amenity:

– Increase in noise and vibration levels as a result of the operation of construction plant and equipment and construction traffic.
– Changes in the visual outlook for properties with views over/towards construction work areas and compounds.
– Increase in dust generated during construction.

These potential impacts and relevant mitigation measures are considered in Chapters 10 (Social), 13 (Traffic and transport), 14 (Air quality), 17 (Noise and vibration) and 21 (Landscape character and visual amenity). Amenity impacts would be temporary and managed by implementing the mitigation measures provided in these chapters.

18.3.9 Land use conflict risk assessment

Land use conflicts occur when one land use is perceived to infringe upon a neighbouring land use whereby in rural areas, they commonly occur between agricultural and residential uses. A process of identifying potential land use conflict is generally to identify potential risks by considering land use changes that may affect existing land uses in the area.

A risk assessment matrix (Table 18-3) has been adopted to assess potential land use conflict risks from the project. It has been used to identify the effects of the proposed land use on neighbouring land uses and identifies a risk rating for each impact based on the probability (P) of occurrence and the consequence (C) of the impact.

Table 18-3 Land use conflict risk ranking matrix

Probability						
Consequence		A	B	C	D	E
		Almost Certain	Likely	Possible	Unlikely	Rare
	1. Severe	25	24	22	19	15
	2. Major	23	21	18	14	10
	3. Moderate	20	17	13	9	6
	4. Minor	16	12	8	5	3
	5. Negligible	11	7	4	2	1

A land use conflict risk assessment (LUCRA) presented in Table 18-4 presents potential conflicts arising from the project and suggests mitigation measures to address these risks.

The LUCRA is presented in Table 18-4 below and. The framework presents the probability (P), consequence (C) and risk ranking (RR) of each risk activity, and the controlled risk ranking (RR) after mitigation factors are applied. A risk ranking of 25-11 (shaded in blue above) is deemed to be an unacceptable risk. A risk ranking of 10-1 is deemed to be an acceptable risk. The objective is to identify and define controls that lower the risk ranking score to 10 or below.

For all risk activities listed, the risk ranking of potential conflict ranges from 18 to 9. With mitigation, the risk ranking is reduced to between 9 and 3.

Table 18-4 Land use conflict risk assessment

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
Air Quality (Dust and Odours)	The main pollutants of concern are dust during the construction stage and odour during the operational stage of the project. The construction works would be completed across the WWTP and the associated pipelines including the recycled water pipeline, sewer rising main, and return effluent pipeline. Assessment took into account the dust emission magnitude and the receptor sensitivity for demolition, earthworks, construction and trackout. No demolition would be required. Assessment of odour impacts was undertaken based on a review of the operational activities, review of the recommended separation distances, estimation of odour emissions based on review of similar operating plants, and prediction of impacts at the nearest sensitive receptors using dispersion modelling. Three scenarios were modelled with varying use of the odour control unit. Predicted concentrations complied with the criteria at all receptors for all modelled scenarios, with increased use of the OCU leading to reduced odour impacts at the receptors. Based on this, the risk of odour impacts at nearby sensitive receptors is considered to be low.	B	4	12	A qualitative assessment was undertaken to estimate the impacts of dust emissions for the construction stage in accordance with the *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management, 2024). Emissions from earthworks, construction and trackout were identified as low risk for construction of the WWTP. Emissions from earthworks and construction were identified as low risk for the construction of the pipelines, and trackout was identified as medium risk. General management and mitigation measures have been proposed for construction to further reduce risk of dust emissions. Additional mitigation measures have been proposed for construction in areas within 20 metres of the nearest sensitive receptors. Management and mitigation measures have been proposed for general operation of the project to further reduce risk of odour emissions. Some of these mitigation measures include establishing a 24 hour emergency maintenance agreements with equipment manufacturers to limit the impact of equipment failures. If the works are emitting odour concentrations which may significantly impact the nearby receptors, the works should be modified or stopped until the hazard is reduced to an acceptable level	D	3	9

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
Fencing	The project area is located mainly within a rural setting and traverses through over 21 hectares of land mapped as grazing activities. Construction actives may result in fences temporarily cut and/or permanently realigned to improve access efficiency. Unless repaired or appropriately planned, cut fences could result in unintended livestock mixing which in turn could disrupt planned breeding programs, require added costs to muster and draft livestock. Fences with adjoining agricultural land would need to be maintained in a condition to minimise the possibility of livestock straying onto major transport corridors, adjoining properties or non-agricultural land. The maintenance of shared boundary fencing between property owners to be confirmed.	D	3	9	Prior to construction, boundary fencing would need to be undertaken to a stock proof standard (at a minimum). Shared boundary fencing is the responsibility of both property owners. Where there are open trenches within a property, arrangements would need to be made with landowners to ensure that these areas are temporarily fenced where livestock are grazing and cannot be excluded from a property.	E	4	3
Bushfire	Bushfire impacts are assessed for infrastructure and equipment that form part of the construction of the project. These impacts are assessed in terms of project related ignition sources. During construction, potential impacts from a bushfire burning within or into the project footprint may consist of ember attack, radiant heat, and direct flame contact. These impacts can result in damage or destruction of construction plant and equipment and pose a risk to the health and safety of workers. WWTP operations have an inherently low risk of bushfire ignition as they do not involve open flame or spark production in normal operation. The mostly non-combustible nature of built structural elements of WWTP infrastructure and fully cleared nature of the proposed WWTP operational infrastructure footprint means that even if accidental spark generation occurred from faults or maintenance works within the WWTP, the absence of significant combustible fuel sources within the WWTP footprint makes it almost certain that fire cannot take hold, escalate and spread from the WWTP site to adjacent vegetated areas, noting also the presence of low fuel areas in the surrounding APZ.	C	3	13	During project construction phase, there are four potential ignition sources that would require mitigation. These sources have the potential to ignite adjacent vegetation near to construction areas and pose a risk to life and assets. These four potential fire ignition sources include: – On-site Hot works (if any). – Catalytic converter-fitted vehicle exhaust system contact with tall flammable grass. – Sparks from metal on metal or rock friction during ground engaging machinery operation (earthworks works, boring works, road construction and realignment works). – Discarded cigarette butts from smokers. A risk assessment of the above potential fire ignition sources was undertaken. Bushfire risk reduction measures are focussed on fire prevention. Fire suppression at the ignition site at the time of ignition is a contingency measure. Potential ignition sources relating to the WTP operation are identified below. – On-site Hot works (if any).	D	4	5

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
					– Exothermic reaction between chemicals stored on site resulting in chemical fire ignition. – Discarded cigarette butts from smokers. A risk assessment of the above potential fire ignition sources was undertaken. Bushfire risk reduction measures are focussed on fire prevention.			
Landscape and Visual	The Landscape and Visual Assessment – Thrumster Wastewater Scheme (GHD 2024) assessed both the potential landscape character impacts and the visual impacts associated with the project. Twelve key viewpoints were selected as a representation only, of a view or potential views from a particular public visual catchment area. The viewpoints were selected due to their proximity to the project. Impact assessment considers both construction and operational stages of the project.	C	4	8	The impacts on the landscape character and visual amenity of the project have been assessed as negligible for construction and mainly negligible during operation, with moderate impacts expected in close proximity to the WWTP. The WWTP would be located within an existing coastal wetland area, which would affect the landscape character of this environment however, views towards the WWTP would be predominantly screened from the public view by existing dense native bushland. Refer to Landscape and Visual Assessment - Thrumster Wastewater Scheme (GHD 2024).	D	4	5
Noise and Vibration	A Noise and Vibration Impact Assessment (NVIA) was prepared to assess the potential noise and vibration impacts from the construction and operation of the project. Noise from WWTP and pipeline construction was predicted to exceed noise management levels (NML) at nearby sensitive receivers. It was predicted some sensitive receivers could potentially experience highly intrusive and moderately intrusive noise levels. Some may even be highly noise affected for short periods of time as the pipeline is progressively installed in close proximity to sensitive receivers. The relative increases in road traffic associated with the construction of the WWTP and pipeline were predicted to increase noise levels along Fernbank Creek Road south of Hastings River Drive, Hastings River Drive west of Fernbank Creek Road, Hastings River Drive east of Winery Drive and Winery Drive south of Hastings River Drive.	B	3	17	Noise and vibration impacts were assessed in accordance with the methods outlined in the NSW Noise Policy for Industry (EPA 2017), NSW Road Noise Policy (EPA 2011) and the Interim Construction Noise Guideline (EPA 2019). The Noise and Vibration Assessment - Thrumster Wastewater Scheme (GHD 2024) outlines a standard suite of noise and vibration management measures that are to be applied on all projects, together with additional mitigation measures which are applicable when construction noise or vibration is predicted to exceed the project's construction noise and vibration objectives. The standard suite of mitigation measures includes management measures such as community consultation, site inductions (with guidance on how to minimise noise and vibration) and the preparation of site-specific Construction Noise and Vibration Management Plans. The guideline also includes several recommendations for reducing the source noise levels of construction equipment via good planning and equipment selection.	C	4	8

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
	Vibration from the construction of the WWTP identified no existing sensitive receivers within the structural damage safe working distances. During trenching construction activities, residential and non-residential receivers that are nearby may potentially experience vibration levels above the standard guidelines. During operating, noise modelling predictions indicate no adverse impacts of the project on sensitive receivers.							
Waste	During construction of the project, the primary waste streams are expected to be generated from site preparation, construction of the project and operation of the site offices. Key waste streams that are expected during operation include dewatered sludge and concentrate from dewatering process, and general waste from operation and maintenance.	C	3	13	During construction, waste would be temporarily stored in the compound areas before on-site reuse or before being collected for off-site treatment or disposal. Appropriately licensed waste recycling and disposal facilities have been identified to accept general waste, construction waste, recyclables and organics waste including dewatered sludge. On the basis of the in-built measures and with the implementation of the identified additional mitigation measures, the project is not anticipated to result in unacceptable impacts on receiving environments in relation to waste. Refer to Waste and Chemicals Assessment (GHD 2024).	D	4	5
Chemicals and Pesticides	During construction, it is expected that some chemical would be used. It is assumed that minimal storage of chemicals would occur, and no stockpiling would occur (just-in-time use). The operation of the project would require chemical substances to be used for wastewater treatment. Pesticides may be used to control weeds during construction and operation.	D	3	9	A dedicated bunded area for the storage tank and dosing pumps and road bund for bulk delivery tanker parking has been proposed in the design to prevent any spills from entering into the stormwater. Regular training of personnel and proper labelling should be followed throughout the operation to ensure the safe handling of chemicals. An emergency response plan would be developed prior to the operation. Apply pesticides in accordance with the *Pesticides Act 1999*, such that only registered pesticides are used based on label instructions and are designed to minimise impact on adjoining land. On the basis of the in-built measures and with the implementation of the identified additional mitigation measures, the project is not anticipated to result in unacceptable impacts on receiving environments in relation to chemicals. Refer to Waste and Chemicals Assessment (GHD 2024).	E	4	3

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
Hazards	A preliminary risk screening of the project in accordance with the requirements of SEPP (Resilience and Hazards). The results indicate that the screening thresholds for dangerous goods storage were exceeded by chlorine, alum and sodium hydroxide to be used during operation. As a result, the project was deemed a 'potentially hazardous industry', and a level 2 PHA was completed.	C	2	18	A qualitative hazard identification study was completed as a systematic way to identify any potential off-site impacts, during construction and operation, which required further analysis. The hazard identification study identified the toxic release of chlorine required a semi-quantitative risk assessment. The impacts associated with alum and sodium hydroxide were considered manageable on site, requiring no further assessment. The semi-quantitative risk assessment found that whilst the consequences of a chlorine release have the potential to reach off-site populations, the risks of a fatality or injury complies with HIPAP 4 risk criteria. The level 2 PHA (hazard identification study and semi-quantitative risk assessment) demonstrated that the project can be designed, constructed, and operated in a manner that would meet the relevant regulations, standards and policies and minimise hazardous impact to the public. Therefore, the risks identified can be managed to acceptable levels throughout the lifecycle of the project.	D	3	9
Lights	Existing sources of night lighting in the immediate vicinity of the project area are minimal due to its semi-rural setting.	D	3	9	Any lighting during construction would be of short duration. Lighting would not be directed or spill into any adjoining landholding. Occupants of adjoining landholdings would be advised of any unlikely night-time construction and the proposed lighting requirements. During operation of the WWTP and SPSs, lighting would be provided in accordance with *AS 4282 – Control of the obtrusive effects of outdoor lighting*. This Standard specifically refers to the potentially adverse effects of outdoor lighting on nearby residents. Design of outdoor lighting would be required to control any obtrusive effects to an acceptable degree.	E	4	3

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
Surface water quality	Runoff from the site would drain into Partridge Creek and its tributaries which in turn would discharge into the Hastings River. the Hastings River estuaries sustain a large Sydney Rock Oyster industry. Works associated with the construction include various activities that have the potential to impact surface water quality. These activities include: – Earthworks, excavation and disturbing of soils. These have the potential to mobilise surface sediments resulting in impacts associated with erosion and sedimentation as well as impacts associated with in-situ sediments. – Handling hazardous materials such as chemicals for the WWTP and fuels for the plant. Potential water quality risks impacts may occur during the operational phase and include risks associated with: – The discharge of effluent from the WWTP. – Local stormwater, including impacts associated with increased imperviousness and chemical storage at site.	D	3	9	The following mitigation measures are proposed to address surface water quality impacts: – Implementation of a Construction Environmental Management Plan (CEMP), a Soil and Water Management Plan (SWMP) and an Erosion and Sediment Control Plan (ESCP) in accordance with the Blue Book. This includes the staging of the WWTP, recycling facility and pipeline construction into manageable portions. – Implementation of a CEMP and SWMP which includes the implementation of typical control measures such as bunding, safely storing hazardous materials, and visual inspection of the works area and waterways. – Implementation of an Operation Environment Management Plan which includes the implementation of typical control measures such as bunding, safely storing hazardous materials, and visual inspection of the works area and waterways, as well as pipeline maintenance. A Pollution Incidence Response Management Plan can also be utilised to manage operational impacts.	E	4	3
Flooding	During construction of the pipeline, trenching or drilling works are required in some areas which are prone to flooding. Risks include altering floodwater dynamics, mobilisation of sediment, ingress of floodwaters within exposed trenches.	D	3	9	Implementation of a CEMP, SWMP and ESCP are required to be developed in accordance with the Blue Book prior to construction, including consideration of staging works and managing pipeline segments which are located within flood-prone land. A Flood Management Plan (FMP) should also be developed as part of the SWMP or CEMP.	E	4	3
Erosion	Open trenching through waterways can be a high-risk construction activity that could lead to an array of environmental hazards such as artificial alteration of bed and bank morphology, erosion and sedimentation impacts, and obstruction of natural waterways. Portions of the sewer rising main and recycled water main pipelines pass through areas of high probability acid sulfate soil. Exposure of such soils during construction could lead to the release of contaminants into waterways.	C	3	13	A CEMP and SWMP, including an ESCP, are required to be developed prior to construction in accordance with the Blue Book, including site specific plans for each waterway crossings. An OEMP is also required to stipulate ongoing inspection requirements of pipeline corridors after rainfall and flood events to identify any areas of erosion, off-site sedimentation, and poor vegetation establishment.	D	3	9

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
	In-built mitigation measures such as HDD in environmentally sensitive areas and designing pipelines in accordance with appropriate guidelines are in place to minimise geomorphic impacts.							
Soils and Contamination	Based on the results of the desktop assessment, the overall likelihood for significant chemical contamination to be present along the proposed project is considered to be low. There is a high probability of encountering ASS during construction along Segments 1, 2, 3, 4 and beginnings of Segment 5. There is also low NOA potential located in portions of Segment 2, 6 and 7.	C	3	13	It is considered that the risks from disturbance of potential contaminated soils within the project can be managed during the proposed works, by implementation of the following: Development of a Contaminated Soil Management Plan (CSMP) to manage any contamination encountered during the demolition and construction of the project and to ensure the completed works are suitable for the intended land use. The CSMP should include the following: – Provision for further detailed assessment where appropriate to confirm the conclusions of this preliminary assessment and to determine whether any specific remediation or management of areas is required. The further assessment should be based on the following: – Potential areas and types of contamination identified in this assessment. – The potential for exposure to workers and to end-users based respectively on the nature of the proposed construction works and the final design of the project. – Appropriate management controls to minimise the potential for exposure of contamination to workers and recreational users within the project both during and post construction. – Description of appropriate excavation, validation, management and/or disposal requirements for potentially contaminated materials, if identified by further assessment or encountered during the construction of the project. – Sampling and analysis requirements for assessment of potentially contaminated soils for re-use or for waste classification prior to offsite disposal. – Contingency plans including unexpected finds protocols for potentially contaminated soils (if encountered) including landfill or anthropogenic waste and PACMs.	D	4	8

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
					– Development of an NOA Management Plan to provide a framework for safely working with NOA encountered during the construction and operation of the project. – Application of the Acid Sulfate Soil Management Plan for Pipe Infrastructure Installations during excavation works. Any future contamination reports should be prepared or reviewed and approved by an appropriately qualified environmental consultant. Refer to Soils and Contamination Preliminary Site Investigation assessment (GHD 2024).			
Traffic and Roads	A Traffic and Transport Assessment was prepared to assess the potential traffic and transport related impacts associated with the construction and operation of the project. It is anticipated that a workforce of approximately 60-100 full time equivalent (FTE) employees would be required during the construction phase of the project. The construction activity for the Thrumster WWTP is expected to generate up to 166 vehicle movements during AM and PM peak hours. As part of the construction process, pump stations and associated infrastructure would require upgrading. This would result in several smaller satellite construction compounds. The construction duration for these compounds ranges from two to six months and results in a maximum increase of 50 light vehicle and 80 light vehicle movements daily, with significantly less vehicle activity expected at the majority of the satellite compounds. Once fully operational it is anticipated that three to four FTE employees would be required to manage the onsite operations at the WWTP, which is similar to the existing Port Macquarie WWTP. The impacts of the WWTP operational traffic on the adjoining road network are expected to be negligible.	C	3	13	Council has undertaken (and is continuing to undertake) community consultation during the planning and design phases, informing the stakeholders, residents, businesses who may be impacted about the expected timeframe for construction activities. For the satellite construction sites associated with supporting upgrades to facilitate the WWTP, it is expected that the project would have a negligible impact on the adjoining road and transport network. On the basis that: – There would be localised short-term impacts to traffic conditions such as reduced speeds and temporary lane closures. However, as the construction period at individual sites is not extensive and would be conducted in a staged approach, impacts to traffic are expected to be negligible. – Onsite parking is provided for construction sites that would induce a material increase traffic volume. – Access would be maintained to all developments throughout construction. Mitigation measures would be implemented prior to construction and during construction to minimise impacts on traffic and transport networks and minimise environmental impacts associated with the movement of vehicles during construction, including the development of a TMP. Refer to Traffic and Transport Assessment (2024).	D	4	5

Risk Activity	Identified potential conflict	Risk Ranking			Mitigating factors (method of control)	Controlled Ranking		
		P	C	RR		P	C	RR
Biosecurity (Weeds and Pests)	Planning, construction and operation activities may create the possibility of introducing or spreading weeds, pests and diseases onto a property. In addition, soil disturbance could reduce competition against current weeds and necessitate increased control costs. Weed incursions or proliferation would reduce crop and livestock production unless properly controlled.	C	3	13	Under the *Biosecurity Act 2015* landholders have a legal obligation to manage identified priority weeds on land that they own or occupy and to fulfil their obligations in accordance with the General Biosecurity Duty. The Construction Environmental Management Plan (CEMP) for the project should also detail measures to minimise the potential for biosecurity risks during construction in accordance with the *Biosecurity Act 2015*. Weed and pest control, including for noxious weed and pests, would be subject to ongoing routine monitoring and management and consultation with relevant regulatory bodies as required.	D	3	9
Theft / Vandalism	Interference with property, machinery and equipment due to increased people in close proximity and adjacent to agricultural and non-agricultural land. See fencing - boundary fencing is expected to reduce the risk posed by theft/vandalism between the site and adjoining agricultural enterprises.	C	3	13	Security and access to the site is to be via an automatically operated slide gate and intercom system to call the operator to enable access to the site. Security fencing to be provided around the site to minimise access from the public and to deter vandalism. This shall be combined with security cameras situated around the site.	D	4	5

18.4 Potential impacts - Operation

18.4.1 Property ownership

The project has been designed and developed to minimise property acquisitions and has prioritised the use of available land. Notwithstanding this, some temporary use and permanent acquisition would be required.

All property acquisitions required for the project would be carried out in accordance with the NSW *Land Acquisition (Just Terms Compensation) Act 1991,* and in accordance with the land acquisition reforms announced by the NSW Government in 2016.

18.4.2 Property access

No impacts to property access are anticipated during the operation of the project.

18.4.3 Biosecurity risks

There is potential that maintenance and operation of the project may introduce or spread animal and plant diseases, pests and weeds within the project footprint. The potential impacts of this would be similar in nature to the construction phase, but the risk would be lower as there would be fewer vehicle and equipment movements and limited ground disturbance.

18.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise land use and property impacts of the project are detailed in Table 18-5.

Table 18-5 land use and property management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
	Impacts on land use and property	The design will continue to be refined to minimise land requirements and potential impacts on land uses and properties as far as reasonably practicable. Consultation with landowners/landholders will be ongoing to confirm feasible and reasonable measures to minimise impacts on their properties.	Contractor	Pre-construction, construction and operation
	Impacts on land use and property	Construction planning will minimise the duration that land is required to the shortest possible duration, particularly where the land requirements affect recreation/nature reserve areas.	Contractor	Pre-construction and construction
	Land requirements and property acquisition	All property acquisitions will be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the land acquisition reforms announced by the NSW Government in 2016.	PMHC	Pre-construction
	Impacts on utilities	The location of all utilities and services, and requirements for access to, diversion, protection and/or support, will be confirmed prior to construction. This will include (as required) undertaking utilities investigations, including intrusive investigations, and consultation and agreement with service providers.	PMHC	Pre-construction and construction
	Rehabilitation of land subject to temporary use during construction	Land subject to temporary use for construction will be rehabilitated as soon as practicable to the pre-construction condition (or as agreed with the landowner/landholder), taking into consideration the existing condition, location and land use characteristics. Rehabilitation will be undertaken in consultation with the relevant landowner/landholder, and in accordance with the rehabilitation strategy.	Contractor	Construction

ID	Impact	Environmental safeguard	Responsibility	Timing
	Biosecurity	Biosecurity controls will be implemented to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will be in accordance with *Come clean, go clean* (Qld Government, 2022) and include development of specific controls if high biosecurity risks are identified. Appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction via the project. The specific controls applicable to a property will be identified in consultation with the affected landowner. The effectiveness of these controls will be monitored in a manner and time interval consistent with the level of risk on each property. In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per *Biosecurity Act 2015* (NSW) and Biosecurity Regulation 2017.	Contractor and PMHC	Construction and operation
	Property management	A property management plan will be developed for directly impacted properties in consultation with landowners and stakeholders. The property management plans will outline the protocols that will be implemented to address landowner concerns during construction. This may include: – The process for rectification of any damage to property infrastructure caused by construction. – The process for rehabilitation and stabilisation of disturbed areas following the completion of construction. – Measures to minimise disruption to agricultural practices during construction. – Any fencing and gate requirements. – Specific biosecurity protocols.	Contractor	Pre-construction and construction

19. Hazard and risk

This chapter provides a detailed summary of the potential hazard and risk impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides proposed mitigation and management measures.
Inputs from Technical Report 12 –Health Impact Assessment, Technical Report 14 – Bushfire Risk Assessment and Technical Report 15 – Preliminary Hazard Analysis Report are provided in this chapter.

19.1 Assessment approach

19.1.1 Legislation and policy context

Key legislation, policies and guidelines considered as part of the assessment of hazards and risks included:

– *State Environmental Planning Policy (Resilience and Hazards) 2021.*
– Applying SEPP 33: Hazardous and Offensive Development Application Guidelines (NSW Department of Planning [NSW DPE] 2011a).
– Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis (HIPAP No 6) (NSW Department of Planning 2011b).
– Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning (HIPAP No 4) (NSW DPE 2011c).
– Multi-level risk assessment (NSW DPE 2011d).
– *Rural Fires Act 1997.*
– Planning for Bushfire Protection 2019 – A guide for councils, planners, fire authorities and developers (NSW Rural Fire Services [NSW RFS] 2019).
– Environmental Planning and Assessment Regulation 2000.
– *Protection of the Environment Operations Act 1997* (POEO Act).
– Protection of the Environment Operations (General) Regulation 2009.
– Protection of the Environment Operations (Waste) Regulation 2014.
– Protection of the Environment Operations (Clean Air) Regulation 2010.
– *Contaminated Land Management Act 1997.*
– *Dangerous Goods (Road and Rail Transport) Act 2008.*
– Guidance detailing specific parts of the assessment process for potentially hazardous industry:
  - NSW Planning and Infrastructure 2011, Assessment Guideline Multilevel Risk Assessment.
  - NSW Planning 2011, Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper No 4.
  - NSW Planning 2011, Hazardous Industry Planning Advisory Paper No 6, Hazard Analysis.
– WHS Regulation 2017 – provides a framework to protect the health, safety and welfare of all workers and others in relation to NSW workplaces and work activities.
– *Waste Avoidance and Resource Recovery Act 2001.*
– NSW EPA Waste Classification Guidelines 2014 (Part 1 Classifying Waste).
– NSW EPA Waste Avoidance and Resource Recovery Strategy, 2014-2021.
– NSW EPA Asbestos Waste Strategy 2019-2021.
– NSW EPA Noise Policy for Industry (NPfI) 2017.
– NSW EPA Interim Construction Noise Guideline (ICNG) 2009 (NSW DECC 2009).
– NSW EPA Assessing Vibration – a technical guidelines (AVTG) 2006 (based on BS 6472).
– Environmental Health Committee *Health Impact Assessment Guidelines 2017*.

- Health Impact Assessment: A Practical Guide, Centre for Health Equity Training, Research and Evaluation.
- *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards 2012.*
- *Schedule B8 Guideline on Community Engagement and Risk Communication, National Environment Protection (Assessment of Site Contamination) Measure, 1999,* National Environment Protection Council.
- National Environmental Protection, *Impact Statement for the National Environment Protection Council (Air Toxics) Measures 2003*.
- *Risk Assessment Guidance for Superfund, Volume I: Hunman Health Evaluation Manual* (Part F, Supplemental Guidance for Inhalation Risk Assessment), EPA-540-R-070-002, 2009, United States Environmental Protection Agency.
- Aeronautical Information Package.
- Civil Aviation Safety Regulations (1998) CASR Part 139—Aerodromes.
- Manual of Standards Part 139 – Aerodromes 2019.
- National Airport Safeguarding Framework Guidelines (various as applicable).
- Airports (Protection of Airspace) Regulations 1996.

19.1.2 Methodology

19.1.2.1 Preliminary Hazards Analysis

A Preliminary Hazards Analysis (PHA) was undertaken in accordance with the requirements of the Resilience and Hazards SEPP. The key tasks undertaken included:

- Identification of dangerous goods which would be used, stored or produced on site during construction and operation, including an indication of storage locations.
- Preliminary risk screening of dangerous goods with the quantities of dangerous goods then assessed against Resilience and Hazards SEPP threshold quantities.
- Hazard identification, which is a desktop qualitative assessment and involves documenting possible events that could lead to a possible off-site incident. The assessment lists potential causes of the incident, as well as identification of operational and organisational safeguards to prevent the incidents from occurring or to mitigate their impact.
- Level 2 PHA using a semi-quantitative risk assessment approach based on comprehensive hazard identification to demonstrate that the activity does not pose a significant risk. The results of the screening indicate that due to the quantity of toxic gas and corrosive liquid stored on site during operation, a PHA is required. It is considered that due to the location near the airport, there is potential for moderately serious harm, and a Level 2 PHA is appropriate. The PHA follows the process shown in Figure 19-1, which complies with the Department of Planning's *Multi-level Risk Assessment Guideline* (NSW DPE 2011d) and the Australian Standard AS 31000:2018 risk management – principles and guidance, consisting of the following:
  - System definition
  - Hazard identification
  - Likelihood analysis
  - Consequence analysis
  - Risk calculation and analysis
- Assessing potential hazard scenarios.
- Risk evaluation (compare against criteria and consider risk mitigation and management options). For this evaluation, the Department of Planning, Industry and Environment (2011), Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning (HIPAP No 4) criteria is used.
- A quantitative risk assessment, that reviews potential hazards that may arise during the construction, operation (and maintenance) of the development, comprising both:
  - Risk analysis
  - Consequence analysis

– Identification of proposed management measures.

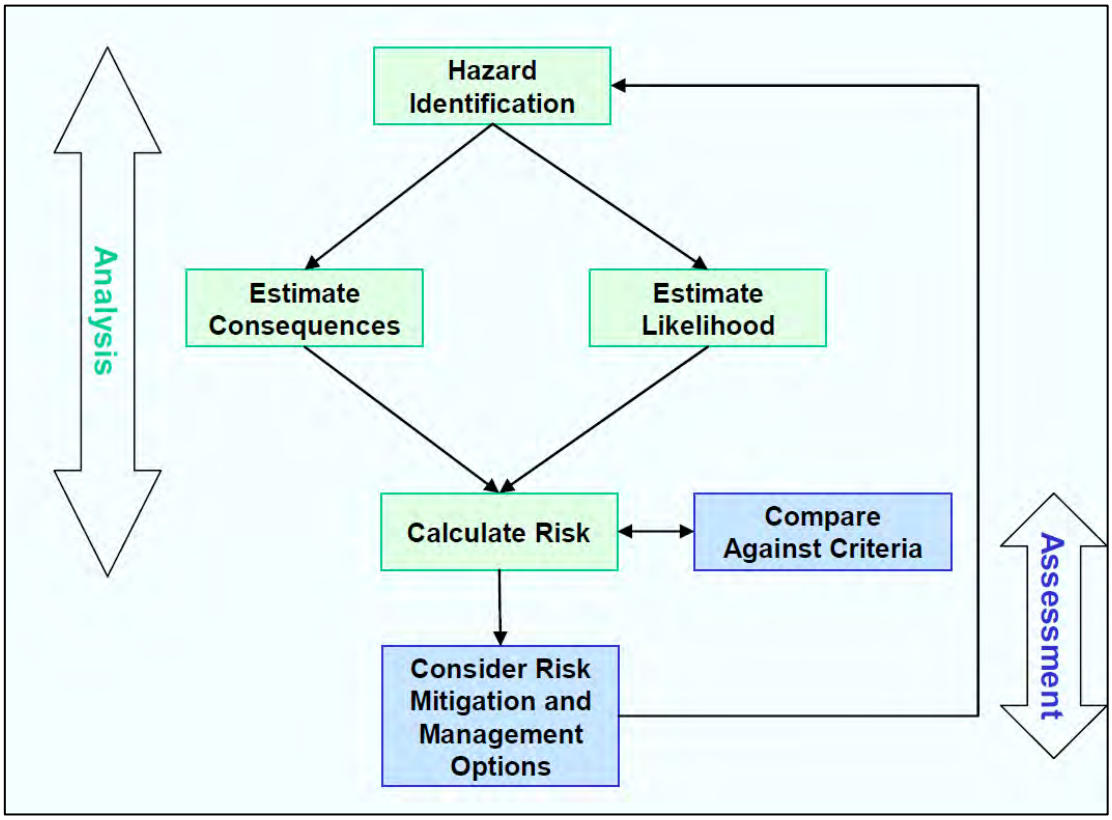

Figure 19-1 PHA process

19.1.2.2 Bushfire Risk Assessment

The project area has been adopted as the bushfire risk study area, however, some risks to the project such as bushfire ignition sources may occur beyond the project footprint.

The key tasks undertaken for the BRA included the following:

– A review to establish existing bushfire conditions, including bushfire prone land (BFPL), fire danger index (FDI), climate change models, bushfire history, vegetation and topography.
– A Bushfire Attack Level (BAL) and Asset Protection Zone (APZ) assessment in order to identify the most appropriate and viable location for an APZ in accordance with relevant PBP requirements, the BAL to be applied in building design and construction, feedback from consultation with stakeholders, and the extent of vegetation required to be cleared in order to facilitate the APZ.
– Identification of potential ignition sources and spread risk during construction and operation.
– Identification of bushfire protection measures relating to access, water supply and services, and emergency and evacuation planning for the proposed WWTP site.
– Recommendations for compliance with PBP performance criteria.

19.1.2.3 Health Impact Assessment

The study area for the purposes of the HIA is the area around the site of the WWTP as well as the areas in the vicinity of the discharge location and the dual reticulation system where the recycled water would be used. The population considered in the HIA includes those who would be serviced by the Thrumster WWS and those who may participate in recreation activities in the relevant waterways during both construction and operation.

The methodology adopted for the HIA was prepared and followed in accordance with national and international guidance that is endorsed by Australian Health and environmental authorities (refer to Section 19.1.2.3). The key tasks undertaken for the HIA included the following:

– Data evaluation and issue identification: review of all available information that relates to the proposed design and outcomes from specialist studies undertaken relevant to assessing potential health impacts. This task also considered if a more detailed evaluation of specific impacts was required with a further focus on the protection of community health.
– Exposure assessment: involving the identification of populations located on the project study area (refer to Section 19.2.3) which may be exposed to impacts from the project.
– Hazard assessment: identifying the adverse health effects and quantitative toxicity values, or exposure-response relationships associated with the key pollutants and stressors that have been identified and evaluated as part of this task.
– Determination of risks to human health based on the quantification of risks and the consideration of uncertainties associated with the concept design, and aspects of other technical studies relied upon for the conduct of the HIA which included:
    - Air quality
    - Noise and vibration
    - Traffic and transport
    - Water quality
    - Preliminary Hazards Analysis (for use of hazardous chemicals and potential soil contamination)
– Identifying appropriate human health mitigation and management measures.

19.1.2.4 Aviation Impact Assessment

The key tasks undertaken for the Aviation Impact Assessment (AIA) included:

– Conduct an inception meeting to validate deliverables and program.
– Review client material.
– Consultation with Port Macquarie Airport and Airservices Australia in respect of identified impacts.
– Prepare and submit a draft AIA and respond to requests for clarification.
– Prepare a final letter of advice for client acceptance.
– Specify all certified aerodromes located within 30 nm (55.6 km) of the project site.
– Nominate all instrument approach and landing procedures at these aerodromes.
– Review the potential effect of project operations on the operational airspace of the aerodrome(s).
– Nominate the airspace classification where the project site is located.
– Nominate radar navigation systems with coverage overlapping the site.

19.2 Existing environment

19.2.1 Hazards

No existing hazards relevant to the PHA such as chemicals and dangerous goods were identified in the existing environment. The proposed WWTP would accept raw sewage from Thrumster, Sancrox, and diversions from the Port Macquarie wastewater network.

19.2.2 Bushfire

19.2.2.1 Bushfire prone land

The proposed WWTP site is located within an identified bushfire prone land (BFPL) area (refer to Figure 19-2). It is noted that the site presently contains Vegetation Category 3 (grassland and freshwater wetland).

Figure 19-2 Bushfire prone land mapping

19.2.2.2 Fire weather

The project is located in the Port-Macquarie-Hastings LGA which falls within the North Coast fire weather district. Fire weather districts are established for the purpose of determining the Fire Danger Index (FDI) to be used for bushfire assessment. The RFS-specified FDI for the North Coast fire weather district is FDI 80 which is in the extreme category.

19.2.2.3 Climate change

Details regarding climatic conditions and trends have been addressed as part of the climate risk assessment and can be found in Chapter 22. Climate change may alter the duration of some bushfire seasons, which may be extended by starting earlier and/or finishing later. The frequency of elevated fire danger days that may support high intensity fire events is predicted to increase. With warmer and drier conditions, bushfire fuel availability is expected to be slightly greater at the commencement of the fire danger period (October) than is currently the case. Combined, these projections detailed in Chapter 22 (Section 22.2.2), indicate that conditions conducive to adverse bushfires are likely to increase relative to historical occurrence.

19.2.2.4 Bushfire history

The NSW Government's Sharing and Enabling Environmental Data (SEED) Portal Fire History layer indicates the proposed WWTP site has been subject to bushfire impact most recently during the Lindfield Park Road fire which is recorded as starting on 18 July 2019 under severe drought conditions. The only other prior fire on record to impact the site was the Munday Creek fire of October/November 2002, another drought-affected season. The Munday Creek fire principally impacted the freshwater wetland parts of the site, but had very limited impact in the managed pasture part of the site. These past fires confirm the potential for the site to be impacted by bushfire in the future, addressed in Section 22.2.2.

19.2.2.5 Vegetation

The proposed WWTP site is located in an area dominated by grassland vegetation. Being located on the Hastings River Floodplan around 2.5 kilometres from the Hastings River, and around 1.5 kilometres west of the Port Macquarie Airport, vegetation cover across the surrounding landscape is highly fragmented with land to the north and west being mostly cleared. Historically, fires in the area have largely been confined to areas of retained native vegetation cover north and west of the airport.

Further information regarding vegetation type is provided in Section 11.2.2.

19.2.2.6 Topography

The topography of the project area and its surrounds is detailed in Section 15.2.1. Slope is an important risk factor that influences fire behaviour. Fires burning uphill are faster and more intense than those burning on even ground or downhill (NSW RFS, 2019).

The WWTP site is located on the Hastings River floodplain with very minor variation in ground surface levels.

19.2.3 Health

19.2.3.1 Population profile

The population within the study area consists of residents and workers as well as those attending schools, day care centres, hospitals and recreational areas. For the purposes of the HIA, the population profile is reflective of the whole Port Macquarie-Hastings LGA (the LGA).

A more detailed assessment of the demographics for the area is provided in the Social Impact Assessment (Technical Report 4 – Social Impact Assessment) and is addressed in Section 10. A summary of the population and demographics of the LGA in comparison to NSW and Australia as a whole indicate that the community generally has:

– Higher proportion of people over 65 than NSW overall.
– Higher median age than NSW overall.
– Lower proportion of very young children (0-4 years) compared to NSW overall.
– Higher proportion of indigenous people compared to NSW as a whole.
– Lower unemployment than NSW as a whole.
– Lower proportion of people born overseas than NSW as a whole.
– Similar household size to NSW as a whole.

– Lower proportion of people with tertiary education compared to NSW as a whole.
– Around the average socioeconomic advantage/disadvantage compared to Australia overall.
– An estimated population growth from 2021 to 2041 in the LGA of around 17% based on NSW population projections.

These indicators provide some insight into the vulnerability of a community, particularly its ability to adapt to environmental stresses. It is important to consider these matters when evaluating a project to ensure some consideration of equity. This project would be implemented in proximity to a community that has potential for increased vulnerabilities based on higher proportions of older people and indigenous people but may have lower vulnerabilities, given the lower unemployment rate and the lower proportion of young children compared to NSW as a whole.

19.2.3.2 Population health

The health of the community is influenced by a complex range of interactive factors including age socio-economic status, social capital, behaviours, beliefs and lifestyle, life experiences, country of origin, genetic predisposition and access to health and social care. The population in the LGA, who are assumed to be representative of the population potentially impacted by the project, are generally similar to the larger NSW population. The following points were noted:

– Higher rates of vegetable consumption (potential for *lower* vulnerability than NSW overall).
– Higher rates of smoking (potential for *higher* vulnerability than NSW overall).
– Higher rates of people who have adequate exercise (potential for *lower* vulnerability than NSW overall).
– Similar rates of hospitalisations for respiratory issues.
– Higher rates of hospitalisations for cardiovascular issues (potential for *higher* vulnerability than NSW overall).
– Higher levels of obese people (potential for *higher* vulnerability than NSW overall).
– Higher levels of fruit consumption (potential for *lower* vulnerability than NSW overall).
– Higher rates of asthma in adults (potential for *higher* vulnerability than NSW overall).
– Similar premature mortality rates (all causes, cardiovascular and respiratory).

Overall, the community in the LGA is similar to NSW overall.

19.2.4 Aviation

Port Macquarie Airport is the closest certified aerodrome to the project and is the only aerodrome concerned about the development's impact on aviation operations. Port Macquarie - Hastings Council operates Port Macquarie Airport, with a published aerodrome elevation of five metre AHD (15 ft AMSL). Port Macquarie Airport’s aerodrome reference point coordinates are Latitude 31°26’09" S and Longitude 152°51’48" E.

A check of the Aeronautical Information Package (AIP) via the Airservices Australia website showed that Port Macquarie Airport is served by non-precision instrument flight procedures.

19.3 Potential impacts – construction

19.3.1 Preliminary risk screening and emissions

19.3.1.1 Dangerous goods storage

Construction of the project would require the use of chemicals and dangerous goods (e.g., paint, solvents, diesel, general oils and lubricants, cleaning products). There would be minimal storage of these chemicals, and no stockpiling would occur during construction of the project. None of the dangerous good thresholds in the Resilience and Hazards SEPP would be exceeded during construction of the project and is not considered potentially hazardous. The assessment of anticipated volumes of dangerous goods against the SEPP threshold is provided in Technical Report 12.

19.3.1.2 Dangerous goods transportation

During construction of the project, there would be low volumes of dangerous goods stored in the construction compounds and used as needed. The transportation screening thresholds for operation would not be exceeded and hazard risk due to transportation of dangerous goods in the construction phase are considered low. The assessment of the transport of dangerous goods against the SEPP threshold is provided in Technical Report 12.

19.3.2 Preliminary hazard analysis

19.3.2.1 Hazard identification

Hazard scenarios identified to potentially cause off-site harm during construction are summarised below in Table 18-1. Most of these hazards would be controlled through the implementation of mitigation measures and relevant management systems detailed in Section 19.5. Hazard scenarios as they relate to further assessment of potential off-site impacts are addressed in other sections of this EIS, which have been included in Table 19-1 for reference.

Table 19-1 Hazard identification list - construction

Hazard scenario	Causes	Consequence	Further assessment to assess potential off-site impacts
Vehicle interactions	– Vehicle movements in vicinity of personnel – Vehicle movements during construction	– Personal injury	No
Natural hazards	– Flooding – Earthquake – Lightning	– Personal injury – Plant shut down – Possible fire	No
External fire (adjacent to site)	– Fire from adjacent land users	– Personal injury	Yes (refer to Section 19.3.3)
Spills of chemical solutions	– Damage to storage vessels	– Soil contamination / degradation	No
Noise and vibration	– Construction related activities	– Noise pollution – Personal or public injury	Yes (refer to Section 17)
Dust from construction	– Trenching and other construction activities	– Air pollution – Personal or public injury	Yes (refer to Section 14).

19.3.3 Bushfire risk

19.3.3.1 Vegetation and potential construction ignition sources

As detailed in Section 19.2.2.1, the proposed WWTP is located within an area of grassland vegetation and accompanies a surrounding landscape of fragmented vegetation cover. The proximity of Fernbank Creek and the Hastings River to the north and west of the WWTP site has assisted in preventing large fires from developing in adverse upwind directions.

The potential for bushfire impact at the proposed site was considered to be principally limited to grass fire due to the extent of previously cleared grassy areas surrounding the site. However, as the site is identified as BFPL and has experienced bushfires in the past, the potential for the site to be impacted by bushfire in the future exists.

The following activities are identified as potential fire ignition sources during construction, which pose further potential for a bushfire to occur in conjunction with the BFPL of the WWTP:

– On-site hot works
– Vehicle exhaust system contact with tall flammable grass
– Sparks from metal or rock friction during ground engaging machinery operation

– Discarded cigarette butts from smokers

These ignition sources increase the potential for a bushfire to occur at each site. During construction, potential impacts from a bushfire burning within or into the project area may consist of ember attack, radiant heat, and direct flame contact. These impacts can result in damage or destruction of construction plant and equipment and pose a risk to the health and safety of workers.

The WWTP site is located within an area with a very minor variation in ground surface levels, such that topography would have a negligible influence on fires approaching the site. A risk assessment of the potential fire ignition sources during construction was undertaken to assess the consequence, likelihood, and risk of potential ignition sources (refer to Technical Report 14 for further details) and is summarised in Table 19-2.

Table 19-2 Construction phase bushfire ignition risk assessment

Potential ignition source	Consequence	Likelihood	Risk
Bush fire ignition and uncontrolled spread caused by on site hot works	Moderate	Very unlikely	Low
Bush fire ignition and uncontrolled spread caused by vehicle exhaust system contact with long grass	Moderate	Very unlikely	Low
Bush fire ignition and uncontrolled spread caused by sparks from earthmoving or hold boring operations	Moderate	Very unlikely	Low
Grass fire ignition and uncontrolled spread caused by cigarette butts discarded by smokers	Moderate	Very unlikely	Low

The consequence (of bush fire ignited by construction activities) was assessed on the basis of grass fire occurrence on days other than Extreme and Catastrophic, due to activity prohibitions under such fire danger ratings.

Additionally, the likelihood (of bush fire ignited by construction activities) was assessed on the basis of risk controls being implemented. Therefore, prevention and mitigation measures included in the risk assessment focussed on fire prevention and fire suppression at the ignition site at the time of ignition as a contingency measure. The risk assessment found that the potential risk posed by ignition sources during construction is of a low likelihood provided the prevention and mitigation measures identified are implemented (refer to Section 19.5).

19.3.3.2 Access

Access to the WWTP site is detailed in Section 3.2.1.8. During a bushfire event, existing property roads may be cut off by the bushfire itself, burning or falling trees, or smoke plumes. Evacuating procedures during the construction phase would be developed and documented consistent with relevant guidelines and be provided in the Bush Fire Emergency Management and Evacuation Plan.

19.3.4 Human health

A summary of the potential human health impacts associated with the construction of the project is provided in Table 19-3. It is noted that all potential human health impacts are related to other areas subject to assessment which have been addressed elsewhere in this EIS. They include:

– Water quality and hydrology (refer to Section 7)
– Transport and traffic (refer to Section 13)
– Air quality (refer to Section 14)
– Soil and contamination (refer to Section 15)
– Noise and vibration (refer to Section 17)

Table 19-3 Summary of potential human health impacts – construction

Potential impacts	Cause	Summary	Addressed elsewhere in EIS
Water quality			
Impact to human health due to ingestion or contact to contaminated water	– Chemicals or microbiological organisms increase above relevant guideline values. – Stormwater runoff from areas where earthworks are being undertaken impacted by higher levels of suspended soils as it runs across cleared areas and picks up soil as it goes.	Negligible impact. – No unacceptable impacts on water quality from stormwater runoff from construction areas is expected for the project, particularly in regard to changes in water quality that could impact on people. – Potential for impacts on water quality during construction is limited to the impacts of stormwater runoff from areas where earthworks are being undertaken. This is common with all types of construction and can be managed through implementing relevant stormwater management measures (see Section 7.4). – No unacceptable impacts on health due to water quality during construction of the project are expected.	– Yes Technical Report 1 - Water Resource and Quality Assessment (refer to Section 7).
Air quality			
Impact to human health due to air emissions (dust and odour)	– Dust emissions produce particulate matter from earthworks during construction which have the potential to cause adverse health effects when inhaled. – Release of odours from earthworks have the potential to cause a range of health complaints (e.g. irritation of eyes, nausea, sort throat, shortness of breath).	Negligible impact. – There are no sensitive locations for people within 250 m of the boundary of the WWTP site. There are, however, some locations within 100 m of pipeline routes. This means that potential for exposure to particles generated from works for this project for people is considered low and does not require any further consideration in accordance with IAQM guidance (see Chapter 14). – Ratings for the magnitude of dust emissions and the location of sensitive people or ecosystems indicates that the risk of impacts from dust/particles for this project are negligible or low for people and medium for ecosystems for all aspects of the project apart from demolition. Following the implementation of mitigation measures, all potential impacts associated with dust emissions are considered likely to be negligible. – Dust suppression using water sprays and other dust management practices would be implemented near unsealed areas where vehicles are required to travel to ensure dust deposition around the pipeline construction does not cause nuisance.	Yes – Technical Report 9 – Air Quality Assessment (refer to Section 14.3).

Potential impacts	Cause	Summary	Addressed elsewhere in EIS
Noise and vibration			
Impacts to human health caused by construction noise and vibration: – Sleep disturbance and annoyance – Hearing impairment – Interference with speech – Memory and concentration – Cardiovascular health	– Noise and vibration associated with the construction of the project, produced by plant and equipment, and vehicles accessing/egressing construction compounds.	Low impact. – Impacts on community health from changes in noise or vibration during construction are expected to be managed with the mitigation measures detailed in Section 17.5. – Works will typically be conducted during Standard Hours for which standard practices would be adopted to manage potential impacts.	Yes – Technical Report 13 – Noise and Vibration Assessment (refer to Section 17.3).
Soil and contamination			
Impacts to human health posed by contamination risks	– Contamination risks (ingestion/exposure) during the construction phase of the project due to potential for exposure to contaminated soil, sediment or groundwater. – Potential for contamination to be present at the site where the WWTP would be located is small as few activities have been undertaken. The exception to this may be the presence of ASS. – Potential for contamination to be present along pipeline routes as the routes follow roads which are exposed to a range of activities and potential contaminant sources.	Low / Negligible impact – Expected low levels of contamination in the project area, mitigation measures proposed to ensure appropriate management of naturally occurring asbestos materials should they be encountered during construction. – Risks from contamination of soil are expected to be negligible during construction. – Potential sources of contamination are likely to be quite small with impacts limited to the site where the source is located or immediately adjacent. Given the nature of works to construct the pipelines, it is unlikely that the works would encounter such small areas should contamination be present.	Yes – Technical Report 10 – Soils and Contamination Preliminary Site Investigation (refer to Section 15.3)
Safety			
Impacts to human health caused by dangerous goods and changes to flood risk	– Handling, transportation and storage of chemicals used during construction, which include fuels, paints, welding, solvents, concrete, bitumen, oil/lubricants, steel, plasterboard etc. For all dangerous goods to be transported to the site during construction, none exceed the dangerous good thresholds. – Bushfire risk caused by potential sources of ignition that could be present on the site during construction.	Negligible impact: – Based on the available data and information, potential impacts on the health of the community due to handling and use of dangerous goods and changes to flooding risk have been assessed and determined to be negligible when managed in accordance with government requirements. – Impacts to public health due to bushfire are expected to be as low as possible following the implementation of identified mitigation measures, standard procedures and management plans.	Yes – Technical Report 12 – Preliminary Hazard Analysis Report (the PHA is addressed throughout this chapter)

Potential impacts	Cause	Summary	Addressed elsewhere in EIS
	– Location of the WWTP is in an area requiring appropriate evaluation of flood risk. Some parts of the pipelines are also in this zone.	– Relevant studies indicate a low to medium flood hazard at the location of the WWTP site. When managed in accordance with the identified mitigation measures and government requirements, potential impacts to public health as a result of flood risk has been determined to be negligible.	
Transport and traffic			
Impacts to human health due to changes in transport and traffic	– Increased vehicle activity on road network caused by transport of goods, materials and workers during construction. Increased anxiety, reduced air quality, increased noise, and poor perceptions of an area due to safety issues are all possible.	Minor/Negligible impact: – Health impacts due to traffic at the WWTP site are currently minimal as the WWTP is in a location that is not frequently accessed. Also, the provision of public transport and active transport, such as walking and cycling, is limited in the area. Potential impacts on community health from changes in traffic at the WWTP site are determined to be negligible. – Impacts on public transport and active transport are expected to be minor along the pipeline routes, however, there may be temporary closures/relocations of bus stops or pedestrian access in areas where trenching would occur. In most locations, access for pedestrians is still available on the other side of the road away from trenching works and would therefore result in a minor impact by providing an alternative pathway. Compliance with standard requirements would ensure that impacts on traffic during construction would be managed appropriately.	Yes – Technical Report 8 – Traffic and Transport Assessment (refer to Section 13.3).

19.4 Potential impacts – operation

19.4.1 Preliminary hazard analysis

19.4.1.1 Hazard identification

Hazard scenarios identified with the potential to cause off-site harm during operation are summarised below in Table 19-4. Most of these hazards would be controlled through implementation of a mitigation measures and relevant management systems detailed in Table 19-8, and in relevant Sections noted in Table 19-4 as they relate to other areas of environmental assessment addressed in this EIS.

Table 19-4 Hazard identification list – operation

Hazard scenario	Causes	Consequence	Further assessment to assess potential off-site impacts
Vehicle interactions	– Vehicle movements in vicinity of personnel	– Personal injury	No

Hazard scenario	Causes	Consequence	Further assessment to assess potential off-site impacts
Natural hazards	– Flooding – Earthquake – lightning	– Personal injury – Plant shut down – Possible fire	No
External fire (adjacent to site)	– Fire from adjacent land users	– Personal injury – Asset damage – Plant shut down	Yes (refer to Section 19.4.2)
Toxic release of chlorine	– Damage to valve during delivery – Catastrophic rupture of drum – Failure/ damage of pipework	– Personal or public injury	Yes (refer to Section 19.4.1.2)
Toxic release of Hydrogen Sulphide	– Confined space entry through inlet works	– Personal injury	Yes (refer to Section 19.4.1.2)
Contact with chemicals	– Handling of corrosive chemicals during operation	– Personal injury	No
Spills of chemical solutions	– Damage to storage vessels – Failure/ damage of pipework	– Soil contamination/ degradation	No
Noise and vibration	– operation of equipment	– Noise pollution – Personal or public injury	Yes (refer to Section 16.3)

19.4.1.2 Hazardous materials

The preliminary risk screening indicated that the screening thresholds for dangerous goods storage were exceeded by chlorine, sodium hydroxide and alum to be used during operation. Impacts from a release of chlorine at the proposed WWTP have the potential to cause off-site harm. The impacts associated with sodium hydroxide and alum were considered manageable on site, requiring no further assessment.

The potential impacts associated with chlorine are considered further below.

Chlorine

Chlorine is a greenish yellow gas at ambient temperature and pressure, with a pungent irritating odour and is potentially fatal if inhaled. Chlorine is not flammable or explosive but would support combustion. It is a powerful oxidising agent and reacts violently with many organic materials, such as oils and grease and finely divided metals. Chlorine has the potential to disperse outside the site boundary and cause an impact to the off-site population. Exposure to chlorine through inhalation, ingestion and direct contact can result in injury and in some cases fatality from asphyxia, shock, and reflex spasm.

Chlorine would be stored on site in 920 kilograms drums with gas draw-off. On this basis, the following worst case scenarios were identified as being worthy of further analysis:

– Catastrophic rupture of a drum.
– Liquid leak release from a 20 millimetre hole. This size is representative of a release during transport from valve damage.
– Gas leak release from a six-millimetre hole. This size is representative of a gas manifold fitting release.

Detailed calculations and a summary of the calculated risk of fatality and injury based on the likelihood estimation and the individual release scenario risk is provided in Technical Report 12. The assessment indicated that the proposed WWTP would be compliant with the HIPAP risk criteria. The level 2 PHA (hazard identification study and semi-quantitative risk assessment) demonstrated that the proposed WWTP can be designed, constructed, and operated in a manner that would meet the relevant regulations, standards and policies and minimise hazardous impact to the public. Therefore, the risks identified can be managed to acceptable levels throughout the lifecycle of the project. Given the toxic nature of chlorine, it is important to maintain mitigations that prevent a chlorine release from occurring. Relevant mitigation measures have been identified to incorporate practices that would prevent risk scenarios occurring and are provided in Section 19.5.

19.4.2 Bushfire risk

19.4.2.1 Vegetation and potential operation ignition sources

As detailed in Section 19.2.2, the WWTP site is located within BFPL, whereby grassland vegetation renders the site susceptible to bushfire risks, potentially exacerbated by the presence of ignition sources on site.

During operation, the following were identified as potential fire ignition sources:

– On-site hot works
– Reaction between chemicals stored on site, resulting in chemical fire ignition
– Discarded cigarette butts from smokers

These ignition sources increase the potential for a bushfire to occur at the sites, which may result in loss of property, damage to infrastructure, dangers to flora and fauna, and potential loss of life to operational workers and any surrounding habitats.

A risk assessment of the potential fire ignition sources during operation was undertaken to assess the consequence, likelihood and risk of potential ignition sources and is summarised in Table 19-5. As for construction sources (refer to Section 19.3.3), prevention and mitigation measures included in the risk assessment for operation focussed on fire prevention and fire suppression at the ignition site at the time of ignition as a contingency measure. The risk assessment found that the potential risk posed by ignition sources during operation is of a low likelihood provided the prevention and mitigation measures identified are implemented (refer to Section 19.5).

Additionally, WWTP operations are considered to have an inherently low risk of bushfire ignition as they do not involve open flame or spark production in normal operation. The built structural elements of WWTP infrastructure are mostly non-combustible, and the proposed WWTP operational infrastructure footprint is currently mostly cleared. Therefore, if accidental spark generation were to occur from faults or maintenance works within the WWTP, the absence of significant combustible fuel sources within the WWTP footprint make it unlikely for a fire to take hold, escalate and spread from the WWTP site to adjacent grassland or forest areas.

Table 19-5 Operation phase bushfire ignition risk assessment

Potential ignition source	Consequence	Likelihood	Risk
Bush fire ignition and uncontrolled spread caused by on site hot works near WWTP perimeter	Moderate	Very unlikely	Low
Fire ignition from exothermic reaction between hazardous chemicals stored or used on the WWTP site	Moderate	Very unlikely	Low
Bush fire ignition and uncontrolled spread caused by cigarette butts discarded by smokers.	Moderate	Very unlikely	Low

19.4.2.2 Potential impacts from bushfires

A bushfire can impact assets through direct flame contact, radiant heat and/or embers threatening a building and people sheltering within it. APZs would be established from the earliest stages of construction and maintained throughout operation around the WTP site. APZs would minimise but not eliminate the risk of bushfire impacting assets.

To provide enhanced bushfire resilience to the WWTP infrastructure the Bushfire Attack Level (BAL) assessment was used to assign an appropriate BAL rating for the WWTP buildings according to their location within the WTP site. This would work alongside the proposed APZs to afford the WTP a prudent level of resilience to bushfire attack.

The APZ is shown in Figure 19-3 and was determined in consultation with key stakeholders. Further detail on the APZ modification is provided in Technical Report 15.

19.4.3 Human health

A summary of the potential human health impacts associated with the operation of the project is provided in Table 19-6. As detailed in Section 19.3.4, all potential human health impacts are related to other areas of assessment which have been addressed elsewhere in this EIS. They include:

– Water quality and hydrology (refer to Section 7)
– Transport and traffic (refer to Section 13)
– Air quality (refer to Section 14)
– Soil and contamination (refer to Section 15)
– Noise and vibration (refer to Section 17)

Table 19-6 Summary of potential human health impacts – operation

Potential impact (s)	Cause	Summary	Addressed elsewhere in EIS
Water quality			
Impact to human health due to ingestion or contact to contaminated water	– Chemicals or microbiological organisms increase above relevant guideline values. – Stormwater runoff from the proposed WTP.	Low impact – Modelling of water quality has been based on a range of scenarios that included consideration of expected changes in the catchment (changes in land use etc) as well as issues around the performance of the proposed WWTP. No significant changes that could impact on public health from introducing the Thrumster treated wastewater into Kooloonbung Creek are predicted. It is assumed that this finding applies for other chemicals that may be remaining in treated wastewater. – No significant changes that could impact on public health from stormwater overflows from the Thrumster WWTP are predicted. This includes assuming that the quality of the overflow is similar to raw wastewater. It is assumed that this finding applies for other chemicals that may be remaining in treated wastewater. – Potential for changes in concentrations sufficient to be of concern for the oysters was found to be low. Therefore, no significant changes in enterococci concentrations that could impact on public health due to consumption of oysters farmed in relevant locations within Hastings River are predicted.	Yes – Technical Report 1 – Water Resources and Flooding Assessment (refer to Section 7.3)

Potential impact (s)	Cause	Summary	Addressed elsewhere in EIS
		– Management in accordance with government requirements (such as bunding etc) would ensure that impacts due to stormwater runoff are negligible. – No unacceptable impacts on water quality during operation of this project are expected.	
Air quality			
Impact to human health due to air emissions (dust and odour)	– Possible odour issues from the materials used to treat wastewater during operation.	Negligible impact – Chlorine dosing would occur within a building at the WWTP site, so the release of such odours is unlikely to be unacceptable. – The WWTP is in the area where there are a limited number of houses, and assessment against relevant odour criteria found that all odour results are in compliance with relevant NSW EPA criteria (see Section 14.4.2).	Yes – Technical Report 8 – Air Quality Assessment).
Noise and vibration			
Impacts to human health caused by construction noise and vibration: – Sleep disturbance and annoyance – Hearing impairment – Interference with speech – Memory and concentration – Cardiovascular health	– Noise and vibration associated with the operation of the project.	Minor / Negligible impact – Modelling at all sensitive locations showed that under all weather conditions noise from the WWTP would not exceed any relevant guidelines as per NSW EPA requirements. The NSW EPA requirements are based on guidelines that are based on protection of health. No mitigation measures are, therefore, required. – Noise levels at the SPSs were also modelled and found to be in compliance with the guidelines. – No operational vibration impacts are anticipated, given that the nearest sensitive receivers to the WWTP are several hundred meters away and the pipelines would be buried underground.	Yes – Technical Report 11 – Noise and Vibration Assessment).
Soil and contamination			
Impacts to human health posed by contamination risks	– During operations, people who might be exposed would be limited to those who work at the WWTP and those who undertake repairs when required on the pipelines.	Negligible impact – Operation of the WWTP and pipelines are not expected to result in new contamination or ongoing movement of existing low level contamination from the WWTP site or from the pipeline route. – Use of chemicals at the WWTP during operation is subject to standard practices, in line with government requirements – e.g. chemical storage being within bunded areas. Compliance with these requirements is expected to ensure negligible potential for soil contamination.	Yes – Technical Report 10 – Soils and Contamination Preliminary Site Investigation (refer to Section 15.4).

Potential impact (s)	Cause	Summary	Addressed elsewhere in EIS
Safety			
Impacts to human health caused by dangerous goods	– Handling, transportation and storage of chemicals used during operation of the WWTP for treatment of waste water. – During operations at the site, the three potential ignition sources are present during maintenance, reactions between chemicals stored on the site (if stored inappropriately) and discarded cigarettes. – Location of the WWTP is in an area requiring appropriate evaluation of flood risk. Some parts of the pipelines are also in this zone.	Negligible impact – Based on the available data and information, potential impacts on the health of the community due to handling and use of dangerous goods as a result of the project have been assessed and determined to be negligible when managed in accordance with government requirements. – Impacts to public health due to bushfire are expected to be as low as possible following the implementation of identified mitigation measures, standard procedures and management plans. – A flood management plan would be implemented for this WWTP during operation also to ensure access and evacuation as well as continuing operation of the facility wherever possible. Operational flood impacts have been determined to be negligible when managed in accordance with government requirements.	Yes – addressed in Technical Report 12 – Preliminary Hazard Analysis Report (the PHA is addressed throughout this chapter).
Transport and traffic			
Impacts to human health due to changes in transport and traffic	– Increased vehicle activity on road network during operation caused by chemical delivery and minor maintenance works as required, and arrival and departure of staff.	Negligible impact – The site would be operational 24 hours a day, seven days a week but with the small number of staff accessing the site, it is not expected that there would be a noticeable change in traffic conditions in and around the WWTP. It is also not expected that the adjoining roads leading to the WWTP would have noticeable changes. – Potential impacts on community health from changes in traffic at the WWTP site during operation have been determined to be negligible due to the small number of vehicle movements.	Yes – Technical Report 8 – Traffic and Transport Assessment (refer to Section 13.4).

Paper Size ISO A4

0 30 60 90 120

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Bushfire Risk Assessment

Project No. **12611129**
Revision No. **0**
Date **26/06/2024**

Asset protection zone map

FIGURE 19.3

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Print date: 26 Jun 2024 - 12:12

Data source: PMHC: Infrastructure data, 2023; BECCA: WTP Design, 2024; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

19.5 Potential impacts - aviation

The potential impacts identified in the AIA for both the construction and operation of the project are summarised below in Table 19-8, including impacts requiring mitigation.

Table 19-7 Potential aviation impacts

Relevant aviation consideration	Detail and potential impact	Mitigation required
Minimum Sector Altitude (MSA)	Obstacles within the 10 nm MSA and 25 nm MSA of Port Macquarie Airport's ARP or Non-Directional Beacon (NDB) define the minimum height at which an IFR aircraft can fly within 10 nm and 25 nm of the airport when not in visual flight conditions. The proposed project is within the Port Macquarie Airport's 10 nm MSA, and is also within the northern-west sector of the airport's 25 nm MSA. The projects' maximum height (including potential crane or franna) during construction would be 22 m AHD which is lower than the 10 nm and 25 nm MSA protection requirements.	No potential impact. No mitigation required.
Instrument Flight Rules (IFR) Circling Areas	A circling approach refers to extending an instrument approach to the specified minimum altitude allowed without visual ground reference. The pilot then visually manoeuvres the aircraft to align with the runway for landing. This type of approach is typically used when there is no instrument procedure aligned with the runway or when the runway specified in the procedure is not suitable for landing. Port Macquarie Airport's instrument flight procedures provide for the most demanding aircraft category, Category C. The project would be within all Port Macquarie Airport's circling areas categories and would not impact circling areas established for instrument flight procedures.	No potential impact. No mitigation required.
Obstacle Limitation Surface (OLS)	OLS are established for each certified aerodrome runway. The Master Plan for Port Macquarie Airport 2010 was used in the AIA to identify the contours of the airport's different OLS surfaces. The maximum horizontal distance that an OLS may extend for an aerodrome is 15 km (8.1 nm) from the edge of a runway strip. The WWTP is approximately 1.7 km (0.9 nm) west of the airport's ARP and some pipelines just next to the runway strip. Therefore, it is constrained by the inner horizontal surface, approach and take-off surface and transitional surface (see Technical Report 19 for detailed descriptions and diagrams of each individual surface). During construction, the temporary crane and franna operation for the pipe laying on the path of flights on the northern side of the airport would be up for 2-5 days. When it is with a fully stretched boom, the height at the tip of the boom would temporarily infringe the approach and take-off surfaces and transitional surfaces.	It is noted that there is an updated master plan currently being prepared, which would include a new OLS, the impacts of any change in the Master Plan would need to be reflected in the detailed design and CEMP for the WWS. Impact considered manageable following implementation of relevant mitigation measures in Table 19-8.
Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) procedures	A detailed assessment of the PANS-OPS surfaces associated with the published instrument approach procedures was undertaken. The project would be beneath all arrival procedure surfaces of Port Macquarie Airport. It would not impact approach procedures.	No potential impact. No mitigation required.
Grid and Air routes Lowest Safe Altitude (LSALT)	MOS 173 requires that the published lowest safe altitude (LSALT) for a particular airspace grid or air route provides a minimum of 1000 ft clearance above the controlling (highest) obstacle within the relevant airspace grid or air route tolerances. The lowest Grid or route LSALT overhead at the project site would be 1900 ft, with a protection surface of 900 ft AMSL.	No potential impact. No mitigation required.

Relevant aviation consideration	Detail and potential impact	Mitigation required
	The project's highest point would be 17m AHD, and during construction, the height of the Crane at the WWTP site would be 22 m (72.17 ft AMSL). In accordance with these requirements, the project would not infringe any LSALT.	
Class G airspace	The project's highest point would be 17 m, and during construction the height of the crane at the WWTP site would be 22 m AHD (72.17 ft AMSL), lower than the vertical limits of Port Macquarie Airport controlled airspace Class A and E (above 8500 ft). Therefore, the project site would be within the Class G airspace (non-controlled airspace). The project would not be located in any Prohibited and Danger areas.	No potential impact. No mitigation required.
Restricted area	The project site is located in a Restricted area (R588C) as shown in Technical Report 19. When analysing the minimum vertical height within R588C, the project was found to not impact any restrictions area, or any controlled or designated airspace. Further detail is provided in Technical Report 19.	No potential impact. No mitigation required.
Aviation facilities	A search on OzRunways, which sources its data from Airservices Australia and AOPA National Airfield Directory datasets, was conducted to identify any aviation facilities that may be affected by the project. The closest aviation facilities to the Project site are at Port Macquarie Airport (YPMQ) - Non-direction Beacon (NDB). According to National Airports Safeguarding Framework Guideline G Protecting Aviation Facilities - Communications, Navigation and Surveillance (CNS), the navigation facilities have areas restricted to developments. The project's WWTP main structure is approximately 1.9 km northeast of Port Macquarie Airport's NDB and outside the areas restricted to developments for noted aviation facilities. Therefore, it would not interfere with these facilities.	No potential impact. No mitigation required.
Aviation radars	The closest radar is the Mt Sandon Secondary Surveillance Radar (SSR), located approximately 137 km west of the proposed WWTP site. The project site is outside the range of the Mt Sandon SSR, and it would not impact this facility.	No potential impact. No mitigation required.
Aircraft noise and building type	As the project would be located near Port Macquarie Airport, there is a risk that the WWTP and construction sites in proximity to the airport would be exposed to aircraft noise. The project belongs to 'other industrial' building type, which is acceptable for all ANEF zones.	Noting the preparation of an updated Master Plan for the Port Macquarie, the project would remain the same building type and therefore it would not be affected even due to changes in the future master plan. Impact considered manageable following implementation of relevant mitigation measures in Table 19-8.
Windshear trigger assessment area	Building generated windshear and turbulence at airports relates to the risk of building generated windshear (i.e. changes in wind speed and/or direction between two points) and building generated turbulence (i.e. rapid irregular changes in wind speed and/or direction at a fixed point) at airports. In accordance with the assessment trigger (see Technical Report 19), the WWTP main structure would be located about 1.5 km from the runway end, which is outside the windshear area. No further assessment is required.	No potential impact. No mitigation required.

Relevant aviation consideration	Detail and potential impact	Mitigation required
Wildlife control zone	In accordance with National Airports Safeguarding Framework Guideline, land uses that present a risk of attracting wildlife should be controlled (and mitigated) within 3 km, 8 km and 13 km of an airport. The project is located within a wildlife management area, specifically Area A (0-3 km) (see Technical Report 19). The AIA concluded that the storm pond is low risk for attracting water birds as the pond is normally empty, and that during periods that the pond is active and in use there would be standing water in other areas to attract birds. The report recommended that the storm pond be emptied within seven days of filling.	Impact considered manageable following implementation of relevant mitigation measures in Table 19-8.

19.6 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise potential hazard and risk impacts of the project are detailed in Table 19-8.

Table 19-8 Hazard and risk impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
HR1	Personal injury caused by vehicle interactions	– Traffic management plan including standard traffic rules, signage – Site speed limits – One way traffic movement through the site for delivery vehicles – Designated pedestrian areas – Driver competency – Construction management plan	Contractor	Pre-construction
HR2	Natural hazards causing personal injury, plant shut down and possible fire	– Structures and tanks designed to appropriate codes and standards – Housekeeping standards – Site drainage	Council/ contractor	Pre-construction, construction, operation
HR3	Toxic release of chlorine	– Implementation of standard operating procedures for drum transfer and connection and ensure personnel have been trained to reduce risk of drum damage during operation and delivery – Notification to Safework NSW of exceeding 10% of the WHS schedule 15 threshold for chlorine – Standard procedure for delivery of drums – Safe piping design – Inspection and maintenance strategies	Council	Operation
HR4	Contact with chemicals	– Training of staff prior to handling – Staff wear appropriate PPE when handling corrosives – Storage as per appropriate standards – Safe work method statements	Contractor/ Council	Construction, operation
HR5	Spill of chemical solutions leading to soil contamination/ degradation	– Storage as per appropriate standards, including bunding – Design of pipework to standards, corrosion allowances where appropriate – Inspection and maintenance strategies	Contractor/ Council	Construction, operation

ID	Impact	Environmental safeguard	Responsibility	Timing
		– Spill management procedures – Ensuring regular maintenance schedules are developed to detect leaks and ensure pipe fittings are in good condition		
HR6	Access	Ensuring the site has an emergency plan for onsite staff taking the effect zone of all hazard scenarios into consideration such that the evacuation point is outside the AEGL 3 effect zone	Contractor/ Council	Construction, operation
HR7	Emergency Access	Coordination with emergency services for off-site management if a loss of containment event was to occur	Contractor/ Council	Construction, operation
HR8	On-site hot works	Prohibited on all days of Severe, Extreme and Catastrophic Fire Danger At all other times: – Hot works requires inclusion in the Job Safety Analysis (JSA) – All hot work would require issue of a hot work permit – All fire prevention measures (fuel free clearance zone around hot work site; wetting down measures and spark guards) specified in the JSA and/or hot work permit to be undertaken – Fire extinguishers or other fire response apparatus required by the JSA and/or hot work permit must be present at the work site – Upon completion of hot works appropriate checks to be undertaken to ensure no fire or smouldering material remains	Contractor/ Council	Construction, operation
HR9	Vehicle exhaust system contact with long grass	Vehicle access onto areas other than on constructed roads and laydown areas prohibited on all days of Extreme and Catastrophic Fire Danger. At all other times avoid parking in long grass.	Contractor/ Council	Construction, operation
HR10	Sparks from metal on metal or rock friction during ground engaging machinery operation	– Prohibited on all days of Extreme and Catastrophic Fire Danger – Grass fire ignition prevention requires inclusion in the Job Safety Analysis (JSA) for all earthmoving and hole boring works – Fire extinguisher to be carried on all earthmoving machinery and present at all hole boring operations	Contractor/ Council	Construction, operation
HR11	Discarded cigarette butts from smokers	No smoking on project area except in designated smoking areas at the construction office site or laydown areas.	Contractor/ Council	Construction, operation
HR12	Chemical reaction between hazardous materials stores or used on the WWTP site	– Separate storage areas for hazardous chemicals – Operating protocols for mixing of chemicals on site – No WWTP process which involve mixing of chemicals in the open are adjacent to the site permitter/in proximity to bushfire fuels	Council	Operation
HR13	Bushfire protection	Project to be undertaken to comply with relevant PBP objectives relating to access, water supply and services and emergency and evacuation planning as detailed in Technical Report 15.	Contractor/ Council	Pre-construction, construction, operation

ID	Impact	Environmental safeguard	Responsibility	Timing
HR14	Obstacle Limitation Surface (OLS)	Detailed planning and communication process need to be undertaken for preparation of CEMP for the Work. And the CEMP to be approved by the Airport Operation. That is more involved than liaison and seeking permissions. As temporary Closure of the airport activities during construction need to be provisioned by the airport operations. Prior written approval shall be obtained from the airport operator for any crane that may be used during the construction phase to penetrate the Obstacle Limitation Surface (OLS). To avoid doubt about whether an approval is required, applicants should check with the airport operator as soon as possible. Port Macquarie Airport Operations may be contacted on 0418 408 529 or via email at airport.operations@pmhc.nsw.gov.au (Noted, Port Macquarie Airport has already been contacted and received advice; refer to Section 4).	Contractor	Pre-construction
HR15	Wildlife hazard	The project would be within a three km wildlife control zone (Zone A), which requires wildlife hazards to be mitigated. Where 'mitigate' is indicated, proposed development of this land use type should be assessed by a wildlife hazard expert and potential wildlife attractants be suitably mitigated either before the development is approved or as a condition of the approval. Where approved, information regarding the development should be provided to the relevant airport operator and it should be included in future monitoring activity undertaken by the relevant airport operator.	Contractor/ Council	Pre-construction, construction

20. Coastal erosion

This chapter provides a summary of the assessment of coastal erosion potential impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides recommended mitigation and management measures.
Assessment of impacts to coastal wetlands, fluvial geomorphology and flooding risks have been considered in Chapters 7 and 11.

20.1 Assessment approach

20.1.1 Legislation and policy context

Key national and state legalisation, guidelines and policies considered as part of the coastal erosion and recession assessment included:

- **State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)** – establishes the development limitations or impact assessment requirements on coastal wetlands and littoral rainforest areas, coastal vulnerability areas, coastal environment areas and coastal use areas.
- ***Coastal Management Act 2016*** – establishes a strategic framework and objectives for managing the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable.
- **NSW Coastal Management Manual (OEH 2018)** – provides technical information and guidance to assist councils and coastal practitioners in addressing the requirements of the CM Act and outlines a risk management process to follow when preparing Coastal Management Plans (CMPs).

Port Macquarie Hastings Council Coastal Management Program

The Council is in the process of preparing its CMP, following the five-stage program outlined in the NSW Coastal Management Manual:

- Stage 1: Identify the scope of a CMP
- Stage 2: Determine risks, vulnerabilities and opportunities
- Stage 3: Identify and evaluate options
- Stage 4: Prepare, exhibit, finalise, certify and adopt the CMP
- Stage 5: Implement, monitor, evaluate and report

The Stage 1 scoping study was completed in 2021, allowing the Council to identify the community and stakeholders and prepare an engagement strategy, determine the context of coastal management in the local area and establish roles, responsibilities and governance arrangements to deliver management actions across the local region. The remaining stages will be divided based on geographic areas, with each stage being done four times (once for each area). Stage 2 is currently underway and anticipated to be finalised in 2024. For the Hastings River Estuary area, Stage 2 will include:

- Bank and riparian condition assessment
- Assessment of estuarine flood/inundation hazard
- Water quality improvement strategy
- Assessing the impact of sewage overflows on oyster harvest areas: Hastings River estuary

For the Port Macquarie-Hastings Open Coastline (excluding the open coastline that is covered in the Lake Cathie/Bonny Hills area), the Stage 2 works will include:

- Coastal Hazard Assessment and Coastal Vulnerability Assessment Mapping
- Sea Country Project

20.1.2 Methodology

A review of available literature was conducted to assess the existing conditions of the project area and surrounds, specifically in relation to the general setting and the coastal processes and hazards. Some of the key resources reviewed to inform the baseline conditions include:

– NCCARF Sediment Compartment Assessments (National Climate Change Adaptation Research Facility (NCCARF)).
– Erosion risk assessment of Town Beach undertaken by SMEC for Port Macquarie Hastings Council and subsequently summarised for NCCARF (Truong, Truck, Davies, & Mathew, 2016).
– Erosion risk assessment as part of the Lake Cathie Coastal Zone Management Plan (CZMP) (Council and SMEC 2016). Although Lake Cathie Beach is south of the coastline seaward of the project, it is part of the same sediment compartment and therefore the erosion risk assessment can be considered relevant to the coastline seaward of the project.

Sediment compartment sensitivity

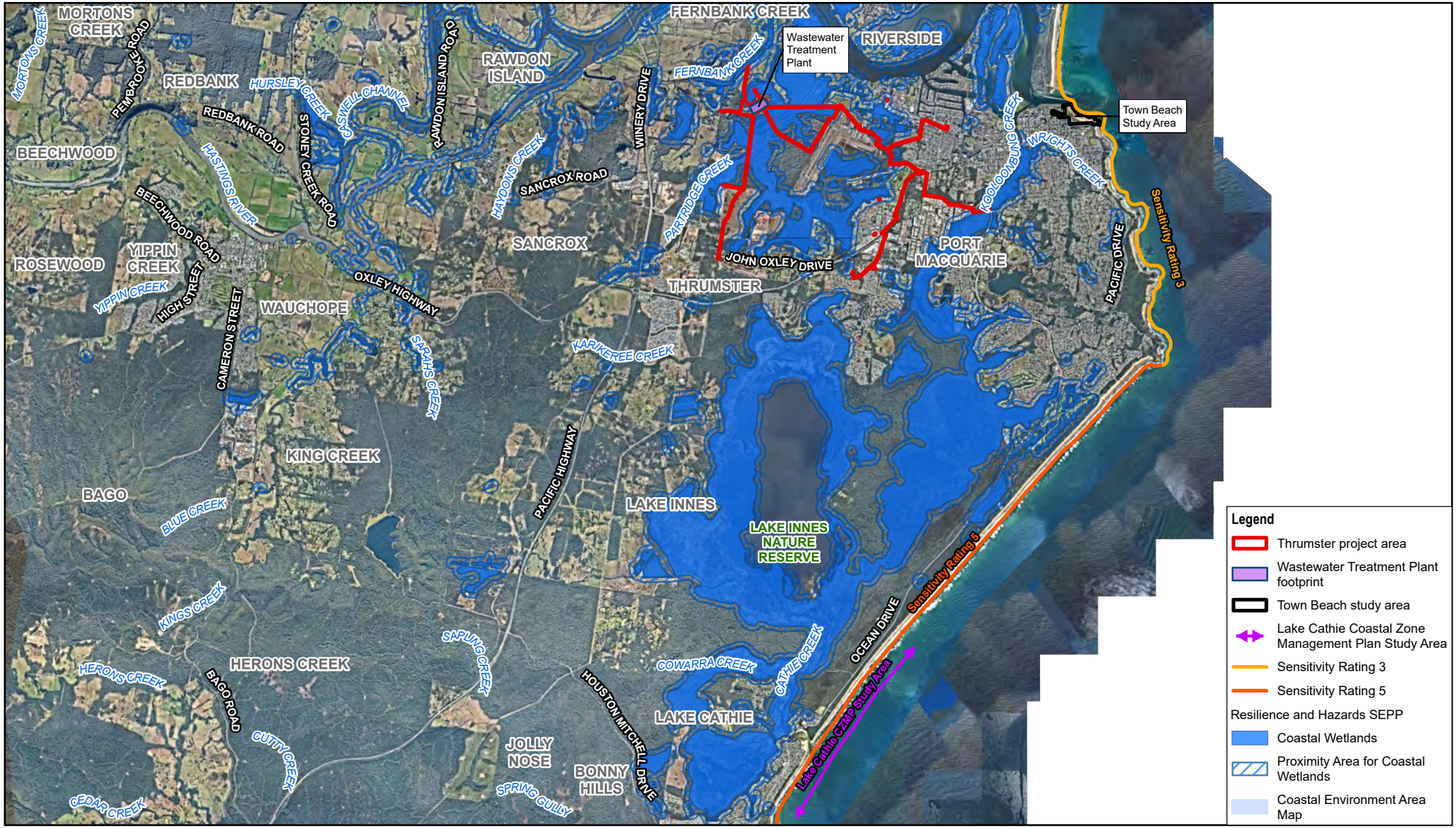
CoastAdapt, a coastal climate risk management tool built by NCCARF, has divided the Australian coast into 359 discrete units, or sediment compartments, within which there are broadly homogeneous features that may include geology, landform types, near-shore currents and sediment availability and movement. A compartment might be, for example, a bay lying between two headlands. CoastAdapt provides descriptions and information for each sediment compartment around Australia. Each compartment is given a sensitivity rating between 1 and 5. The sensitivity ratings are given below in Table 20-1.

Table 20-1 Sensitivity ratings for sediment compartments

Rating	Description
1	Shorelines that are presently accreting and are likely to continue or accelerate their accretion as sea-level rise continues (as a result of increased supply of sand from an alongshore source or from river/tidal channel sources).
2	Shorelines that are currently stable but are likely to start accreting as sea-level rise continues (includes shorelines that periodically grow seaward but may be subject to episodes of erosion).
3	Relatively stable shorelines which may be subject to periodic erosion followed by recovery (accretion), but no long-term recession expected in the next few decades since the sediment budget remains sufficiently balanced over time from offshore, alongshore or terrestrial sources.
4	Shorelines that currently do not show evidence of long-term recession but are likely to begin receding with continuing sea-level rise (based on sediment availability onshore and offshore).
5	Shoreline recession is occurring now (typically documented by historical shifts in shoreline position) and the shoreline is likely to continue to recede as sea level rises (possibly at a faster rate depending on local conditions).

20.2 Existing environment

The Coastal Environment Area and Coastal Wetlands defined within the Resilience and Hazards SEPP planning policy are shown in relation to the project area in Figure 20-1.



Paper Size ISO A4

0 1 2 3 4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Coastal Erosion – Historical studies and relevant classifications

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 20.1

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Print date: 22 Jul 2024 - 11:12

Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; DPE: SEPP Coastal Management, 2024; Geoscience Australia: Coastal Sediment Compartments, 2015; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

20.2.1 Sediment compartment sensitivity

The two compartments relevant to the project are Crescent Head (Crescent Head: NSW01.03.01) and Bonny Hills (Bonny Hills: NSW01.03.02).

– Crescent Head NSW01.03.01 (from Laggers Point to Tacking Point).
– Sensitivity rating is a 3 overall. The southern section may be a 4; erosion was inferred to the south of the compartment by Chapman et al. (1982), but sustained erosion has not been documented.
– Bonny Hills NSW01.03.02 (from Tacking Point to Crowdy Head).

Sensitivity rating is a 5, although much of the compartment might appear as a 4 at present. There is limited supply of sediment from offshore, Pleistocene deposits are exposed in places on the shoreline, and there is an erosion hotspot at Lake Cathie.

The sensitivity rating of both sediment compartments is shown in Figure 20-1.

20.2.2 Predicted erosion

Town Beach

Erosion risk quantification was undertaken by SMEC using photogrammetry in 2005 for Town Beach at Port Macquarie and is summarised in Truong et al (2016). Although the study area lies approximately 3.5 kilometres from the closest proposed infrastructure and was not completed in accordance with the current NSW Coastal Manual, the results are considered appropriate to inform this part of this EIS. The location of the Town Beach study area in relation to the project is shown in Figure 20-1.

The erosion risk assessment found that the main coastal hazard in Town Beach includes:

– Long term coastline recession due to sea-level rise
– Long term coastline recession
– Short term coastal erosion resulting from severe storms
– Wave runup inundation of low lying areas

SMEC constructed a coastal hazard risk line as the sum of the recession due to sea level rise (SLR) (calculated based on the Bruun rule), the long term coastline recession estimated based on historical recession rates provided by photogrammetric data, and the short term coastal erosion resulting from a design storm. Results on long term erosion due to sea-level rise are given in Table 20-2 and Table 20-3 for 2050 and 2100, respectively Truong et al (2016).

Table 20-2 20250 long term erosion estimates due to sea-level rise

Sea level rise scenario (m)	Total beach recession (m)	Total beach erosion (m^3/m)
0.05	1.3	15
0.15	3.8	45
0.30	7.6	90

Table 20-3 2100 long term erosion estimates due to sea-level rise

Sea level rise scenario (m)	Total beach recession (m)	Total beach erosion (m^3/m)
0.1	2.5	30
0.35	8.9	105
0.85	21.6	184

The coastal hazard limit developed by SMEC indicates that without remedial action, parts of the foreshore access road and car park are at risk and the recreation area is subject to high coastal hazard risk within the 50-year planning period.

Figure 20-2 Estimated coastal hazard limit in Town Beach (SMEC 2005)

SMEC considered the historical erosion at the northern end of the beach to be related to the construction of the Northern Breakwater, with the eroded sand accreting at the southern end of the beach. Town Beach is bounded by the training wall, headlands and rocky reefs which limit the potential for sand to be carried around the headland by longshore transport. (Woodroffe, et al., 2012). The potential for longshore transport of sand at the beaches immediately to the south of Town Beach (Oxley Beach, Rocky Beach, Flynn's Beach, Nobbys Beach, Shelly Beach, and Miners Beach) is limited by similar features.

Lighthouse Beach /Lake Cathie Beach

Unlike Town Beach and its immediate neighbouring beaches, Lighthouse Beach and Lake Cathie Beach cannot be considered pocket beaches and can be considered to be the same compartment, with no headlands or other structures to limit longshore sediment transport.

The Lake Cathie CZMP (Council and SMEC 2016) predicted erosion for Lake Cathie Beach is given in Table 20-4, based upon the parameters given in the CZMP. Table 20-4 shows that Lake Cathie Beach is subject to recession regardless of the increase in sea level. Although the study area for the CZMP lies south of the project area and was not completed in accordance with the current NSW Coastal Manual, the results are considered appropriate to inform this part of this EIS. The location of the Lake Cathie CZMP in relation to the project is shown in Figure 20-1.

Table 20-4 Long term shoreline recession due to sediment loss and sea level rise

	2050	2100
Long-term recession due to sediment loss	9 m	19 m
Long-term recession due to sea level rise	17 m	42 m
Total	**26 m**	**61 m**

20.3 Potential impacts – construction

Construction activities in coastal areas have the potential to disrupt sediment transport pathways through earthworks, excavation and disturbing of soils. This can in turn alter patterns of erosion and accretion. In this instance, construction of the project would be undertaken approximately five kilometres from the coastline.

Previous coastal hazard assessments, given in Section 20.2.2, estimated that the present day extent of coastal hazard zones to be approximately 100 metres inland from the coast in locations to the north and south of the proposed infrastructure (Town Beach and Lake Cathie Beach). For coastal erosion to interact with the proposed construction activities, shoreline recession would need to be considerably greater than that estimated during the previous studies. In addition, approximately two-thirds of the Town of Port Macquarie would need to be lost to coastal erosion before the coastal erosion to interact with the proposed construction activities.

Accordingly, there is no significant risk that the project would result in impacts to coastal erosion during construction.

Similarly, there is no significant risk that the construction activities would be impacted by coastal erosion during the construction phase.

Assessment of impacts to coastal wetlands, fluvial geomorphology and flooding risks have been undertaken in Chapter 7 (Water quality and hydrology), Chapter 11 (Terrestrial biodiversity) and Chapter 12 (Aquatic ecology).

20.4 Potential impacts – operation

Operation of the WWTP and associated infrastructure such as pipelines in coastal areas have the potential to disrupt sediment transport pathways through infrastructure blocking longshore sediment transport, blocking or changing natural waterways and drainage systems or the installation and operation of ocean outfalls. This can in turn alter patterns of erosion and accretion. In this instance, the proposed infrastructure would be between 3.5 kilometres and 10 kilometres from the coastline.

Previous coastal hazard assessments, outlined in Section 20.2.2, estimated the long term (2100 scenario) beach recession associated with sea level rise to be approximately 22 metres to the north of the proposed infrastructure (Town Beach) and approximately 61 metres to the south of the proposed infrastructure (Lake Cathie Beach). In order for coastal erosion to interact with the proposed construction activities, shoreline recession would need to be considerably larger than that estimated during the previous studies. In addition, approximately two-thirds of the Town of Port Macquarie would need to be lost to coastal erosion before the coastal erosion to interact with the proposed construction activities.

Accordingly, there is no significant risk that operation of the project would result in impacts to coastal erosion. Similarly, there is no significant risk that the operational activities would be impacted by coastal erosion.

20.5 Management measures

Given that there is no significant risk of impacts from construction and operation on coastal erosion, and no significant risk of the construction and operational activities themselves being impacted by coastal erosion, no mitigation or management measures are deemed to be required.

21. Landscape character and visual amenity

This chapter provides a detailed summary of the potential landscape character impacts (impact on the area's built, natural and cultural character or sense of place) and the visual impacts associated with the project (impact on views in and around the area), and where required, proposes feasible and reasonable mitigation and management measures. The full assessment is provided in Technical Report 13 – Landscape Character and Visual Impact Assessment.

21.1 Assessment approach

21.1.1 Legislation and policy context

The Land Character and Visual Impact Assessment (LCVIA) was undertaken in accordance with methodology provided in the NSW Roads and Maritime Services as set out in the *Environmental Impact Assessment Practice Note EIA-N04 – Guideline for landscape character and visual impact assessment* (Transport for NSW) as it provides a robust process and clearly defined criteria on which to assess the potential impacts of the project and has consistently been accepted by DPE as a valid methodology for such assessments. Other relevant guidelines for the preparation of LCVIA include:

– The Guidance for Landscape and Visual Impact Assessment (GLVIA), Third Edition (2013), prepared by Landscape Institute and Institute of Environmental Management & Assessment (IEMA 2013).
– Guidance Note for Landscape and Visual Assessment (June 2018), Australian Institute of Landscape Architects (Queensland chapter) (2018).

21.1.2 Study area

The study area for the LCVIA comprised of the potential visual catchment of the project and areas beyond this which have a landscape character of functional relationship with the project area. This was determined based on the interpretation of aerial photographs and verified by field investigations.

21.1.3 Methodology

The key tasks for the LCVIA involved:

– Reviewing the legislative and policy context and applicable guidelines.
– A contextual analysis, describing the general setting of the area including land use, existing features, landform, vegetation, and possible future development in the area.
– Assessing landscape character sensitivity to the project.
– Assessing visual receptor sensitivity within the surrounding area through the use of viewpoints.
– Visual inspection during a site visit to take photographs from representative viewpoints.
– An assessment of the significance of impacts on landscape character and visual amenity at the viewpoints as a direct result of the project.
– Identification of residual and cumulative impacts including a consideration of night light effects.
– Proposed mitigation strategies to ameliorate adverse visual impacts.

For the full methodology refer to Technical Report 13 - Landscape Character and Visual Impact Assessment.

21.1.3.1 Assessment criteria

The landscape character and visual impact ratings have been determined using the sensitivity and magnitude matrix based on the Environmental Impacts Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (Transport for NSW [TfNSW] 2020).

Sensitivity is a qualitative measurement considering the capacity of the landscape character zone or visual receiver to absorb change from the project. Magnitude is a qualitative measurement of the scale, form and character of the project when compared to the existing environment. For the visual impact assessment, this includes consideration of how far the project is from the viewer.

Table 21-1 is the impact rating matrix used to evaluate potential landscape character and visual impacts. The matrix is used to determine the overall impact level, which represents a combination of sensitivity and magnitude ratings. The effect of the overall impact was then qualitatively assessed as ‘adverse’, ‘neutral’ or ‘beneficial’ when measured against the existing environment.

Table 21-1 Impact rating matrix

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	Moderate - High	Moderate	Negligible
	Moderate	Moderate - High	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

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Kilometres

Map Projection: Transverse Mercator
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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Site location and surrounding land uses

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

FIGURE 21.1

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21.2 Existing environment

21.2.1 Project location and surrounding land uses

The project area and surrounding land uses are detailed in Chapter 18 (Project description). Further detail is provided in Technical Report 13 - Landscape Character and Visual Impact Assessment. Figure 21-1 illustrates the location of the project area in relation to key surrounding land uses, routes and townships, which have been annotated for reference. Additionally, land allotments and ownership proposed for the WWTP and pipeline infrastructure, including the landscape zones the project components are proposed in, are detailed in Section 3.1.

The topography of the proposed WWTP is low-lying lands of the Hastings River floodplain, with the surrounding area dominated by dense native bushland, which generally screens the proposed WWTP site.

The pipeline components of the project cover a large area of flat and low undulating landform with highly fragmented vegetation including open cleared areas, scattered remnant vegetation varying forest groups (refer to Chapter 11 (Terrestrial biodiversity) for further detail).

Across the project area, fragmentation of the landscape has occurred through progressive historic clearing of native bushland, to accommodate rural activities, aviation activities, residential and commercial development. In many cases, these activities and developments are bounded in close proximity by remnant native bushland areas.

21.2.2 Landscape character zones

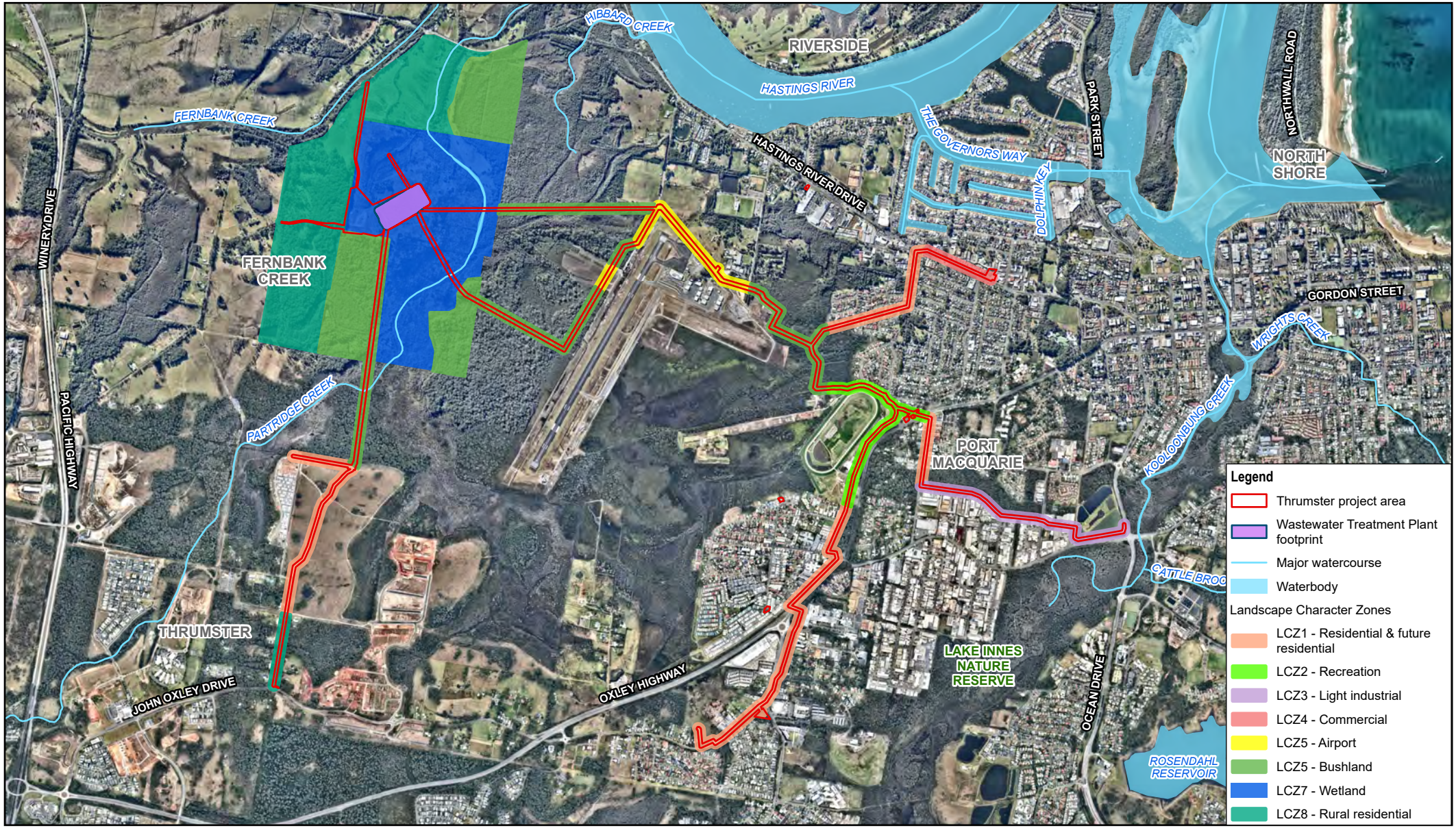
The project area was divided into a series of landscape character zones (LCZs). The LCZs analysed are shown in Figure 21-2 and summarised in Table 21-2. Each LCZ is summarised in the following sections. Further detail and photographs showing the existing landscape character of each LCZ can be found in Technical Report 13 - Landscape Character and Visual Impact Assessment.

Table 21-2 Landscape character zones

Landscape character zone (LCZ)	Description	Reference image
LCZ 1 Residential and future residential	– This landscape has few biodiversity features and retains little original or intrinsic value with strong modern trends associated with low density residential development. – It is a moderately settled landscape with medium level of built form. There is some representation of the original forested landscape character type and scenic beauty on the development boundary. – Residences are somewhat bounded by remnant native bushland and rural activities. – Outlooks are inconsistent, with mostly open outlooks sometimes enclosed by vegetation or neighbouring homes. – Vegetation comprises dense native bushland to some of the development perimeter, and scattered vegetation to street frontages and or residential gardens. – Infrastructure in the street consist of residential streets, street lighting, and electricity transmission lines. – Land uses include Port Macquarie Base Hospital, Lake Innes Village Shopping Centre, and Bunnings.	 Residential homes on The Binnacle

Landscape character zone (LCZ)	Description	Reference image
LCZ 2 Recreation	– Characterised by open outlooks associated with the Port Macquarie racecourse and other recreational facilities, with minimal built infrastructure. – The land is mostly flat in the developed recreational areas, with dense vegetation and undulating hills to some parts of the boundary. – Vegetation comprises a mix of dense and scattered native bushland around the perimeter. – Surrounding infrastructure includes Lady Nelson Drive, Oxley Highway, street lighting and electricity transmission lines. – Land uses include the Port Macquarie Racecourse and ancillary buildings, and outdoor recreation spaces.	 Port Macquarie Racecourse, Lady Nelson Road
LCZ 3 Light industrial	– Associated with light industrial buildings of medium to large scale. – Retains little original character that exists in dense forested area to the perimeter of Acacia Avenue. – Vegetation in the area comprises large cleared open areas with dense vegetation to development perimeter. Occasional scattered planting and or gardens are present to street frontages. – Land uses include mid to large scale industrial offices, warehouses, and associated car parking spaces.	 Light industrial – Acacia Avenue
LCZ 4 Commercial	– Associated with small to medium scale commercial development, situated along Hastings River Drive. – Characterised by wide road reserves with central nature strips that have introduced species. – Vegetation comprises a mixture of domestic and native plantings and street trees, and scattered remnant native forest particularly to development perimeters. – Surrounding infrastructure comprises Hastings River Road, street lighting, and overhead power transmission lines. – Land uses include commercial buildings and associated car parking.	 Commercial – Hastings River Drive
LCZ 5 Airport	– Associated with Port Macquarie which is adjacent to Newman Senior Technical College and Tuffins Lane Sports Fields. – The area is moderately developed and retains little character that exists in the dense forested area to the airport boundaries. – Vegetation comprises of native wetland, shrubland and sedgeland vegetation along the development perimeter. – Surrounding infrastructure comprises an aeroplane runway, street lighting, and Tuffins Lane. – Land uses include Port Macquarie Airport, and associated carparking, access roads and sheds. – Vast open outlooks over cleared land for airport infrastructure.	 Cleared land for aviation activities, Turfinns Lane

Landscape character zone (LCZ)	Description	Reference image
LCZ 6 Bushland	– Associated with distinctive native bushland with minimal development or disruption to the original environment. – Vegetation comprises native wetland, shrubland, sedgeland, and dense forest vegetation. – Surrounding infrastructure comprises overhead power transmission lines, access roads and The Binnacle Trail. – Land uses include council owned nature reserve. – The distinctive native bushland character provided the zone a strong sense of place and high amenity, with enclosed screened outlooks.	 Native bushland, John Oxley Drive
LCZ 7 Wetland	– Associated with distinctive native wetlands and sedgeland vegetation with minimal development or disruption to the original environment. – Bounded by dense native forest and Partridge Creek, prone to flooding. – Surrounding infrastructure comprises overhead power transmission lines, unsealed access roads, Partridge Creek weir, and previously installed incoming sewer mains. – Land uses include council owned reserve, and small remnant rural structures (house and shed). – The zone maintains a distinctive native wetland character, a strong sense of place and high amenity, with open outlooks framed by dense bushland.	 Native wetlands off Fernbank Creek Road.
LCZ 8 Rural residential	– Associated with low density rural residential development and open cleared lots with scattered remnant vegetation. – Residential dwellings are minimal and spaced out on large lots. – The area is bounded by dense native bushland and areas of native wetland. – Vegetation comprises of native bushland to some of the development perimeter, bounded in parts by native wetland, and remnant vegetation scattered across vast cleared land, including introduced species on residential properties and gardens. – Surrounding infrastructure comprises access roads and electricity transmission lines. – Open outlooks interrupted by scattered vegetation or residential dwellings. – Enclosed outlooks screened by vegetation along road reserves.	 Rural residential property, Thrumster Street



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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Landscape character zones

FIGURE 21.2

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21.2.3 Key viewpoints

12 viewpoints were selected as a representation only, of a view or potential views from a particular public visual catchment area to the project. They are shown in Figure 21-3 and summarised in Table 21-3.

Table 21-3 Key viewpoints

Key viewpoint	Description	Reference image
Viewpoint 1	Fernbank Creek Road – Represents mainly motorists, travelling at speed. – Moderately modified environment, which includes roads and associated infrastructure and partial clearing of native bushland.	 Fernbank Creek Road, looking towards WWTP
Viewpoint 2	Fernbank Creek Road near residential home – Represents mainly motorists, travelling at speed along Fernbank Creek Road. – Moderately modified environment, which includes roads and associated infrastructure, partial clearing of native bushland and rural residences.	
Viewpoint 3	Hastings River Drive – Represents mainly motorists, travelling at speed along Hasting River Drive. – Moderately modified environment, which includes roads and associated infrastructure, partial clearing of native bushland and rural residences.	 Hastings River Drive, Fernbank Creek Road, looking towards WWTP
Viewpoint 4	Tuffins Lane – Represents mainly pedestrians using Tuffins Lane Sport Fields. – The environment is moderately to significantly modified for recreational purposes and the Port Macquarie Airport beyond, which includes a vast open area of cleared bushland.	 Tuffins Lane, Fernbank Creek Road, looking towards major trenching intersection

Key viewpoint	Description	Reference image
Viewpoint 5	Tuffins Lane near residential homes – Represents mainly motorists accessing the Port Macquarie Airport entry and carpark. – The environment is moderately to significantly modified for rural purposes and the Port Macquarie Airport, which includes vast open areas of cleared bushland.	 Tuffins lane, Fernbank Creek near residential homes looking towards trenching and SPS.
Viewpoint 6	The Binnacle – Represents residents and therefore sensitive receptors within close proximity to the sewer rising main component of the project. – The environment is however moderately to significantly modified, represented by the large areas of cleared bushland, to make way for medium density residential development and associated infrastructure.	 The Binnacle, Port Macquarie looking towards SPS
Viewpoint 7	Clifton Drive – Represents mainly motorists on Clifton Drive and Hastings River Drive and some residences and business owners along Hastings River Drive. – Significantly modified environment, associated with commercial land uses and associated infrastructure.	 Clifton Drive, Port Macquarie looking towards proposed SPS, compound and carpark
Viewpoint 8	Lady Nelson Drive – Represents residents on Lady Nelson Drive, within close proximity to the sewer rising main, recycled water main, return effluent pipeline, laydown area and carpark components of the project and to a less extent, visitors to the racecourse. – The environment is moderately to significantly modified, represented by the large areas of cleared bushland, to make way for medium density residential development and associated infrastructure and the racecourse.	 Lady Nelson Drive, Port Macquarie looking towards proposed laydown area and carparking.

Key viewpoint	Description	Reference image
Viewpoint 9	Acacia Avenue – Represents motorists and business owners on Acacia Avenue within a moderate to significantly modified environment, for light industrial uses	 Acacia Avenue, Port Macquarie looking towards return effluent pipeline
Viewpoint 10	John Oxley Drive – Represents motorists on John Oxley Drive, visitors to Village Shopping Centre and some residential dwellings. – The environment is already moderately to significantly modified for commercial and residential use and major roads.	 John Oxley Drive, Port Macquarie looking towards proposed compound and parking area.
Viewpoint 11	Intersection of the Ruins Way and Joh Oxley Drive – Represents motorists travelling John Oxley Drive. – The environment is moderately modified due for road use.	 Intersection of the Ruins Way and John Oxley Drive, Port Macquarie looking towards proposed SPS
Viewpoint 12	Thrumster Street – Represents residents and therefore sensitive receptors within close proximity to the RWM component of the project. – The environment is however moderately modified, represented by the large areas of cleared bushland, to make way for rural residential development and associated infrastructure.	 Thrumster Street, looking towards and along the recycled water main

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Map Projection: Transverse Mercator
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Port Macquarie-Hastings Council
Thrumster Wastewater Scheme
Environmental Impact Statement

Project No. **12611129**
Revision No. **0**
Date **22/07/2024**

Key viewpoints

FIGURE 21.3

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Data source: PMHC: Infrastructure data, 2023; LPI: DTDB / DCDB, 2023; Nearmap WMS Server: Aerial imagery - date extracted 12/10/2023. Created by: fmackay

21.3 Potential impacts – construction

The potential impacts identified in the LCVIA are largely contained to the construction of the project. Potential impacts have been considered during both construction and operational (see section 21.4) stages of the project, as the impacts for the WWTP and respective pipeline components would be noticed differently. Landscape character impacts and visual impacts are addressed respectively in the following sections and in section 21.4.

21.3.1 Landscape character impacts

Across all LCZs, construction activities would involve the temporary mobilisation of plant and equipment. The impacts to landscape character during construction of the sewer rising main, recycled water main, return effluent pipeline, and electricity and communications supply were considered negligible for all LCZs, largely due to being short term works for the duration of construction only.

The Bushfire Assessment Report (Technical Report 14 - Bushfire Risk Assessment) recommends an APZ minimum 20 metres wide as measured from the nearest part of built structures to the nearest point of grassland hazard to each structure. Under the current design, this APZ zone is able to be fully incorporated within the proposed cleared, filled and built area. Therefore, the construction of the WWTP would not require any clearing.

Table 21-4 below summarises the construction impact assessment for each landscape character zone.

Table 21-4 Potential impacts to LCZs - construction

Landscape character zone (LCZ)	Sensitivity	Magnitude	Impact rating and summary
LCZ 1 Residential and future residential	Low	Negligible	Negligible Construction of the sewer rising main, return effluent pipeline, and electrical and communications supply would involve trenching and would be mostly contained within existing road reserves. There would also be a temporary compound and carpark to support the works during construction. The works would only impact these areas during construction periods would have no impact during plant operation. A new SPS would constitute a minor alteration to the existing landscape character with the introduced elements being consistent with the existing environment. Any lighting during construction would be of short duration. During operation of the SPS, lighting would be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.
LCZ 2 Recreation	Moderate	Negligible	Negligible The project would be contained within road reserves and would constitute a minor loss of, or alteration of the overall character during construction of the sewer rising main, recycled water main, and return effluent pipeline. The new SPS would have low impacts during construction as it is located within an area that already has changes to the original character and would be situated near existing small-scale buildings. It would also be partially screened by scattered native trees. Any lighting during construction would be of short duration.

Landscape character zone (LCZ)	Sensitivity	Magnitude	Impact rating and summary
LCZ 3 Light industrial	Low	Negligible	Negligible The project would be constrained within the road reserve and would constitute a minor loss of, or alteration of the overall character for the construction of the return effluent pipeline only. Any lighting during construction would be of short duration.
LCZ 4 Commercial	Low	Negligible	Negligible The project would be largely contained within the existing cleared services easement corridor and would constitute a minor loss of, or alteration of the overall character during construction of the sewer rising main. There would be a temporary compound and carpark located nearby during construction only. Any lighting during construction would be of short duration.
LCZ 5 Airport	Low	Negligible	Negligible Most of the project would be contained in the existing road reserve for the construction of the sewer rising main, electrical and communication supply, recycled water main, and return effluent pipeline. There would also be an associated laydown area on Tuffins Lane during construction only, which would have a low impact. Any lighting during construction would be of short duration.
LCZ 6 Bushland	High	Negligible	Negligible The project would impact the landscape character of this area during the construction of the sewer rising main, electrical and communication supply, recycled water main, and return effluent pipeline. Where possible the trenching follows existing access roads and would constitute in a minor loss or alteration of the overall character during construction.
LCZ 7 Wetland	High	Moderate	Moderate – High The WWTP would be located on a cleared area adjacent to the wetlands. Although it won't have a direct impact on the wetlands, the introduction of uncharacteristic elements to the environment would result in a partial loss to the existing landscape character.
LCZ 8 Rural Residential	Moderate	Low	Moderate – Low The original native bushland has already been cleared for rural residential purposes and has therefore already lost most of its distinctive character and biodiverse features. However, it does hold some remnant characteristics and a moderate sense of place. The construction of the WWTP would result in a minor loss or alteration to the existing landscape character.

21.3.2 Visual impacts

Views towards the WWTP from adjacent roads and a low numbers of residents are mostly screened by the existing dense vegetation and would have moderate to low visual impacts. The proposed access roads would be used solely to support this infrastructure and follow existing informal roads.

Construction impacts at most viewpoints are considered to be negligible due to the short-term nature of construction activities and the nature of some viewpoints as currently significantly modified. Further detail is provided in Technical Report 13 - Landscape Character and Visual Impact Assessment.

Viewpoints with potential moderate impacts are summarised below in Table 21-5.

Table 21-5 Visual impact assessment summary

Viewpoint	Sensitivity	Magnitude of change	Impact
Viewpoint 2 – Fernbank Creek Road near residential home	Moderate	Low	Moderate – Low This view would be affected during construction, however the WWTP would be mainly screened by existing vegetation and would therefore have negligible impacts. Any lighting during construction would be of short duration.
Viewpoint 5 – Tuffins Lane near residential homes	Low	Moderate	Moderate The sewer rising main, return effluent pipeline, and electrical and communication supply would only impact the view during construction with lasting impacts being negligible. Any lighting during construction would be of short duration.
Viewpoint 10 – John Oxley Drive	Moderate	Low	Moderate – Low The sewer rising main, and construction compound and parking area would have a moderate to low impact the view during construction. Any lighting during construction would be of short duration.

21.4 Potential impacts – operation

The impacts of the sewer rising main, recycled water main, return effluent pipeline, and electrical and communication supply components have been assessed as negligible for all LCZs and viewpoints. This is largely due to the fact that the impact of the pipeline components would not be visible during operation due to their underground presence.

21.4.1 Landscape character impacts

The WWTP was assessed to have an impact on the LCZ 7 (Wetland) by introducing uncharacteristic elements to the environment. This would have a moderate to high impact on the landscape character within immediate proximity to the WWTP site. The proposed WWTP site is approximately 500 meters from Fernbank Creek Road located within native bushland. Views towards the WWTP would be predominantly screened from the public view by existing dense native bushland.

Operation of the pipeline components would have no ongoing operational impact, as they would be located underground and result in no change in landscape character.

Operation of the new SPSs would constitute a minor alteration to the existing landscape character, where they are proposed to be located, following construction. However, this is considered to result in a low impact as the SPSs would be consistent with surrounding introduced elements in the environment. Additionally, most LCZs where the SPSs would be located are partially screened by existing vegetation and situated near small scale buildings, and therefore assist in minimising alterations to the landscape. During operation of the SPSs, lighting would be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting to minimise intrusive light impacts to the surrounding area.

21.4.2 Visual impacts

Operation of the pipeline components would result in no visual impacts as they would operate underground.

The main potential viewpoint impacts associated with the operation of the project is summarised below in Table 21-6. These potential impacts were considered to result in moderate to low impacts to the respective viewpoints. Consideration of alternatives for the WWTP site and pipeline routes also factored in visual impact considerations where practicable resulting in a reduction of any potential visual impacts to be minor in nature.

Table 21-6 Potential viewpoint impacts - operation

Viewpoint	Sensitivity	Magnitude of change	Impact
Viewpoint 2 Fernbank Creek Road near residential home	Moderate	Low	Moderate - Low This view would be affected during operation, however the WWTP would be mainly screened by existing vegetation and would therefore have negligible impacts. During operation of the WWTP, lighting would be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.
Viewpoint 5 Tuffins Lane near residential homes	Low	Moderate	Moderate – Low This view would be moderately affected during operation, as the SPS would be visible from the road. During operation of the SPS, lighting would be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.

21.5 Mitigation and management measures

Management and mitigation measures that would be implemented to minimise visual impacts of the project are detailed in Table 21-7.

Table 21-7 Landscape character and visual impact management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
LV1	Lighting	Any lighting during construction would be of short duration. Lighting would not be directed or spill into any adjoining landholding. Occupants of adjoining landholdings will be advised of any unlikely night-time construction and the proposed lighting requirements.	Contractor	Pre-construction
LV2	Lighting	During operation of the WWTP and SPSs, lighting will be provided in accordance with AS 4282 – *Control of the obtrusive effects of outdoor lighting*. This Standard specifically refers to the potentially adverse effects of outdoor lighting on nearby residents. Design of outdoor lighting will be required to control any obtrusive effects to an acceptable degree.	Operator	Operation
LV3	Works areas during construction	During construction, work areas will be kept tidy and clear of rubbish, stockpiles appropriately contained, and equipment, plant and parking managed and contained within identified works areas.	Contractor	During construction

22. Climate change

This chapter provides a detailed summary of the assessment of potential climate change impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides proposed mitigation and management measures.
The full assessment is provided in Technical Report 17 – Climate Risk Assessment (GHD, 2024).

22.1 Legislation and policy context

The following guidelines and polices were considered as part of the climate risk assessment (CRA):

- AS 5334-2013 Climate change adaption for settlements and infrastructure – A risk-based approach
- ISO 31000:2018 Risk Management – Principles and guidelines
- ISO 14901:2021 Adaptation to climate change – Guidelines on vulnerability, impacts, and risk assessment
- Climate Change (Net Zero Future) Act 2023 No 48
- Climate Change Fund Strategic Plan
- The NSW Environment Protection Authority (EPA) Climate Change Action Plan 2023–26
- EPA Climate Change Policy
- NARCliM
- Net Zero Plan Stage 1: 2020-2030
- NSW Climate Change Adaptation Strategy
- NSW Climate Change Fund
- NSW Climate Change Policy Framework (November 2016)
- Imagine 2050 Community Strategic Plan
- Shaping Our Future 2040 Local Strategic Planning Statement (LSPS)
- Sustainability Policy
- Climate Change Response Policy

22.2 Methodology

22.2.1 Key tasks

The CRA was prepared in accordance with the principles and criteria outline in Infrastructure Sustainability version 2.1 (ISV2.1). Key tasks undertaken included:

- Review of SEARs requirements.
- Identification climate variables that could impact the project.
- Assessment baseline weather data and climate projection data to inform the assessment.
- Confirmation the asset design life and relevant risk matrix (NSW Government Climate Risk Assessment Tool Risk Criteria).
- Review of the existing concept design report to inform CRA.
- Development of high-level climate risks to the project.
- Determination of preliminary risk likelihood and consequence in alignment with the relevant risk matrix.
- Identification of controls implemented in design to mitigate climate risks.
- Identification of additional mitigations to further reduce risks.

The CRA aligns with the resilience credit within Isv2.1. This credit (Res-1 Climate and Natural Hazard Risks) is intended to assess and treat risk to the asset associated with climate change and natural hazards. The ESD assessment (Technical Report 17) has addressed the application of Isv2.1 to the project as a recommended condition of approval.

22.2.2 Selected projections and anticipated design life

The project's infrastructure and assets have a varied expected design life depending on the component or system, as shown in Table 22-1. As such, the selection of 2050, 2070 and 2090 projections allowed the CRA to consider their anticipated design life. Minimum design lives are indicative for the purposes of the CRA and may be subject to change.

Table 22-1 Minimum asset design life criteria

Item	Design life in years
Roofing – Structural	25 years
Roofing – Non-structural	25 years
Access Structures	25 years
Reinforced Concrete Structures	50 years
Pipe	30 Years
Pumps	10 years
Civil and structural	50 years

The selected Representative Concentration Pathway (RCP) and timescales chosen for the CRA are shown in Table 22-2. Further detail regarding RCP selection, including the climate baseline and projection data used to inform the CRA, is provided in Technical Report 17 - Climate Risk Assessment.

Table 22-2 Projections used in CRA

Scenario	Timeframe
RCP8.5	2050±10 years
	2070±10 years
	2090±10 years

The use of three timeframes from the near future to the late century under a very high emissions scenario such as RCP8.5 allowed for a comprehensive understanding of potential risks to the project. This selection encouraged all potential risks to be identified, addressing the design life of project assets. Applying the RCP8.5 scenario allowed the worst-case scenario risks to be addressed so that risk is not underestimated, acknowledging that scenarios may transpire earlier than projected.

22.3 Existing environment

22.3.1 Local climate and historical events

The average annual climatic data applicable to the project area was sourced from the Bureau of Meteorology (BoM). The data indicated the following climate features in the project region (Port Macquarie):

– The project region is classed as temperate, featuring warm/humid summers and mild winters, and experiences an average maximum temperature of 23.6°C, and an average minimum temperature of 12.6°C.
– The project region receives most of its rainfall in autumn, experiencing an average of 513 mm of precipitation over the baseline period. This is due to the warmer ocean currents bringing moisture to the area which produces higher levels of rainfall.

– Along the east coast of the project region, bushfires typically occur during dry spring and summer conditions. There have been more extreme conditions during summer, and an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring.

Additionally, in recent years, the project region has been significantly impacted by the 2019/20 bushfires as well as rainfall and flooding. During the Black Summer Bushfires of 2019/2020, the region suffered substantial losses with bushfires burning 47 per cent of Port Macquarie Hastings (1,740 square kilometres). In addition to this, from late February to early April 2022, catastrophic flooding impacted the Port Macquarie-Hastings LGA. Notably, Port Macquarie Hastings witnessed flooding across 89 square kilometres (2 per cent of the area) (Australian Institute for Disaster Resilience [AIDR] 2021). The year before, from March to June 2021, NSW again encountered extreme rainfall, particularly on the east coast, resulting in widespread flooding. Details of the disaster declarations issued to Port Macquarie-Hastings LGA by the NSW Government from 2019 are provided in Technical Report 17 - Climate Risk Assessment.

22.3.2 Meteorology and projected trends

A summary of meteorological conditions and projected trends applicable to the project and its surrounds is provided in Table 22-3.

Table 22-3 Meteorological conditions and projected trends

Projected climate trends	The projected climate trends along the east coast of Australia were identified to inform the climate environment where the project is situated. Detailed climate trends and climate data is provided in Technical Report 17 - Climate Risk Assessment. The key trends identified include: – Average temperatures would continue to increase in all seasons (very high confidence). – More hot days and warm spells are projected (very high confidence). Fewer frosts are projected (high confidence). – By late in the century, less rainfall is projected during the cool season (high confidence). – Heavy rainfall intensity is projected to increase (high confidence). – Greater time spent in meteorological drought is projected with medium confidence by late in the 21st century under RCP8.5. – An increase in the frequency and duration of extreme drought is projected with low confidence. – It is anticipated that the proportion of the most intense storms would increase over the century. Extreme rainfall and flooding (CSIRO and BoM, 2015).
Temperature and heat extremes	The NARCliM1.5 dataset (Adapt NSW 2020) was used to identify baseline (maximum) and projection (minimum) temperatures for the region. The project's regional mean maximum and minimum daily temperature is expected to increase to 26.7°C and 17.6°C by 2090 under RCP8.5 (using NARCliM1.5 dataset). Detailed climate data is provided in Technical Report 17.
Bushfire	The East Coast Cluster Report projects with high confidence that climate change would result in harsher fire-weather (CSIRO and BoM, 2015). Fire weather was estimated using the McArthur Forest Fire Danger Index (FFDI). Using this index, when FFDI exceeds 50 it is considered severe fire weather. The projected changes in average annual number of days with a FFDI greater than 50 in the far future (2060–2079) for Coffs Harbour (the closest station to the project) are expected to increase from a baseline of 0.1 days to 0.2 days in 2030 and 0.4 days in 2090 under RCP8.5 (CSIRO and BoM, 2015). A Bushfire Assessment (Technical Report 14 - Bushfire Risk Assessment) has been completed and is addressed in Chapter 19.
Drought	Drought is defined as 'a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use' (BoM, 2023). The project region has suffered through various droughts, and drought conditions are projected at a high confidence to continue to be a feature of the NSW region (CSIRO and BoM, 2015). Australia is projected to experience continued warming, with more extremely hot days and fewer extremely cool days and a decrease in cool season rainfall across many regions of the south and east, leading to more time spent in drought (CSIRO and BoM 2022).
Rainfall and flooding	The project region receives most of its rainfall in autumn, experiencing an average of 513 millimetres of precipitation over the baseline period (1985 to 2005). This is due to the warmer ocean currents bringing moisture to the area which produces higher levels of rainfall. The East Coast Cluster Report indicates with medium confidence that a decrease in winter rainfall is projected while the other seasons are anticipated to see a range of changes, with a tendency towards increased rainfall during summer (based on CSIRO and BoM dataset).

Storm events	The probability of thunderstorms on the East Coast is likely to rise with increasing temperatures. Climate models project an increase in extreme low-pressure systems during warmer months, the primary drivers of severe storms along the NSW coast. Additionally, there may be a decrease in smaller to moderate low-pressure systems during cooler months. Furthermore, climate change forecasts indicate a southward shift of tropical cyclones, leading to more intensity and impact in the Mid North Coast region (Adapt NSW 2022).

22.4 Impact assessment

The CRA identified 34 risks which are applicable to the project. A summary of the climate change risks identified, including their ratings under the current baseline climate, in 2090 (under RCP 8.5) is provided in Table 22-4.

The climate change projections for the future detailed in Table 22-4 are relevant to the project's proposed construction and operation timeframes. Of the 34 risks identified, up to nine were rated 'high' and up to 21 were rated as 'medium'. The high-level hazards to the project were identified based on a review of project documentation, local hazard mapping and in consideration of future climate projections. No 'extreme' risks were identified.

Table 22-4 Summary of climate risks confirmed for the project in the CRA

Risk classification	Baseline	2050	2070	2090	Residual
Extreme	0	0	0	0	0
High (H)	0	4	4	7	9
Medium (M)	23	21	21	23	21
Low (L)	11	9	9	4	4
Total	34	34	34	34	34

The 'high' risks have been grouped by the following climate variables:

– Extreme rainfall/flood events
– Extreme heat
– Extreme drought
– Bushfire events
– Storm events and wind
– Solar radiation

A description of the potential impacts associated with these 'high' risks is provided in Table 22-5 below. It is noted that the potential impacts of these risks are predominantly associated with the operational phase of the project.

Table 22-5 'High' climate risk potential impacts

Climate variable	Associated potential impacts	Project phase
Extreme rainfall	Extreme rainfall leading to onsite overland flow or riverine flooding, causing damage to electrical equipment and housing leading to electrical system outages, asset damage and loss of treatment.	Operation
	Extreme rainfall leads to more water in the wastewater system resulting in maximum capacity of the treatment systems leading to increased spillage of polluted water into the environment.	Operation
	Flooding/rainfall leads to treatment needs beyond capacity challenging environmental compliance.	Operation
	Extreme rainfall leading to localised flooding of access roads, leading to (temporary) loss of access to site - including trucks taking biosolids off site.	Construction / Operation
	Flood event leads to breach of storm storage pond facility resulting in uncontrolled discharge to the environment; environmental impact on surface water.	Operation

Climate variable	Associated potential impacts	Project phase
	Storm event results in loss of containment of chemicals which is released to soil, groundwater or local waterways.	Construction / Operation
	Increased erosion leads to undermining of infrastructure (outfall); damage to equipment; loss of containment (storm storage pond).	Operation
	Floods increasing grit load, causing clogging of inlet works increasing risk of sewage bypass treatment.	Operation
	Increase in extreme rainfall results in flooding which may result in cutting access roads to the site.	Construction / Operation
	Extreme rainfall leads to groundwater levels rising causing impact on flotation of structures.	Operation
	Increased frequency and severity of storms and increased rainfall results in erosion of landscaped areas.	Construction / Operation
Extreme heat	Temperature increase causes higher power demand by grid users resulting in higher risk of grid interruptions for key utility service providers.	Operation
	Higher and extreme temperatures lead to reduced capacity to dissolve oxygen, negatively impacting on treatment process efficiency and non-compliant outflow water quality into the receiving water body.	Operation
	Temperature increase leads to algae outbreaks in open storage resulting in contaminated water and associated health risks.	Operation
	Higher temperatures result in odour emissions resulting in community complaints.	Operation
	Increased temperature impacts on treatment chemicals which gas off leading to locked pipes and impact on treatment capacity and efficiency.	Operation
	Hydrogen sulfide (H2S) emissions increase leading to damage to wastewater infrastructure and overall increase to odour and corrosion risk.	Operation
	Temperature increase leads to changes to operating conditions of the treatment processes requiring additional chemical dosing and alternative dosing practice.	Operation
	Extreme heat affects materials (e.g. concrete durability) causing cracking and damage, resulting in reduced reliability and design life.	Operation
	Extreme temperatures increase risk of electrical / mechanical asset failure (particularly for above ground assets directly influenced by ambient temperature).	Operation
	Increasing temperatures cause increased need for air conditioned facilities increasing power load requirements.	Operation
Extreme drought	Increased periods of extreme drought affecting water availability and WWTP performance, resulting in loss of service.	Operation
	Drought changes ground conditions for example due to lower groundwater tables leading to changes in ground stability.	Construction / Operation
	Drought causes change in inflow water quality, such as higher salinity leading to increased corrosion of equipment.	Operation
	Drought changes the composition of inflow water quality resulting in loss of biological treatment performance and insufficient aeration.	Operation
	Drought leads to low domestic waste water flows resulting in higher salinity concentrations causing impact to the receiving water bodies.	Operation
	Increasingly ephemeral creek/river; potential long-term changes to licencing; capital required; community expectations for higher quality water / reuse.	Operation
	Drought affects near surface ground movement, potentially causing differential settlement and expansion/contraction of soils, resulting in potential cracking and increased risk of building, infrastructure and/or stormwater system failure.	Operation
Solar radiation	Increased solar radiation (UV) leads to faster deterioration of materials, leading to increased maintenance and replacement prior to end of asset life.	Operation
	Solar radiation and high temperatures lead to loss of instruments, impacting on operations.	Operation

Climate variable	Associated potential impacts	Project phase
Bushfire	Bushfires causing damage to access roads, resulting in temporary loss of access for maintenance.	Construction / Operation
	Bushfire leads to increased frequency of short term concentrated sewage (nutrients, contaminants).	Operation
	Bushfire causes interruption to power supply resulting in safety issues and operational disruptions.	Operation
Storm events	Severe storms causing operation phase impacts associated with maintenance activities and system malfunctions.	Operation
	Severe storms cause damage to the electricity network leading to an inability to operate, resulting in system overflow and discharge into river.	Operation
	Severe storms leading to damage of structures, equipment casing and housing, leading to increased maintenance and replacement prior to end of asset life.	Construction / Operation
	Wind causes falling trees which result in damage to plant/equipment, power supply; and OH&S risk.	Construction / Operation
	Severe storm event leads to power outages resulting in increased effluent spills from emergency storage ponds.	Operation

Adaptation measures for these risks were identified the required controls included as part of the concept design of the project.

It is noted that through the no adaptation pathway is required for the project as the high to extreme risks would be mitigated.

23. Greenhouse gas and ecologically sustainable development

This chapter provides a detailed summary of the assessment of potential ecologically sustainable development and greenhouse gas impacts for the project. It describes the existing environment, assesses the impacts of construction and operation of the project, and provides proposed mitigation and management measures.
The full assessment reports are provided in Technical Report 16 – Ecologically Sustainable Development and Technical Report 18 – Greenhouse Gas Assessment (GHD, 2024).

23.1 Assessment approach

23.1.1 Legislation and policy context

The plans, policies and guidelines that were considered for the Greenhouse Gas Assessment (GHGA) include:

- Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (2021).
- Paris Agreement under the United Nations Framework Convention on Climate Change (2016).
- National Greenhouse and Energy Reporting Act 2007 (NGER Act).
- National Greenhouse and Energy Reporting (Measurement) Determination 2008.
- National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulations).
- National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.
- Carbon Credits (Carbon Farming Initiative) Rule 2015.
- National Greenhouse Accounts (NGA) Factors Workbook 2023.
- AS ISO 14064-1:2006 Greenhouse gases – Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
- Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol) (World Business Council for Sustainable Development and World Resources Institute 2015).
- Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC 2022).
- *Climate Change Act 2022.*
- NSW Climate Change Policy Framework.
- National Greenhouse and Energy Reporting (NGER) scheme.

The most relevant sustainability aspects identified in local policy and guidance documents for the ecological sustainable development (ESD) assessment are:

- Sustainability Policy
- Climate Change Response Policy
- Imagine2050 Community Strategic Plan
- Shaping Our Future 2040 Local Strategic Planning Statement

23.1.2 Methodology

23.1.2.1 Key tasks

The GHGA involved:

- Review of relevant legislation, guidelines, and policy documents to establish the regulatory context for the GHG assessment.

– Identifying the GHG emission sources during construction and operation of the project in accordance with the *Estimating emissions and energy in the electricity generation, transmission, and distribution sectors guideline* (CER, 2021), which considered:
  - Scope 1 emissions - direct GHG emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level.
  - Scope 2 emissions - indirect GHG emissions released to the atmosphere from the indirect consumption of an energy commodity.
– Quantifying the fuel use or other activity data for each emission source.
– Identifying appropriate emission factors, such as National Greenhouse and Energy Reporting (NGER) (Measurement) Determination emission factors, are being referenced.
– Establishing baseline GHG emissions associated with different phases of the project and calculate total tonnes of carbon dioxide equivalent (t CO2-e).
– Assessment of potential GHG emissions reduction measures that may be applicable to incorporate into the project.

The emissions inventory estimates the quantity of emissions associated with the project during both construction and operation for each relevant greenhouse gas. Total emissions are expressed in 'carbon dioxide equivalent' ($CO_{2\text{-}e}$) terms as per the NGER scheme.

The ESD assessment included the following tasks:

– Reviewing relevant legislation, guidelines, and policy documents to establish the regulatory context for the ESD assessment.
– Defining the project sustainability commitments / objectives in consultation with the client.
– Drafting a Materiality assessment and scorecard using ISC 2.1 Rating pathway.
– Documenting outputs in an Infrastructure Sustainability Management Plan (ISMP) being this document including the Sustainability Rating pathway.

Sources of information used for the calculations include:

– Beca HunterH2O Thrumster WWTP Concept Design Report
– National Greenhouse and Energy Reporting (Measurement) Determination 2008
– National Greenhouse Accounts Factors Workbook 2023
– Carbon Gauge TAGG Calculator, 2011
– Technical Report 1 – Water Resource and Flooding Assessment
– Technical Report 2 – Aboriginal Cultural Heritage Assessment
– Technical Report 3 – Historic Heritage Assessment
– Technical Report 8 – Traffic and Transport Assessment
– Technical Report 9 – Air Quality Assessment
– Technical Report 10 – Soils and Contamination Preliminary Site Investigation
– Technical Report 13 – Noise and Vibration Assessment
– Technical Report 16 – Landscape Character and Visual Impact Assessment

Infrastructure Sustainability Rating Tool

Infrastructure Sustainability (IS) rating tool provides a clear and comprehensive approach to sustainability in infrastructure projects, covering a wide range of sustainability issues, including environmental, social, economic, and governance aspects.

The tool sets distinct criteria for design and construction, with some credits applying to both phases, highlighting the need for ongoing sustainability efforts from start to finish. The 37 credits are divided into four themes and 15 categories:

Governance theme

1. Place (Pla)
2. Leadership and Management (Lea)
3. Sustainable Procurement (Spr)
4. Resilience (Res)
5. Innovation (Inn)

Economic theme

6. Options Assessment (Ecn)
7. Energy and Carbon (Ene)

Environment theme

8. Environmental Impacts (Env)
9. Resource Efficiency and Management (Rso)
10. Water (Wat)
11. Ecology (Eco)

Social theme

12. Stakeholder Engagement (Sta)
13. Legacy (Legh)
14. Heritage (Her)
15. Workforce Sustainability (Wfs)

The IS Rating Scheme uses a points system to measure a project's sustainability performance, offering up to 100 points, plus an extra 10 for innovation.

23.2 Existing environment

23.2.1 Sustainability objectives

The sustainability objectives for the project are as follows:

- **Environmental compliance and monitoring:** Ensure strict adherence to environmental regulations, with continuous monitoring during construction to mitigate negative impacts and ensure compliance with sustainability objectives.
- **Energy and carbon management:** Develop and implement an energy and carbon reduction strategy targeting greenhouse gas emissions associated with construction activities, including energy efficiency measures, renewable energy sources, and carbon offsetting.
- **Climate risk and resilience:** Assess risk associated with climate in the region and design infrastructure to withstand future climate impacts, ensuring long-term reliability and serviceability amidst extreme weather events.
- **Circular response management:** Employ innovative construction techniques and materials that ensure future adaptability, focusing on sustainability, circularity, and waste reduction by prioritising the use of recyclable, recycled, and repurposed materials to support a circular economy.
- **Water stewardship and efficiency:** Emphasise the use of water efficiently and conservation in both design and construction to ensure not only sustainable water management but also waste minimisation, leading to the conservation and improvement of quality in the receiving waters.
- **Biodiversity:** Implement measures to protect and enhance local biodiversity during construction, including habitat preservation, minimising land disturbance, and enhancement of ecological value.

– **Community:** Ensure meaningful involvement of local communities in the project's planning and execution phases. This objective is about listening to and addressing community concerns, incorporating their feedback, and ensuring the project delivers tangible benefits to the local population.
– **Culture, heritage and education:** Commit to acknowledging and respecting Aboriginal and non-Aboriginal heritage while educating the community on the project's role and its sustainable technologies. Blend cultural reverence with environmental stewardship, enriching community understanding of the site's heritage and its contribution to sustainable water management.
– **Innovation:** Foster innovative thinking to address sustainability challenges and the application of best practice sustainable solutions that enhance market and professional development.

23.2.2 Climate context

The existing climatic and meteorological conditions at the project area and its surrounds is detailed in section 22.3. The existing air quality conditions are detailed in Chapter 14 (Air quality).

23.2.3 Greenhouse gas and global warming potential

The greenhouse gases considered in the GHGA and the corresponding global warming potential (GWMP) for each GHG is listed in Table 23-1.

GWP is a metric used to quantify and communicate the relative contributions of different substances to climate change over a given time horizon. GWP accounts for the radiative efficiencies of various gases and their lifetimes in the atmosphere. The use of GWP allows for the impacts of individual gases on global climate change to be compared relative to those for the reference gas carbon dioxide.

The GWPs from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment report and section 2.02 of the NGER Regulations 2008, updated November 2023, were used in the GHGA.

Table 23-1 Greenhouse gases and 100-year global warming potentials

Greenhouse gas	Global warming potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265

23.3 Impact assessment

23.3.1 IS materiality assessment and scorecard

A preliminary materiality assessment (or weighting assessment) has been conducted to understand the relative importance (materiality) of sustainability aspects and identify the most important issues for the project, using the IS rating tool v2.1 scorecard. This adjusts the value of certain items within the IS rating tool to best reflect the context of the project. During the assessment, each topic is categorised as one of the following:

– 0 = not material (scoped out)
– 1 = Low materiality (half as moderate as important as moderate)
– 2 = Moderate materiality
– 3 = High materiality (more than 50% more important than moderate)
– 4 = Very high materiality (twice as important as moderate)

The categories assessed to be most material for the project from the default calculations are primarily:

– Resource Efficiency and Management (Rso), with 14.86 points
– Resilience (Res), with 11.71 points
– Environmental Impacts (Env), with 10.86 points

– Energy and Carbon (Ene), 10.13 points
– Innovation (Inn), with 10 points
– Ecology (Eco), with 9.45 points

Resource efficiency and management

'Resource Efficiency and Management' category, with 15.46 points available across seven credits, is considered important as it focuses on efficient and sustainable resource management. By emphasising zero waste to landfill, reuse, design optimisation, and recycling, the project can minimise environmental impact and optimise resource use. Concepts like circular economy and industrial symbiosis are particularly relevant for the Thrumster WWS helping reduce resource consumption, minimise waste, and drive cost savings. This not only enhances the scheme's environmental responsibility but also fosters innovation, community integration, and economic growth. Another aspect is the reduction of the project footprint, thus reducing the need for clearing vegetation. In the case of any site clearing, investigate options for the use of the removed timber in the project. The same applies to any materials arising from decommissioning.

Resilience

'Resilience' category, which has 12.18 points available across two credits, is essential for project as it ensures the identification and implementation of actions that enhance the resilience and responsiveness of infrastructure to the needs of cities and communities. This category emphasises considering the broad impact and influence of infrastructure assets, necessitating inclusive stakeholder engagement to address shocks and chronic stresses. Given that climate and natural hazards pose significant risks to infrastructure, specific credits within the category focus on adapting assets to changing climates and responding to existing natural hazard risks.

Environmental impacts

The 'Environmental Impacts' category, with 7.27 points available across five credits, is crucial for the success of this project as it evaluates the effectiveness of management practices in preventing and mitigating various environmental discharges over the asset's life cycle. Emphasising the importance of safeguarding water quality and covering aspects such as air, water, and land, including receiving water quality, noise, vibration, air quality, and light pollution, this category facilitates projects to adhere to regulatory standards and consider the diverse contexts and legal requirements.

Energy and carbon

The 'Energy and Carbon' category, with 10.54 points available across three credits, holds significant importance for the project as it aims to prioritise reductions in energy demand and greenhouse gas emissions throughout the infrastructure life cycle, aligning with the goal of achieving net zero carbon. The credit structure emphasises a hierarchy, focusing on avoiding and reducing energy demand and emissions through design and construction, maximising energy efficiency, incorporating renewable energy sources, and considering carbon offsetting as a last resort.

Innovation

'Innovation' category is vital for Thrumster WWS as it plays a key role in advancing the economy, society, and environmental sustainability. In the context of the IS Rating Scheme, this category is designed to encourage and reward the adoption of innovative technologies, designs, and processes in infrastructure projects. Emphasising sustainability across the triple bottom line, innovation promotes more effective and efficient approaches, reducing environmental impacts and contributing to societal progress. The category not only acknowledges outstanding sustainability performance but also allows innovations from other project categories to be recognised, provided they meet the innovation credit criteria.

Ecology

The ‘Ecology’ category, which has 9.84 points available across the one category, is deemed essential for the project as it aims to promote and recognise infrastructure developments and operations that protect and enhance terrestrial and aquatic ecology. By employing evidence-based approaches to identify and manage ecological impacts and opportunities, the category emphasises the importance of minimising the project's impact on biodiversity. Monitoring and reporting on project outcomes further ensure accountability and adherence to ecological goals.

Refer to Technical Report 16 - Ecologically Sustainable Development Assessment for further details.

23.3.2 Potential impacts – construction

23.3.2.1 Impact of emissions

The construction of the project would result in emissions associated with the following:

– Emissions from the combustion of diesel by plant and equipment.
– Emissions from the combustion of diesel by light and heavy vehicles while traveling to, from and on the site.
– Vegetation clearing resulting in carbon sink losses.
– The following scope 2 emissions, or the emissions from indirect energy use from imports and exports of electricity, heat or steam were considered, namely.
– Electricity from the grid (NSW).

The calculations of emissions that would be produced during the construction of the project are based on these activities which have been summarised below in Table 23-2. It is noted that where these activities have been detailed elsewhere in the EIS, a reference is included to the relevant section.

Table 23-2 Sources of emissions - construction

Activity	Summary and relevance to GHG	Reference to relevant EIS chapter
Heavy vehicles	Construction of the project would produce 88 heavy vehicle movements per day. Fuel consumption associated with the movement of a single rigid truck to, from, and on site is assumed to 29 litres per 100 kilometres (ABS, 2020). The distance covered by trucks during construction is assumed to be10 kilometres per day.	Section 3.4.7
Light vehicles	Construction of the project would produce 122 light vehicle movements per day. Fuel consumption associated with the movement of a single Ute to, from, and on site is assumed to 13 litres per 100 kilometres (ABS, 2020). The distance covered by light vehicles during construction is assumed to be 20 kilometres per day.	Section 3.4.7
Construction equipment	The consumption of fuel associated with construction activities was based on each phase of construction as follows: – Mobilisation and site establishment / demobilisation and surface rehabilitation – 7 litres per hour – Civil works – 102 litres per hour – WWTP, clear water reservoir, sludge management infrastructure construction – 25 litres per hour – Pipeline installation including set out under boring locations and laydown areas – 190 litres per hour – Testing and commissioning – 7 litres per hour	Section 3.4.8

Activity	Summary and relevance to GHG	Reference to relevant EIS chapter
Vegetation clearing	Vegetated areas would need to be cleared for the construction of the WWTP. As such, there would be some emissions associated with the felling of trees (or other vegetation) as well as fuel use of vehicles involved in land clearing activities. Maximum Potential Biomass Class for the project area has been identified as 'Class 4' and the Vegetation Class as per the NVIS has been identified as 3.34 ha of 'MVG2 - Eucalypt Tall Open Forests', 1.66 ha of 'MVG21 Other Grassland, herb lands, sedgelands and rush lands' and 0.04 ha of 'MVG10 Other Forests and Woodlands'. The remaining area (17.57 ha) is classified as 'MVG25 Cleared, non-native vegetation'. The area that would require clearing has been calculated at approximately 22.61 hectares.	Section 3.4.9
Electricity	Information provided by Council indicates that there would be a grid electricity requirement of up to 60 kilowatts for 10 hours each day construction activities are performed.	Section 3.4.10

Construction emissions are estimated to be 10,880 t CO2-e over a 36-month period with the following breakdown of emissions:

– Removal of vegetation - 33%
– Heavy and light vehicles - 42%
– Diesel combustion by construction equipment - 21%
– Electricity generation – 4%

Combined annual emissions from construction and operations are estimated to be about 0.02 per cent of NSW's total emissions when compared to the 2021 state emissions inventory. Construction scope 1 and 2 emissions associated with the project are below the threshold of 25,000 tonnes CO_2-e per annum for facility level reporting under the NGER Act and would not require annual reporting under the NGER scheme.

During construction, carbon sink losses from vegetation removal and emissions from construction plant are the largest sources of scope 1 emissions. Construction emissions are estimated to be about 0.004 per cent of total NSW emissions of GHGs compared to the 2021 state emissions inventory.

As listed above, vegetation clearing contributes the most to emissions associated with the construction of the WWTP, making up 54 per cent of the total construction stage emissions. A sustainability workshop in consultation with the Council identified several sustainability opportunities for the project, the majority of which include revegetation through regenerative planting techniques, along with suggestions to rehabilitate native flora and fauna (Beca HunterH2O 2024). In addition to these identified opportunities, it is considered that the implementation of the mitigation measures identified in Section 23.4 would assist in reducing construction related emissions.

23.3.3 Potential impacts – operation

23.3.3.1 Impact of emissions

Annual emissions from plant operation are estimated to be 21,990 t CO2-e, with 60 per cent of those associated with emissions from wastewater treatment and 40 per cent associated with consumption of grid electricity for plant operations. Maintenance operations, including vehicle and diesel-powered generator, were not calculated as part of the limitation provided in Technical Report 18 - Greenhouse Gas Assessment.

A summary of estimated scope 2 GHG emissions occurring as a result of operations for the project is presented in Table 23-3. The assumptions and calculations of these estimations are presented in Technical Report 18. During the operation stages, the main sources of emissions are identified as the wastewater treatment process, which includes transport of wastewater and composting of sewage sludge, as well as grid electricity use.

Table 23-3 Summary of annual emissions – operation

Activity	Activity data	Units	Annual emissions (t CO_2-e)			Contribution to total emissions (%)
			Scope 1	Scope 2	Total	
Wastewater handling - deep anaerobic lagoons + aerobic treatment	40,000	people serviced by WWTP	13,104	-	13,104	60%
Biological treatment - composting	214	tonne/year of sludge	10	-	10	0.04%
Sewage sludge transport fuel consumption	0.5	kL	1	-	1	0.006%
Grid electricity consumption (NSW)	13,050	MWh	-	8,875	8,875	40%
Total emissions (t CO_2-e/year)			**13,115**	**8,875**	**21,990**	**100%**

As detailed in Section 23.3.1, combined annual emissions from construction and operations are estimated to be about 0.02 per cent of NSW's total emissions when compared to the 2021 state emissions inventory.

Operational scope 1 and 2 emissions associated with the project are below the threshold of 25,000 t CO2-e per annum for facility level reporting under the NGER Act so would not require annual reporting under the NGER scheme.

Operational emissions associated with the project are estimated to be about 0.017 per cent of total NSW emissions compared to the 2021 state emissions inventory. It is considered that the implementation of the mitigation measures identified in Section 23.4 would assist in reducing operation related emissions.

23.4 Mitigation and management measures

23.4.1 Sustainability opportunities

The key sustainability requirements to be implemented for the Thrumster WWS project during the detailed design and construction phases to meet the sustainability objectives of the project are detailed in Technical Report 16. A summary of the opportunities was translated into the following key issue conditions, intended to be incorporated into the approval in order to achieve SEARs requirements and where feasible, mitigate or manage residual impacts.

- **Environmental Compliance and Monitoring:** The project must achieve a minimum Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) Design and As Built rating of Silver (Version 2.1) or equivalent level of performance if using the IS Essentials Design and As Built Rating (Version 2.1).
- **Energy and carbon management:** The project must be designed and built to minimise the embodied and operational greenhouse gases emissions to the maximum feasible extent possible, and to replace the use of fossil fuels with renewable sources of energy.
- **Climate risk and resilience:** The project must be designed to withstand known high to very high risks associated with climate change to year 2100 using an assessment comprising RCP8.5 (AR5) and SSP5-8.5 (AR6) scenarios with timeframes of 2050, 2070 and 2090 in accordance with climate information assets including but not limited to the NSW Common Planning Assumptions as well as the Climate Change Considerations chapter of Australian Rainfall and Runoff: A Guide to Flood Estimation.
- **Circular Resource Management:** The project must be designed and built to minimise primary/virgin resource and waste generation during all life cycle stages by embedding circular design strategies (as defined in the NSW Circular design guidelines for the built environment) and maximise the opportunities for flexibility and adaptability in design, and reuse of components at the end of the lifetime of the asset. The project should have a comprehensive waste management plan that promotes recycling and responsible disposal of construction materials.

- **Water Stewardship and Efficiency:** The project must develop and implement an integrated water management plan for the project construction and operation, encompassing impact modelling, goal setting, measure identification, and monitoring aligned with water quality goals.
- **Biodiversity:** The project must incorporate design strategies to minimise impacts, develop management plans for ecological outcomes, and model post-development ecological values to demonstrate no quantifiable loss compared to its pre-development state.
- **Community:** The project must develop, implement, and periodically review a stakeholder engagement strategy that is informed by the local context and integrated into project governance. This strategy must include a plan for the participation of Indigenous People of the Land and confirm that high-priority stakeholder issues are identified and addressed with positive outcomes.
- **Culture, Heritage and Education:** The project must ensure that heritage values are comprehensively assessed, communicated to the community, monitored, and integrated into project design and training. Furthermore, it should integrate knowledge sharing opportunities for the community during both construction and operational stages, fostering a culture of learning and environmental consciousness.
- **Noise and vibration:** The project must implement all reasonable and feasible mitigation measures with the aim of managing construction noise and vibration impacts to minimise disruption to the surrounding community.
- **Air quality:** The project must implement all reasonably practicable measures to minimise the emission of dust and other air pollutants during construction.

These conditions would address the ISC credits as detailed in the Section 23.3.1 that are being pursued and any subsequent updates to achieve the mandated 'Silver' rating. A detailed ISC pathway and potential opportunities and initiatives for the project are detailed in Technical Report 16 – ESD. The identified list of sustainability initiatives in Technical Report 5 is not intended to be an exhaustive list but rather an indication of the potential departures the contractor may intend to make from their standard design and construction practices for the specific purposes of achieving the IS rating v2.1.

23.4.2 Mitigation measures

Management and mitigation measures that would be implemented to minimise greenhouse gas emissions produced by the project are detailed in Table 23-4.

Table 23-4 Greenhouse gas emissions mitigation and management measures

ID	Impact	Environmental safeguard	Responsibility	Timing
GHG1	Construction related emissions produced by vegetation removal	Reuse vegetation removed from the project area to be mulched or composted where possible.	Council/ Contractor	Construction
GHG2		Consideration of options for revegetation near the project site (beyond any biodiversity offsets required) to reduce the project's carbon impact.	Council	Construction/ operation
GHG3	Construction related emissions produced by vehicle and equipment use	Investigate substitution of fuels with sustainable fuels such as B10 biodiesel or renewable hydrogen.	Council/ Contractor	Construction
GHG4		Use of electric construction plant and vehicles for the construction works where reasonable and feasible.	Contractor	Construction
GHG5	Construction related emissions produced by electricity consumption	Investigate opportunities for on site power generation through solar panels or source electricity from renewable sources.	Council/ Contractor	Construction
GHG6	Operational related emissions produced by methane			
		Explore an alternative to flaring such as using the captured methane as an energy source to substitute a portion of the WWTP's grid electricity requirements or, if possible, piping it into the natural gas supply.	Council	Operation

ID	Impact	Environmental safeguard	Responsibility	Timing
GHG7	Operation related emissions produced by electricity consumption	Where it's not possible to avoid carbon emissions, reducing emissions should be considered in the first instance. Energy efficient electrical equipment (pumps, treatment equipment etc) should be specified to reduce the electrical consumption of the WWTP.	Council	Operation
GHG8		Further investigate options for onsite power generation through solar installations on the roof of the wastewater treatment plant.	Council	Operation
ESD	Sustainability	The project would be designed and constructed in accordance with the sustainability objectives.	Council/Contractor	Pre-construction, construction

24. Cumulative impacts

This chapter describes the potential cumulative impacts of the project and considers other existing or proposed major projects in line with the *Cumulative Impact Assessment Guideline for State Significant Projects* (DPIE, 2022). The cumulative impact assessment draws on the findings of other specialist assessments of the project contained throughout the EIS and publicly available assessment documentation on other existing or proposed major projects in the Port Macquarie-Hastings LGA.

24.1 Assessment approach

The approach to assessing cumulative impacts focused on the project's interaction with other projects in the locality of the project, where construction and/or operational timeframes are likely to be concurrent, and where the potential impacts would be of a scale that could cause cumulative impacts.

The approach undertaken for the cumulative impact assessment is:

– A desktop review of concurrent projects has been conducted by reviewing the following:
  - DPIE's online major projects database.
  - Development consents on Council website and development applications placed on the NSW Planning Portal.
  - Proponent websites.
– Review project environmental aspects to determine those with the potential to result in cumulative impacts.
  - Undertake a desktop cumulative impact assessment for environmental aspects with the potential for cumulative impacts to occur.
  - Recommend additional management measures to address identified cumulative impacts where they have not been suitably addressed elsewhere as part of the assessment of the project.
– Assessing and evaluating the potential impacts of the future project, including identification of any issues likely to have material cumulative impacts during construction and/or operation of the project.
– Identifying suitable mitigation and management measures to manage potential cumulative impacts.

The projects identified within this review were screened in relation to their potential for cumulative impact based on type of development, size, anticipated timing relative to the project and proximity to the project.

Cumulative impacts have the potential to occur for noise (Chapter 17), social (Chapter 10) and air quality (Chapter 14). As such, the specialist assessments for each of these impacts were reviewed to understand the cumulative impacts the project may have.

24.2 Existing environment

A search of the major projects register (DPHI) within the Port Macquarie-Hastings LGA was undertaken on 4 June 2024 to identify those projects that may contribute to cumulative impacts.

The identified projects were then screened against a criterion, as summarised in Table 24-1, to determine whether a project could potentially cause a cumulative impact with the project. Projects that satisfied at least one of the requirements in each of the four criteria were included in the assessment.

Table 24-1 Screening criteria

Criteria	Requirements for consideration
Location	– Project footprints intersect. – Project are in proximity where there is the potential for impacts to spatially overlap.

Criteria	Requirements for consideration
Status	– Approved projects, including approved projects that have not started construction, projects currently under construction, and recently completed projects. – Proposed projects where there is enough publicly available information to allow for analysis of potential cumulative impact issues.
Timeframe	– Overlapping construct program with the project. – Consecutive construction program with the project. – Similar operation regime and maintenance requirements.
Scale	– Project is a large-scale major development or infrastructure project that could potentially cause cumulative impacts with the project.

Projects that were considered to have the potential for cumulative impacts either during the construction and operation of the project are summarised in Table 24-2.

Table 24-2 Projects with the potential for cumulative impacts

Project	Location	Status/timing/overlap
Cowarra Water Supply Scheme (SSI-57056461)	South of Cowarra Dam, Cowarra Access Road, Burrawan Forest Drive, and various local roads, Port Macquarie	Concept design and EIS stage. Construction scheduled: 2025-2027. Timing is expected to overlap with the construction of the project and potential for cumulative impacts are possible.
Hastings Secondary College Port Macquarie Campus Upgrade (SSD-11920082)	Owen Street, Port Macquarie	Works mostly complete. Unlikely for overlap. Potential for cumulative impacts are considered low.
Port Macquarie Health and Education Precinct (SSD-19888478)	Area bounded by John Oxley Drive, Lake Road, industrial area, Lake Innes Nature Reserve and St Columba Anglican College, Port Macquarie.	Works complete. Unlikely for overlap. Potential for cumulative impacts are considered low.
Cairncross Waste Management Facility Expansion (SSD-5792)	Telegraph Point Road, Pembrooke, NSW	Works complete. Unlikely for overlap. Potential for cumulative impacts are considered low.
John Oxley Drive Upgrade (Port Macquarie Hastings Council)	John Oxley Drive between Kingfisher Road and The Ruins Way	Detailed Design and environmental assessment stage of this Project is nearing completion. Depending on timing, cumulative impacts are possible.
Proposed Sancrox Quarry Expansion Project (SSD-7293)	Sancrox, Port Macquarie	Original consent issued 1995. Application with DPIE to expand and extend life of quarry. Assessment process underway. Given nature of proposal, potential for cumulative impacts are considered low.

Table 24-3 provides a review of the environmental aspects assessed in this EIS and the potential for additional cumulative impacts to occur. Where additional cumulative impacts may occur an approach to assessing this impact is proposed.

Table 24-3 Potential cumulative impacts for relevant future projects

Environmental Aspect	Cumulative impact potential	Cumulative assessment approach
Water quality	– Impacts to flooding – during construction of the project, trenching or HDD are required in some sections which are prone to flooding. Any flooding impacts during construction are unlikely to generate a cumulative impact in association with other projects.	NA

Environmental Aspect	Cumulative impact potential	Cumulative assessment approach
	– Impacts to neighbouring landholder bores. There are a number of register landholder waters in proximity to the pipelines, however the project is unlikely to cause drawdown at any of the registered water supply bores. There are three registered water supply bores in proximity to the WWTP and recycled water facility, however the construction will not impact nearby water supply bores. – Impacts to groundwater quality – construction. There are no proposed discharges during construction and on this basis the construction of the project is not anticipated to cause any significant change to groundwater quality. – Impacts to groundwater quality – operation. Discharge of treated effluent are not anticipated to result in notable impacts to groundwater receptors. Emergency discharges will only occur under extreme and prolonged rainfall conditions are not anticipated to result in notable impacts to groundwater receptors. – Any groundwater quality impacts during construction or operation are unlikely to generate a cumulative impact in association with other projects. – Impacts to groundwater dependent ecosystems – there are a number of high priority GDEs within 5 km of the project. The potential project impacts to water quality would be localised and the potential for cumulative impacts based on the known major projects in the area is considered low.	
Aboriginal heritage	The project area comprises largely developed land with the majority of the proposed linear infrastructure being associated with previously developed roads and infrastructure such as residential, farming and parkland. The overall cumulative impact on the archaeological record for the region is likely to be minimal, assuming a similar density of artefact sites remain across the wider region. The project offers a potential design with minimal impacts to Aboriginal values if appropriate mitigation management measures are adhered too.	NA
Non-Aboriginal heritage	The project would not impact any known non-Aboriginal heritage sites. Potential cumulative impacts are likely to include the continued modification of the landscape within the project area. However cumulative impacts, such as vibration or interruption of current views or vistas, have been assessed as low.	NA
Social	The key cumulative impacts that may occur during construction are summarised below: – Competition for skilled labour during construction of projects, which could result in more roles being filled by non-residents, leading to increased demand for housing and accommodation in the region. – Increased traffic and changes in access to businesses, community facilities and residential areas in the potentially affected communities during construction which could increase disruptions and delays, particularly during construction of the pipeline alignment. – Combined amenity impacts (noise, vibration, air quality) during construction, particularly along Fernbank Creek Road, Hastings River Road, Oxley Highway and John Oxley Drive which may disturb day-to-day activities for nearby residents and community members which may affect their daily routines and quality of life. The cumulative impacts that may occur during operation are summarised below: – Operation of the two infrastructure schemes (Thrumster Wastewater Scheme and Cowarra Water Supply Scheme) is expected to indirectly support the region's economic growth as critical and enabling infrastructure which would support the region's population growth.	Addressed in Technical Report 4 - Social Impact Assessment.

Environmental Aspect	Cumulative impact potential	Cumulative assessment approach
	– Together, the two projects are also expected to support an overall healthier environment and waterways in Port Macquarie, supporting community values and aspirations, and community health and wellbeing.	
Biodiversity	The project would involve removal of vegetation to enable construction of the WWTP and associated infrastructure and pipelines. Negligible cumulative impacts identified.	NA
Traffic and transport	The project would generate traffic movements on the public road network which has the potential to result in cumulative traffic impacts through minor increases in traffic and access changes during construction.	Addressed in Technical Report 7 - Traffic and Transport Assessment.
Air quality	The project would generate dust which has the potential to result in cumulative impacts at identified sensitive receivers. Possibility for combined amenity impacts during construction.	Addressed in Technical Report 8 - Air Quality Assessment.
Soils and contamination	The potential for cumulative soil and contamination impacts would be negligible and contained within the project area with the implementation of mitigation and management measures.	NA
Waste and chemicals	Whilst the project would generate some waste streams that might require offsite disposal, such waste streams are likely to be minor and not create capacity issues at local waste management facilities.	NA
Noise and vibration	The project would generate construction noise which has the potential to result in cumulative impacts at sensitive receivers. Possibility for combined amenity impacts during construction.	Addressed in Technical Report 11 - Noise and Vibration Assessment.
Landscape and visual	Potential cumulative impacts of the project are expected to be minor. The WWTP is located in a reasonably isolated location surrounded by dense native bushland and exotic grassland areas.	NA
Hazard and risk	Hazards and risks have been assessment and management measures identified to ensure impacts are contained within the project site. Check.	NA
Land use and property	Negligible. The land use assessment identifies potential land use and properties and considers existing and potential future land use in the vicinity of the project.	NA
Coastal erosion	Negligible.	NA
Climate change	Negligible.	NA
Greenhouse gas	Negligible.	NA

24.3 Mitigation and management measures

Table 24-4 Cumulative impact management measures

Impact / Aspect	ID	Measure	Timing
General impact reduction	CL1	The mitigation measures presented in Appendix D will be implemented effectively to reduce the project's impact on the environment.	Pre-construction, construction, operation

25. Environmental management

This chapter summarises proposed environmental management framework that will be implemented during delivery of the project. Environmental management measures and plans have been recommended based on the project potential environmental impacts as identified in Chapter 7 to Chapter 24.

25.1 Overview

This chapter provides an overview of the strategic environmental management framework which would apply during all stages of development of the Thrumster Wastewater Supply Scheme (the project). It describes the overarching environmental management strategy and associated issue-specific environmental management subplans that would be developed and implemented to avoid, mitigate, and manage the potential environmental impacts associated with the construction and operation of the project.

25.2 Environmental management strategy

The environmental management strategy would be prepared in accordance with the mitigation measures and commitments detailed in this EIS and the subsequent SSI approval, if the project is granted development consent by the NSW Minister for Planning. It would also be prepared in accordance with any other statutory or licensing requirements that apply to the project at the time and be consistent with policies or standards in place at the time, such as Australian Standards (AS)/New Zealand Standards (NZS) 14001:2015 Environmental Management Systems.

The purpose of the environmental management strategy would be to ensure that environmental management measures outlined in the issue-specific environmental management plans are incorporated into a comprehensive framework to facilitate appropriate management throughout the life of the project. The environmental management strategy would include requirements to:

– Ensure that controls are properly implemented, regularly monitored, and audited to assess their effectiveness.
– Ensure processes for resourcing and implementing the environmental management strategy are developed to provide certainty of delivery.
– Demonstrate compliance with statutory, legislative and consent conditions.
– Minimise impacts on the community and the environment.
– Ensure timely and efficient response to environmental incidents and complaints.
– Monitor, review, and report on environmental impacts of construction, operation, and decommissioning and rehabilitation activities.

25.3 Issue-specific environmental management subplans

25.3.1 Requirements

The issue-specific environmental management subplans are to be developed and implemented as part of the environmental management strategy and would include various construction environmental management subplans, operational environmental management subplans. The issue-specific environmental management subplans would be living documents and would be reviewed and amended, as necessary, over the life of the project.

The issue-specific environmental management subplans would be prepared in accordance with the mitigation measures and commitments detailed in this EIS and the subsequent SSI approval, if development consent is granted the project is approved by the NSW Minister for Planning and Public Spaces. They would also be prepared in accordance with any other statutory or licensing requirements that apply to the project at the time.

In addition to the above requirements, the issue-specific environmental management subplans would be developed to be consistent with any other overarching plans, policies or standards in place at the time, such as:

– ISO 14001:2015 Environmental Management Systems
– NSW Environmental Management Plan Guideline (DPIE 2020)

The issue-specific environmental management subplans would also make reference to the relevant industry standard guidelines for specific issues and activities. For example, erosion and sedimentation would be managed in accordance with Soils and Construction: Managing Urban Stormwater Volume 1 (the 'Blue Book').

25.3.2 Content and structure

The content of the issue-specific environmental management subplans would follow the same basic structure, similar to that outlined in Table 25-1 and in accordance with the requirements listed in Section 25.3.1.

Table 25-1 Example content of issue-specific environmental management subplans

Chapter	Content
Introduction	– Purpose, scope and objectives of the plan – Identification of the conditions of consent to which the plan relates and where in the document these are addressed
Project description	– Project overview – Site location – Scope of works – Timing of activities
Community and stakeholder engagement	– How the community and other stakeholders will be informed about the project status and environmental performance – How complaints and enquiries will be managed
Environmental management framework	– Relationship to environmental management system – Environmental management structure and responsibilities – Legal and compliance requirements – Training and awareness – Environmental risk assessment – Hold points – Environmental management measures – Environmental monitoring program – Environmental inspections – Environmental control maps or plans – Environmental management documents – Compliance monitoring and reporting – Environmental auditing – Environmental incident and emergency planning, preparedness and response – Corrective and preventative actions – Review and revision

25.4 Work method statements/protocols

Work method statements/protocols would be developed for construction and operation for the project. These work method statements/protocols would contain instruction for contractors (during construction) and for employees (during operation) on how to implement the environmental management measures outlined in the issue-specific environmental management subplans. Each contractor would likely develop their own work method statements/protocols.

25.5 Mitigation measures

A summary of mitigation measures is provided in Appendix D (Summary of Mitigation Measures). These mitigation measures would be incorporated into the environmental management strategy and environmental management plans developed for the construction and operation for the project.

26. Project justification and conclusion

26.1 Justification for the project

The project is considered to be justified because it:

- Responds to a critical, recognised need and is consistent with several state and regional government plans, policy and guidelines concerning water security.
- Improve the reliability, redundancy and resilience of wastewater infrastructure across the Port Macquarie-Hastings LGA.
- Provides short and long-term benefits to the wider Port Macquarie-Hastings LGA.
- Would not result in significant, adverse environmental, social or economic impacts.
- Is consistent with the principles of ecologically sustainable development, the objects of the EP&A Act and is considered to be in the public interest.

26.1.1 Strategic justification

As discussed in Chapter 2 (Strategic context) the growth of Port Macquarie LGA would require the provision of a variety of utilities and services including community centres, schools and recreation facilities. Fundamental to all the development accompanying this projected growth is the need for a sewage treatment scheme. Council has been undertaking planning investigations to provide a new WWTP to the area for two decades, seeking to provide the optimal location for the wastewater treatment scheme with consideration to statutory, community, environmental, population growth and engineering design considerations.

The strategic context of the project is influenced by, and would meet the outcomes of, strategic plans and policies at the State, regional and local levels, particularly those relating to regional water security. The key strategic plans and polices are summarised below:

- **NSW State Infrastructure Strategy 2022-2042:** The project would improve the reliability, redundancy and resilience of water supply and sewerage infrastructure across the LGA. Recycled water for non-potable use is also presented as a significant opportunity to reduce the need for new supply, provide water for public green spaces, return water to river ecosystems, and reduce major capital investment needed for conventional sewerage expansion. This would be achieved by the establishment of a second RWTP at the Thrumster WWTP to continue the supply of recycled water to customers in Port Macquarie and ensure high quality recycled water for potential future industrial users.
- **NSW Water Strategy 2021:** The strategy states, ‘every person in NSW has a right to expect access to safe drinking water for use at home and water security in their communities to sustain job creating businesses and healthy natural environments’. A particular objective is to achieve ‘safe, secure and sustainable water supply and sewerage services, managed by local water utilities in an efficient and customer-focused manner’. The project provides infrastructure needed to achieve these priority areas, providing a more resilient water supply and sewage services.
- **NSW Government Regional Water Strategies 2020:** The NSW Government is taking action to improve the security, reliability, quality and resilience of the State’s water resources. The project is located under the North Coast Regional Water Strategy 2022. Under the strategy, the project would deliver the objectives of the Town Water Risk Reduction Program which include identifying long-term solutions to challenges and risks to providing water supply and sewage in regional towns in collaboration with local councils. Moreover, the strategy also recognises the need to support local councils and water users to manage risks, particularly for sewage discharges and sewer overflows that pose risks to water quality, water security and the environment. The project would facilitate these objectives for the Port Macquarie LGA by easing capacity constraints on the existing Port Macquarie WWTP and deliver secure infrastructure that will meet future demands.
- **North Coast Regional Plan 2041:** The provision of a secure water supply system is closely linked to the ability to plan to meet the needs of projected population growth within the region. The project would aim to provide infrastructure to improve water supply and support the predicted population growth across Port Macquarie-Hastings LGA.

The project is considered to be strategically justified because it:

– Responds to a critical, recognised need and is consistent with several state and regional government plans, policy and guidelines concerning water security.
– Improves the reliability, redundancy and resilience of wastewater infrastructure across the Port Macquarie-Hastings LGA.
– Provides short and long-term benefits to the wider Port Macquarie-Hastings LGA.
– Would not result in significant, adverse environmental, social or economic impacts.
– Is consistent with the principles of ecologically sustainable development, the objects of the EP&A Act and is considered to be in the public interest.

26.1.2 Objects of the EP&A Act

The project consistency or otherwise with the object of the EP&A is summarised in Table 26-.

Table 26-1 Objects of the EP&A Act

Object	Comment
(a). To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The project has considered impacts to the community and social and economic impacts of the project have been assessed in Chapter 10 and Technical Report 4 – Social Impact Assessment. The project has been designed to minimise impacts on the environment where possible including the need for land acquisition. The project has also minimised impacts on existing development and local communities during the construction of the pipelines by implementing HDD construction methods in some sections. This resulted in reducing surface disturbance and disruption. As discussed in Chapter 2 (Strategic context), the selection of the preferred route and WWTP location aimed to best meet the project objectives, having regard to avoiding and minimising the impacts on the environment. During construction and operation of the project, opportunities would be taken to reduce material use and maximise the use of materials with low embodied environmental impact, where practical. Overall, the operation of the project would deliver a reliable wastewater treatment system for the Port Macquarie-Hastings LGA addressing the future demand from predicted population growth. Mitigation measures (refer to Appendix D (Summary of mitigation measures)) would seek to further avoid and minimise environmental, social and economic impacts of the project where possible.
(b). To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The principles of ecologically sustainable development have been considered in the planning and development of the project. As described in Section 26.1.2 the project is consistent with the principles of ecologically sustainable development.
(c). To promote the orderly and economic use and development of land,	The project would promote the orderly and economic use and development of land by supporting the economic growth of Port Macquarie as outlined in the North Coast Regional Plan 2041. The project promotes long term economic benefits and improves the reliability, redundancy and resilience of wastewater infrastructure across the Port Macquarie-Hastings LGA.
(d). To promote the delivery and maintenance of affordable house,	The project would support and facilitate the delivery and maintenance of affordable housing.
(e). To protect the environment, including the conservation of threatened and other species of native animals, plants, ecological communities and their habitats,	The project option selection process considered a range of constraints to avoid and/or minimise the impacts on the environment (refer to Chapter 2 (Strategic context) with a particular focus on the avoidance or impact minimisation of important biodiversity values.

Object	Comment
	The project impact on biodiversity have been assessed in Chapter 11 (Biodiversity) and Technical Report 5 – Biodiversity Development Assessment Report in accordance with the Biodiversity Assessment Method. The assessment found that while the project has been refined to avoid and minimise impacts to biodiversity values where practicable, direct impacts are expected to native plant community types and threatened species and their habitats identified under the BC Act and EPBC Act. These impacts would primarily be attributed to the removal of vegetation and threatened ecological communities within the project footprint. The project is unlikely to have a significant residual impact on any EPBC Act listed fauna or flora species or communities. Residual impacts to native vegetation would require retirement of 105 ecosystem credits and 895 species credits in accordance with the Biodiversity Offsets Scheme. Mitigation measures have been identified any potential impacts and would be implemented to address the residual impacts of the project on biodiversity. During finalisation of the project design, opportunities to further avoid or minimise impacts would be investigated.
(f). To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The potential impacts on Aboriginal and historic heritage have been assessed in Chapter 8 (Aboriginal heritage) and Chapter 9 (non-Aboriginal heritage), and the corresponding Technical Report 2 – Aboriginal Cultural Heritage Assessment and Technical Report 3 – Historic Heritage Assessment. The project has been designed to avoid impacts on heritage items where possible. There would be no direct impacts to any listed historical heritage items. The Aboriginal Cultural Heritage Assessment was carried out in accordance with the *Code of Practice* (DECCW, 2010) and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011). It included consultation with RAPs in accordance with the Consultation Requirements (DECCW, 2010). An assessment of the potential impact of the project and associated ground disturbance indicates that two Aboriginal cultural heritage sites are located within the project area. Due to previous salvage, one site is no longer valid. The remaining site is partially located in the project area, assessed to have low to moderate significance. A proposed test excavation program has been included as part of the Aboriginal Cultural Heritage Assessment in order gain a clearer understanding of the deposit's nature.
(g.) To promote good design and amenity of the built environment,	The potential visual amenity impacts have been summarised in Chapter 20 (Landscape character and visual amenity) and in detail in Technical Report 13 – Landscape Character and Visual Impact Assessment. There would be impacts on the amenity of the built environment as a result of construction and/or operational impacts, including noise, air (dust) and visual amenity. These impacts would be minimised through the mitigation measures summarised in Appendix D (Summary of mitigation measures). All permanent infrastructure would be designed and operated in accordance with appropriate Australian standards and guidelines.
(h). To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The construction of the project, including associated buildings for operational ancillary infrastructure, would be completed in line with the applicable Australian and international safety standards and guidelines.
(i). To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	The responsibility for environmental planning and approval in relation to the project rests primarily with the NSW Government. No formal approval role is required by local government however, there has been ongoing consultation with both local and State government representatives throughout the project planning and environmental assessment process (refer to Chapter 5 (Community and stakeholder consultation) and Appendix C).

Object	Comment
(j). To provide increased opportunity for community participation in environmental planning and assessment.	Consultation with the community and relevant government agencies was undertaken during the preparation of the EIS. Consultation will be ongoing during the project (refer to Chapter 5 (Community and stakeholder consultation) and Appendix C).

26.1.3 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological process. ESD requires the effective integration of economic and environmental consideration in decision making process. The four principles of ESD, as stated in Section 193 of the EP&A Regulation, include:

– The precautionary principle – Where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
– Inter-generational equity – The present generation should ensure that the health, diversity, and productivity of the environment are maintained or enhanced for the benefit of future generations.
– Conservation of biological diversity and ecological integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.
– Improved valuation, pricing, and incentive mechanisms – Includes the recognition of the principles that the costs of environmental externalities should be internalised, and that the polluter should bear the costs associated with environmental pollution.

26.1.3.1 The precautionary principle

The principle states that:

"If there are threats of serious of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to preventing environmental degradation. In apply the precautionary principle, public and private decisions should be guided by:

a. Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

b. An assessment of the risk-weight consequences of various options."

The WWTP site has been selected in order to avoid significant fauna concerns associated with the surrounding wetlands, within an isolated cleared area that provides opportunity for future site expansion.

Several investigations since the early 2000s have informed the potential site location and analysis of both the project requirements and environmental constraints have been heavily assessed. Desktop and field investigations have been undertaken to ensure that the potential environmental, social, and economic impacts of the project are understood with a high degree of certainty. The assessments undertaken have adopted accepted scientific methodologies and have taken into account relevant statutory and government agency plans, policies, and guidelines.

The project has been designed to avoid environmental impacts, where possible, and to reflect the findings of the specialist studies undertaken. Mitigation and management measures have been proposed to minimise environmental, social, and economic impacts. None of the potential impacts are considered likely to result in serious or irreversible environmental impacts if the recommended mitigation and management measures are implemented effectively.

26.1.3.2 Intergenerational equity

The principle states that:

"The present generation should ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations."

The project would deliver inter-generational equity by providing the means to renew sewerage infrastructure for current and forecasted growth in the area, and increase the resilience of sewer services and recycled water demands by ensuring it is fit for purpose to serve the community well into the future. Thus, ensuring the health, diversity and productivity of the environment is maintained for the benefit of future generations. The project would deliver a secure sewerage infrastructure for Port Macquarie-Hastings consumers.

During construction of the project, opportunities would be taken to reduce resource and material use and maximise the use of materials with low embodied environmental impact, where feasible. Initiatives to deliver benefits to local communities, including employment opportunities, have also been identified.

The project has the potential to lead to some environmental risks during operation. However, implementation of the precautions and protocols included in the mitigation measures would help reduce the likelihood of a significant impact that would diminish the health, diversity, or productivity of the environment for present or future generations.

26.1.3.3 Conservation of biological diversity and ecological integrity

The principle states that:

"The conservation of biological diversity should be a fundamental consideration."

The development of the project has been carried out with the aim of identifying, avoiding, minimising and mitigating impacts on biological diversity and ecological integrity in accordance with relevant legislation. This includes field investigations and assessment, which have informed the concept design and project footprint to avoid and minimise impacts. Where potential impacts cannot be avoided, mitigation measures would be implemented to reduce the impact as far as possible.

26.1.3.4 Improved valuation, pricing and incentive mechanisms

The principle states that:

"environmental factors should be included in the valuation of assets and services, such as—

a. Polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and

b. the users of goods and services should pay prices based on the full life cycle of the costs of providing the goods and services, including the use of natural resources and assets and the ultimate disposal of waste, and

established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems."

The environmental impact assessment has identified the potential environmental, social, and economic impacts of the project and identified mitigation and management measures, where appropriate, to manage potential impacts. If approved, the project would be undertaken in accordance with these mitigation and management measures. These requirements would result in an economic cost to the proponent, indicating that environmental resources have been given appropriate valuation in the development of the project.

The project has been designed with an objective of minimising potential impacts on the surrounding environment. This indicates that the project has been developed with consideration of environmental outcomes.

26.1.4 Project benefits

The project would deliver the following benefits:

– Improve the quality of treated wastewater and minimise public health and environmental risks associated with using and disposing of treated wastewater.
– Provide a secure and reliable sewage treatment system to service the predicted population growth.
– Avoid excessive loading of the existing Port Macquarie wastewater treatment plant beyond its design capacity.

– Provide redundancy for sewerage treatment assets across Port Macquarie.
– Provide recycled water for reuse scheme across Thrumster.
– Promote Council as a regional leader through the project delivery and improve the standard of community and environmental outcomes in areas including:
    - Network odour and loss of containment events in the sewerage network impacting the community.
    - Energy efficiency and power costs associated with sewer network and treatment.
    - Providing high quality recycled water for third pipe scheme including potential future industrial users.
    - Biosolids resource recovery processes and sludge handling at Thrumster Wastewater Treatment Plant will be designed for Council to manage biosolids stabilisation offsite as part of Council's broader organics recycling strategy.

26.1.5 Biophysical, social and economic impacts

The environmental impacts of the project have been assessed, including a thorough analysis of the key biophysical, social and economic impacts. Chapters 7 through 23 provide a summary of environmental assessments undertaken for the project including appropriate measures to avoid and/or minimise impacts. The following sections provide a summary of the biophysical, economic and social impacts during the construction and operation of the project.

Key biophysical impacts

The key potential impacts on the biophysical environment during construction would primarily relate to biodiversity. Design refinements have occurred to avoid and minimise impacts to biodiversity where possible, however based on the disturbance area, this would likely include direct impacts on 3.43 ha of native vegetation having a Vegetation Integrity Score of >15, representing a considerable utilisation of low vegetation integrity areas by the project. Threatened flora and fauna were recorded within the project area, and assumed present in accordance with the BAM are identified in Chapter 11.

Proposed management measures would aim to avoid and minimise impacts on biodiversity. However, there would be some residual impacts that could not be further mitigated. Residual impacts to native vegetation will require retirement of 105 ecosystem credits and 895 species credits in accordance with the Biodiversity Offsets Scheme.

Other impacts on the biophysical environment including, flooding, soil, air quality and odour, noise and vibration, and water quality (including surface water and groundwater), would be temporary, short term, limited in extent, and manageable through standard and proven construction management and mitigation measures.

The key potential impacts on the biophysical environment during operation would primarily relate to water quality and aquatic ecology due to the treated effluent discharge at Kooloonbung Creek. The expected changes to water quality in Kooloonbung Creek due to the introduced Thrumster WWTP discharge are generally minor relative to the influence of the Port Macquarie WWTP under existing and projected future discharge rates. This is because of the advanced treatment at the Thrumster WWTP relative to the existing Port Macquarie WWTP and the predicted increase to tidal lushing with sea level rise over the design horizon. However, some adverse impacts are predicted to occur for parameters such as nutrients and salinity. The results also indicate the potential for improvements (i.e. reductions) in Chlorophyll-a and Enterococci counts, however there is the potential for localised cumulative increases in algal biomass due to the higher nutrient loading.

Limited impacts to the Hastings River estuary are predicted as a result of the additional flows from the Thrumster WWTP. There is potential for localised increases in nitrogen and phosphorus concentrations in the vicinity of the confluence with Kooloonbung Creek but present a low risk of impact in terms of additional algal growth or increases in pathogens.

Ways to further reduce and minimise unavoidable potential impacts on the environment have also been considered. Mitigation and management measures to minimise any outstanding impacts are identified in this document. These measures, and the proposed approach to environmental management during construction and operation, are provided in Chapter 25 (Environmental management).

Key social and economic impacts

Construction of the project is expected to contribute approximately $134 Million to the regional economy through capital expenditure. There would be opportunities for local businesses to supply goods and services to the primary construction contractor during construction of the project.

There would also be an estimated 60 to 100 FTE roles required to construct the project. These roles would include trade and construction personnel, subcontracted construction personnel and engineering, and function and administrative staff. Minimal indirect jobs may also be generated through the construction supply chain. Construction would lead to increased job and income generation opportunities available to regional residents during the two-year construction period. There is potential for some food and beverage and retail businesses located in close proximity to construction activities to benefit from incidental spending of construction worker wages on meals. This is expected to be a temporary, minimal benefit for some local businesses. The key social impacts with the potential to occur during construction are summarised as follows:

– Temporary disruptions and inconveniences for some nearby residents, birdwatchers, schools, community facilities, businesses and users of recreation areas due to changes in access and connectivity including detours, increased construction traffic and both temporary loss of parking in some precincts.
– Reduced amenity including noise, vibration, dust and visual impacts in some urban areas which are located close to construction activities and haulage routes, with some residents affected by several combined impacts during construction, including amenity changes, property impacts and access changes. Potential concerns for some facilities close to construction activities which cater to vulnerable groups (e.g. aged care facilities).
– Temporary reduction in access to and enjoyment of some community and recreation facilities directly affected by land requirements and construction activities, particularly birdwatchers near WWTP site, traffic delays on Hastings River Drive and residents located on Fernbank Creek Road.

Operation of the project is expected to support overall health and wellbeing of Port Macquarie communities, both existing and future by treating wastewater for the community. Operation of the project would require three to four full time equivalent employees to manage the onsite operations at the WWTP. These positions would be a long-term benefit for these individuals but is not expected to be a benefit experienced by the broader community.

26.2 Project uncertainties and approach to design refinements

The infrastructure approval application seeks approval for Stage 1 of the Thrumster Wastewater Scheme including a WWTP with a design capacity of 40,000 EP with a design flow of 9.2 ML/day. The WWTP is expected to be commissioned in 2027 and will reach the design horizon of 40,000 EP by around 2039 or later based on future growth projections.

This EIS is based on a concept design (Beca HunterH20, 2024) for the project. It is noted that during subsequent design stages that details of the project may change or be refined. To achieve a level of flexibility without compromising the level of impact assessment, the general approach adopted in this EIS has been to assess a ‘realistic worst case’ impact for particular project elements and construction methodologies where there is reasonable potential for design refinements to occur.

The Stage 1 design horizon is based upon flows transferred from the existing Port Macquarie WWTP sewerage catchment and the predicted development in the outer suburbs of Port Macquarie. The flow projections incorporate a conservative allowance for flows from industrial and warehouse facilities. It is noted that the design horizon and operational life for Stage 1 of the scheme may extend beyond 2039 if residential and non-residential flows are lower than assumed in growth projections delaying the need for the planned future expansion of the plant.

The project footprint has been adopted in the EIS as a conservative area that has the potential to be directly affected by the construction and operation of the project. The project footprint has been developed to achieve a level of flexibility for future design refinements that allows for further avoidance and minimisation of impacts while allowing for a rigours level of impact assessment to be carried.

The detailed design process would be carried out by the construction contractors and informed by the assessment completed for the project as well as government, landowner, community and/or other stakeholder feedback received on the project. During this stage, the mitigation and management measures identified in this EIS relevant to the detailed design would be implemented to enable the avoidance and minimisation of potential environmental impacts.

If any refinements, post approval, are not consistent with the approval issued by the NSW Minister for Planning and Public Spaces, and constitute a modification, an approval would be sought from the Minister for any such modifications in accordance with the requirements of Part 5 Division 5.2 of the EP&A.

26.3 Conclusion

The project comprises the construction and operation of a new WWTP, associated pipelines and infrastructure at Port Macquarie on the NSW Mid North Coast. The project has been declared as a SSI and is a priority project for Council to ensure communities have access to necessary resources in a safe and reliable manner.

The project would include:

– New WWTP, including a recycled water plant within Lot 14, DP 1139180 on 433 Fernbank Creek Road, about six kilometres west of Port Macquarie Central Business District.
– Return treated effluent pipeline to Kooloonbung Creek.
– Main access road to the WWTP and a flood-proof, all-weather access road.
– New sewer pump stations, sewer rising mains, recycled water mains and a potable water connection.
– Upgrade works at identified existing sewer pump stations (SPSs) to reduce the current load on the existing system.
– Improvements to site access, optic fibre and electricity supply.

The project is required to respond to the population growth within the Port Macquarie-Hastings LGA. The predicted population growth will result in significant pressure on the existing wastewater infrastructure and utilities . The project will increase wastewater security for Port Macquarie-Hastings LGA addressing future demand issues, whilst support economic growth by providing the essential resources for key areas of urban development. The project is intended to deliver a WWTP and recycled water supply to existing and proposed residences of Thrumster, Sancrox and Fernbank Creek areas of Port Macquarie. The project would support the growth of urban and industrial areas in these suburbs. This project will provide the required redundancy for Council's sewage treatment and reticulation network.

A project of this scale and geographical spread would inevitably have some potential impacts on the local environment and community, during construction and operation of wastewater infrastructure. As described in the EIS, the project would incorporate environmental management and design features to ensure the potential impacts are managed and mitigated as far as practically possible. The majority of the potential construction related impacts would be effectively mitigated by the implementation of best practice construction management, including the implementation of the environmental management approaches described in Chapter 25 (Environmental management) and the mitigation measures compiled in Appendix D.

Construction and operation of the project would provide positive economic activity to the regional and NSW economy. It is expected that the project will contribute approximately $134 Million to the regional economy through capital expenditure.

The project is consistent with the principles of ecologically sustainable development identified in the EP&A Regulation.

The project has been developed following a robust and iterative process that has involved substantial options analysis, design, environmental assessment, and stakeholder engagement. Where feasible and reasonable, the project has aimed to avoid and minimise biophysical, social and economic impacts. At this stage of assessment, a conservative worst-case assessment approach has been implemented. The potential residual construction and operational impacts of the project are considered manageable with the implementation of the proposed mitigation and management measures.

Overall, the project is a critical component in delivering reliable wastewater infrastructure to Port Macquarie-Hastings LGA and supporting the economic growth by providing the essential resources for key areas of urban development. Having regard to all of the matters considered in this EIS, it is considered that the project is justified, as the need for, and the benefits of the project would outweigh the residual impacts.

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Appendices

Appendix A

Secretary's Environmental Assessment Requirements

Table A.1 summaries the SEARs requirements and what section in the EIS they have been addressed.

Table A.1 SEARs requirement

Legislation	SEARs requirement	Where addressed in the EIS
General requirements	The Environmental Impact Statement (EIS) must meet the minimum form and content requirements as prescribed by Part 8 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) and must have regard to the State Significant Infrastructure Guidelines.	Appendix A (Secretary's Environmental Assessment Requirements) Appendix B (Statutory Compliance)
	The EIS must include, but not necessarily be limited to, the following: – An executive summary.	Executive Summary
	– A full description of the Thrumster Water Supply Scheme (the project), including: • The design for the project that is proposed to be constructed and operated, the strategic objectives of the proposal, the size and type of the operation, the nature of treatment processes and the products, by-products and wastes produced.	Chapter 2 (Strategic context) Chapter 3 (Project description)
	– Details of all components, disturbance areas, materials, activities, site preparation and construction infrastructure required to construct the project, including any ancillary development that may require separate approvals.	Chapter 3 (Project description)
	– A construction timetable and staging; hours of construction, proposed construction methods, including any earthworks or site clearing, reuse and disposal of cleared material.	Chapter 3 (Project description)
	– Details of the operation of the project, and associated infrastructure that is proposed to be constructed.	Chapter 3 (Project description)
	– Likely staging or sequencing of the project, including construction, operation, maintenance, and any plans for future expansion.	Chapter 3 (Project description)
	– Site plans, maps, drawings and diagrams at an adequate scale with dimensions in an electronic format that enables integration with mapping and other technical software, showing: • The location and dimensions of all project components. Include a site diagram showing the site layout and location of environmental controls and proximity to water resources. • Existing infrastructure, land use and environmental features. • The development corridor that has been assessed and consideration of design options.	Chapter 3 (Project description)
	The likely interactions between the project and any other existing, approved, proposed, reasonably foreseeable development in the vicinity of the site, including an assessment of cumulative impacts on the environment	Chapter 3 (Project description) Chapter 24 (Cumulative impacts)
	A summary of the strategic need with regard to its State Significance and relevant State Government policy.	Chapter 2 (Strategic context)
	A description of how alternatives to and options within the project were analysed and optimised to inform the selection of the preferred alternative/option. The description must contain sufficient detail to enable an understanding of why the preferred alternative was selected over other options(s) considered for achieving the project strategic objective, including consideration of environmental outcomes.	Chapter 2 (Strategic context)
	An assessment of the likely impacts of the project on the biophysical and socio-economic environment, focusing on the specific issues identified below and any other significant issues identified, including: – description of the existing environment likely to be affected by the project using relevant and adequate data.	Chapter 7 – 25 Technical Report 1 – 19

Legislation	SEARs requirement	Where addressed in the EIS
	– An assessment of the potential impacts of the project, including any cumulative impacts, and taking into consideration relevant guidelines, policies, plans and industry codes of practice.	Chapter 7 – 25 Technical Report 1 – 19
	– A description and details of how the project has been designed to avoid, minimise and offset impacts (through design, or construction or operation methodologies).	Chapter 3 (Project description) Chapter 7 – 25 Technical Report 1 – 19
	– A description of how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Chapter 6 (Approach to impact assessment)
	– Assessment must be in consultation with relevant agencies and in accordance with agency advice.	Chapter 5 (Community and stakeholder consultation) Appendix C (Community Engagement Table)
	A chapter that synthesis the environment the environmental impact assessment and provides: – A succinct but complete description of the project for which approval is sought.	Chapter 3 (Project description)
	– A description of any uncertainties that still exist around design, construction and/or operational methodologies and how these will be resolved in the next stages of the project.	Chapter 26 (Project justification and conclusion)
	– A compilation of the impacts of the project that have not been avoided.	Appendix D (Summary of Mitigation Measures)
	– A compilation of the proposed measures associated with each impact to avoid or minimise or offset these impacts.	Appendix D (Summary of Mitigation Measures)
	– A compilation of the outcome(s) the proponent will achieve.	Chapter 2 (Strategic context)
	– The reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts.	Chapter 25 (Cumulative impacts) Chapter 26 (Project justification and conclusion)
	– A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS, including the anticipated level of performance in meeting required environmental standards and cleaner production principles.	Chapter 25 (Environmental management) Appendix D (Summary of Mitigation Measures)
	Notwithstanding the key issues specified below, the EIS must include an environmental risk assessment to identify the potential environmental impacts associated with the infrastructure. Where relevant, the assessment of key issues below, and any other significant issues identified in the risk assessment, must include: – Adequate baseline data – Consideration of the potential cumulative impacts due to other developments in the vicinity (completed, underway or proposed) – Measures to avoid, minimise and if necessary, offset predicted impacts, including detailed contingency plans for managing any significant risks to the environment, and – A health impact assessment of local and regional impacts associated with the development, including those health risks associated with relevant key issues.	Chapter 7 – 25 Technical Report 12 – Health Impact Assessment
	The EIS must be accompanied by a declaration from a Registered Environmental Assessment Practitioner (REAP) in accordance with the *Registered Environmental Assessment Practitioner Guidelines 2022.*	Page i

Legislation	SEARs requirement	Where addressed in the EIS
	The EIS must also be accompanied by a Quantity Surveyor Report for Capital Investment Value and Employment, providing: – A detailed calculation of the estimated capital investment value (CIV) of the development, prepared by a AIQS Certified Quantity Surveyor or RICS Chartered Quantity Surveyor in accordance with *Planning Circular PS 21-020: Calculation of capital investment value*. The calculation of the estimated CIV is to be accurate at the date of application and include details of all components and assumptions from which it is derived. – an estimate of the retained and new jobs that would be created during the construction and operational phases, including details of the methodology to determine the figures provided.	Section 3.1.3
Key issues	– Statutory and Strategic Context. – Include consideration of how the project meets the provisions of the Environmental Planning and Assessment Act 1979 (the EP&A Act) and the EP&A Regulation and a list of any approvals that must be obtained under any other Act or law before the project may lawfully be carried out.	Chapter 2 (Strategic context) Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	– Address the statutory provisions applying to the development contained in all relevant environmental planning instruments, including: • State Environmental Planning Policy (Planning Systems) 2021.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	• State Environmental Planning Policy (Transport and Infrastructure) 2021.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	• State Environmental Planning Policy (Primary Production) 2021.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	• State Environmental Planning Policy (Biodiversity and Conservation) 2021.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	• State Environmental Planning Policy (Resilience and Hazards) 2021.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	• Any other relevant State Environmental Planning Policies (SEPPs), Regional Planning Policies (REPs) Local Environmental Plans (LEPs), or draft SEPPs', REPs' and LEPs'.	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
	– Address the relevant planning provisions, goals and strategic planning objectives including but not limited to the following (or relevant draft documents that may supersede or supplement these): • NSW State Plan: NSW 2021	Chapter 2 (Strategic context)
	• North Coast Regional Plan 2041	Chapter 2 (Strategic context)
	• Port Macquarie-Hastings Local Environmental Plan 2011	Chapter 2 (Strategic context)
	– Relevant Port Macquire-Hastings Council policies plans and strategies such as: • Community Strategic Plan	Chapter 2 (Strategic context)
	• Urban Growth Management Strategy	Chapter 2 (Strategic context)
	• Local Strategic Planning Statement	Chapter 2 (Strategic context)
	• Delivery Program and Operational Plan.	Chapter 2 (Strategic context)

Legislation	SEARs requirement	Where addressed in the EIS
	– Identify all approvals and licences required under environmental protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land and water).	Chapter 4 (Statutory context) Appendix B (Statutory Compliance)
Water	– Describe the background conditions for any water resource likely to be affected by the project, including: • Existing surface and groundwater across all sites, including hydrological and geomorphological conditions.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Water quality and Water Quality Objectives (as endorsed by the NSW Government) including groundwater, that represent the community's uses and values for the receiving waters accordance with the ANZECC Guidelines for Fresh and Marine Water Quality 2000 and/or local objectives, criteria or targets endorsed by the NSW Government.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and economic perspective.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Assess the impacts of the project on receiving water bodies, including: • The nature and degree of impact on receiving waters for both surface and groundwater sources, (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, groundwater dependent ecosystems, and ground water levels.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Identification of proposed monitoring of water quality.	Technical Report 1 – Water Resources
	• Demonstrate how the project protects the Water Quality Objectives and River Flow Objectives where they are currently being achieved and contributes towards achievement of the Water Quality Objectives and River Flow Objectives over time where they are currently not being achieved.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Indicate the potential impacts to water quality and adjacent Priority Oyster Aquaculture Areas associated with the operation of the scheme and what measures will be implemented to ensure that water quality is not negatively impacted by the scheme and that water quality will comply with the water quality objectives and guidance set out within the NSW Oyster Industry Sustainable Aquaculture Strategy 2021 and the NSW Healthy Estuaries for Healthy Oysters Guidelines 2017.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Details of potential effluent reuse and impacts.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Description of water treatment measures.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Identification of mitigation and management measures. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management both during and after construction.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources

Legislation	SEARs requirement	Where addressed in the EIS
	– Assess the impact of the development on hydrology, including: • Water balance including quantity, quality and source.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	• Volume, frequency and quality at proposed intake and discharge locations.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Effects to downstream rivers, wetlands, estuaries, marine waters, groundwater and floodplain areas.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Effects to water-dependent fauna and flora including groundwater dependent ecosystems.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Impacts to natural processes and functions within rivers, wetlands, estuaries, coastal areas and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Site drainage details and runoff yield, including mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Identify potential geomorphological impacts to landforms and/or aquatic areas the extent of project influence.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Identification of proposed monitoring of hydrological attributes, and mitigation or management measures.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Include mapping of the project's interaction with: • Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Groundwater.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Groundwater dependent ecosystems.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources

Legislation	SEARs requirement	Where addressed in the EIS
	• Proposed intake and discharge locations.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
Water take and licensing	– Description of all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Details of all water take for the operational life of the project and post closure, where applicable. This is to include water taken directly and indirectly, and the relevant water source where water entitlements are required to account for the water take. If the water is to be taken from an alternative source confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Details of Water Access Licences (WALs) held, to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth where water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the Water Management Act 2000 should be detailed by the proponent.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
Flooding	– Identify flood risk (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the Floodplain Development Manual 2005, including the potential effects of climate change and an increase in rainfall intensity. If there is a material flood risk, include design and stormwater management solutions for mitigation, including for any risk to the community.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Map the following features relevant to flooding as described in the Floodplain Development Manual 2005 including: • Flood prone land	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Flood planning area, the area below the flood planning level.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Hydraulic categorisation (floodways and flood storage areas).	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Flood hazard.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Assess the impacts of the project on flood behaviour, including: • Whether there will be detrimental increases in the potential flood affectation of other properties, assets, and infrastructure.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Consistency with Council floodplain risk management plans.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources

Legislation	SEARs requirement	Where addressed in the EIS
	• Consistency with any Rural Floodplain Management Plans.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Compatibility with the flood hazard of the land.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Any impacts the project may have upon existing community emergency management arrangements for flooding. This should be undertaken in consultation with the NSW State Emergency Service (SES).	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Whether the project incorporates specific measures to manage risk to life from flood. This should be undertaken in consultation with the NSW SES.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Emergency management, evacuation and access, and contingency measures for the project considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). This should be undertaken, and have the support of, the NSW SES.	Technical Report 1 – Water Resources
	• Any impacts the project may have on the social and economic costs to the community as consequence of flooding.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Develop an appropriate business emergency plan to assist in being prepared for, responding to and recovering from flooding.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	– Model the effect of the project on the current flood behaviour for a range of design events as identified in 16 below and including the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	– Describe flood assessment and modelling undertaken in determining the project's design flood levels for a range of flood events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment

Legislation	SEARs requirement	Where addressed in the EIS
	– Modelling in the EIS must consider and document: • Any existing flood studies in the area and examine consistency to the flood behaviour documented in these studies.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	• The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	• Impacts of the project on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	• Relevant provisions of the *NSW Floodplain Development Manual 2005.*	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resource and Quality Assessment
	• Impacts of climate change for the project design life at 20-year intervals.	
Aboriginal Cultural Heritage	– Provide an Aboriginal Cultural Heritage Assessment Report (ACHAR), prepared in accordance with relevant guidelines and requirements, identifying, describing and assessing any impacts to Aboriginal cultural heritage sites or values associated with the site.	Chapter 8 (Aboriginal heritage) Technical Report 2 – Aboriginal Cultural Heritage Assessment
	– In the event of unexpected finds, notification is required under s89A of the National Parks and Wildlife Act 1974. In this scenario, work must cease in the affected area(s). Additional assessment and approval may be required under the relevant legislation prior to works continuing in the affected area(s) based on the nature of the discovery.	Chapter 8 (Aboriginal heritage) Technical Report 2 – Aboriginal Cultural Heritage Assessment
Non-Aboriginal Heritage	– If applicable, provide a Statement of Heritage Impact (SOHI) prepared by a suitably qualified heritage consultant in accordance with the guidelines in the NSW Heritage Manual. The SOHI is to address the impacts of the proposal on the heritage significance of the site pipeline alignments and adjacent areas. • If the SOHI identifies impact on potential historical and/or maritime archaeology, an historical and/or maritime archaeological assessment should be prepared by a suitably qualified archaeologist in accordance with the guidelines *Archaeological Assessment (1996)* and *Assessing Significance for Historical Archaeological Sites and Relics (2009).* • In the event of unexpected finds, notification is required under s146 of the *Heritage Act 1977*. In this scenario, work must cease in the affected area(s). Additional assessment and approval may be required under the relevant legislation prior to works continuing in the affected area(s) based on the nature of the discovery. • If a SOHI is not required, an explanation of why the SOHI is not required must be provided in the EIS and should include correspondence with HeritageNSW.	Chapter 9 (Non-Aboriginal heritage) Technical Report 3 – Historical Heritage Assessment
Social	– Provide a Social Impact Assessment prepared in accordance with the Social Impact Assessment Guideline for State Significant Projects 2021.	Chapter 10 (Social) Technical Report 4 – Social Impact Assessment

Legislation	SEARs requirement	Where addressed in the EIS
Ecologically Sustainable Development	– Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the project.	Chapter 26 (Project justification and conclusion)
	– Demonstrate how the project: • Will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	Technical Report 16 – Ecologically Sustainable Development Assessment
	• Minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	Technical Report 18 – Greenhouse Gas Assessment
	– Provide an environmental mass balance for the project and any life-cycle strategies, developed in consultation with the NSW Environment Protection Authority (NSW EPA).	Technical Report 16 – Ecologically Sustainable Development Assessment
	– Climate modelling is to be on accordance with NSW and ACT Government Regional Climate Modelling (NARCLiM) version 1.5 or later, as determined in consultation with the relevant agency.	Technical Report 17 – Climate Risk Assessment
	– Demonstrate that the project incorporates objectives and mechanisms for achieving ESD, including: • An assessment of a range of options available for use of the resource, including the benefits of each option to future generations.	Technical Report 16 – Ecologically Sustainable Development Assessment
	• Proper valuation and pricing of environmental resources.	Technical Report 16 – Ecologically Sustainable Development Assessment
	• Identification of who will bear the environmental costs of the proposal.	Technical Report 16 – Ecologically Sustainable Development Assessment
Biodiversity	– The EIS must assess biodiversity impacts related to the project in accordance with Section 7.9 of *the Biodiversity Conservation Act 2017* using the Biodiversity Assessment Method (BAM) and must document this assessment in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and the BAM, unless the Biodiversity and Conservation Division and Planning and Assessment Group determine that the project is not likely to have any significant impacts on biodiversity values.	Chapter 11 (153Terrestrial biodiversity) Technical Report 5 – Biodiversity Development Assessment Report
	– The BDAR must document the application of the avoid, minimise, and offset framework including assessing all direct, indirect, and prescribed impacts in accordance with the BAM.	Technical Report 5 – Biodiversity Development Assessment Report
	– The BDAR must include details of the measures proposed to address the offset obligation as follows: • The total number and classes of biodiversity credits required to be retired for the project.	Technical Report 5 – Biodiversity Development Assessment Report
	• The number and classes of like-for-like biodiversity credits proposed to be retired.	Technical Report 5 – Biodiversity Development Assessment Report
	• The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.	Technical Report 5 – Biodiversity Development Assessment Report
	• Any proposal to fund a biodiversity conservation action.	Technical Report 5 – Biodiversity Development Assessment Report

Legislation	SEARs requirement	Where addressed in the EIS
	• Any proposal to conduct ecological rehabilitation.	Technical Report 5 – Biodiversity Development Assessment Report
	• Any proposal to make a payment to the Biodiversity Conservation Fund.	Technical Report 5 – Biodiversity Development Assessment Report
	– If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	Technical Report 5 – Biodiversity Development Assessment Report
	– The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM.	Technical Report 5 – Biodiversity Development Assessment Report
	– The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016.	Technical Report 5 – Biodiversity Development Assessment Report
	– The EIS should identify the existing hydrological functioning of coastal wetlands mapped by the State Environmental Planning Policy (Resilience and Hazards) 2021 (SEPP) in the vicinity of the proposal, and address the range of potential impacts including, construction impacts, changes to hydrology, any vegetation removal required for the construction and/or maintenance of access tracks, flooding, activation of acid sulfate soils and the potential for effluent to be discharged into any of the mapped wetlands due to the failure of the sewer network. In particular, the EIS should identify how the proposed effluent disposal area will be accessed during the construction and operational phases of the project.	Technical Report 1 – Water Resources Technical Report 5 – Biodiversity Development Assessment Report
	– The EIS should consider strategies and actions to avoid and minimise potential impacts on threatened entities and their habitats (including remnant vegetation) occurring on and/or adjoining the site.	Chapter 11 (153Terrestrial biodiversity) Technical Report 5 – Biodiversity Development Assessment Report
	– The EIS and BDAR should assess the impact of the project on any shorebird foraging and/or roosting habitat located within and/or adjoining the development site for both construction and operational stages of the project.	Chapter 11 (153Terrestrial biodiversity) Technical Report 5 – Biodiversity Development Assessment Report
	– The EIS should assess the impact of the project on any wildlife corridors in the locality of the project.	Technical Report 5 – Biodiversity Development Assessment Report
	– Provide an up-to-date coastal erosion and recession study for the effluent disposal area. The updated study must consider the latest IPCC projections and NSW Coastal Management Manual 2018 requirements of a probabilistic assessment over multiple probabilities and planning horizons.	Chapter 20
National Parks Estate	– Assess the nature, extent and duration of any potential direct or indirect impacts on all environmentally and culturally sensitive land reserved under the National Parks and Wildlife Act 1974 in the proximity of the proposal. • The assessment should address all matters outlined in Developments adjacent to National Parks and Wildlife Service lands: guidelines for consent and planning authorities (DPIE NPWS 2020).	Chapter 18 (Land use and property)
	– The following National Park specific issues should also be addressed: • Impacts to groundwater, estuary and wetlands in the parks, resulting from dewatering.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources

Legislation	SEARs requirement	Where addressed in the EIS
	• Impacts to water quality and hydrology of water entering the parks, resulting from effluent disposal.	Chapter 7 (Water quality and hydrology) Technical Report 1 – Water Resources
	• Odour and air quality impacts on the parks, including visitor infrastructure and facilities.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• The plans of management for the parks identify the values of each reserve. These values should be considered in the assessment of the proposal's impacts on reserved land.	Chapter 18 (Land use and property) Appendix B (Statutory Compliance)
	• The reserve fire management strategies for the parks identify access for fire management for each reserve. Existing NPWS access should be considered in the assessment of the proposal's impacts on reserved land.	Technical Report 14 – Bushfire Risk Assessment
	– Identify measures proposed to avoid, mitigate and manage any potential direct and indirect impacts on National Parks, including an evaluation of the effectiveness and reliability of the proposed measures, and quantify any residual impacts.	Appendix C – (Community Engagement Table)
Aquatic Ecology	– Prepare an aquatic ecology assessment in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (2013) addressing all direct and indirect impacts of the project and associated works on Key Fish Habitat and associated flora and fauna including threatened species, populations, and communities during construction and operation for the life of the project. The aquatic ecology assessment should include: • A clear description of aquatic environments including: an aquatic and riparian vegetation survey map of the area potentially impacted by the project which shows the location and/or coverage of saltmarsh, mangrove, seagrass, macroalgae, macrophytes, riparian vegetation and snags.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Map(s) of the development area and adjacent areas – this should include nearby waterways, adjacent infrastructure and land use.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Details of the nature, timing, magnitude and duration of the proposed disturbance to the aquatic environment.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Identification of mapped key fish habitat as per DPI Fisheries Spatial Data.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Description of local wave and current regimes, and water quality.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Details on types of surrounding land use.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Condition of riparian and/or marine vegetation.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Substrate type.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment

Legislation	SEARs requirement	Where addressed in the EIS
	• Photographs of the potentially impacted areas at high and low tide including any vegetation present.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Presence of any listed threatened or protected aquatic species or	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• 'critical habitat' under the Fisheries Management Act 1994 and the Environment Protection and Biodiversity Conservation Act 1999.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Details of the general regional context, any protected areas, other developments in the area, and/or cumulative impacts.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Consideration of geomorphic impacts relating to effluent disposal, and potential impacts on aquatic ecology.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Details of any activities that damage marine vegetation, including:	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Type, area, density and distribution of marine vegetation to be harmed.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Reasons and methods of harm, including details of construction.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	• Options analysis of alternative activities including justification for the preferred option.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	– Details how the proposal has been or may be modified and managed to minimise impacts to aquatic ecological values and details of mitigation measures during construction and operation that minimise impacts to aquatic ecological values.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	– Information on an offset proposal, if necessary, that will offset unavoidable impacts to Fisheries resources, developed in consultation with DPI Fisheries.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
	– Details of any proposed dredging and reclamation works in accordance with DPI Fisheries requirements.	Chapter 12 (Aquatic ecology) Technical Report 6 – Aquatic Ecology Assessment
Traffic and Transport	– Provide a Traffic Impact Assessment (TIA) prepared by suitably qualified person/s in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Transport for NSW (TfNSW) Supplement and RTA Guide to Traffic Generating Developments. • The TIA should be tailored to the scope of the proposed development. The TIA should be prepared in accordance with TfNSW requirements and include consideration of emergency vehicle access. • TfNSW notes that access to the Oxley Highway, a Controlled Access Road, is generally restricted, therefore evidence must be provided of consultation with TfNSW to show that this has been resolved.	Technical Report 7 – Traffic and Transport Assessment

Legislation	SEARs requirement	Where addressed in the EIS
	– Consult with TfNSW regarding any potential impacts to navigable waterways.	Chapter 5 (Community and stakeholder consultation) Appendix C – Community Engagement Table
	– Consult with Port Macquire Airport, the Civil Aviation Safety Authority, AirServices Australia and commercial operators at Port Macquire Airport regarding any potential impacts to the aviation safety during both construction and operational phases.	Chapter 5 (Community and stakeholder consultation) Appendix C – Community Engagement Table
Air Quality – in consultation with the NSW EPA	– Provide an Air Quality Impact Assessment report including the following: • Identify all sources or potential sources of air emissions from the development.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Provide details of the project that are essential for predicting and assessing air impacts including:	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• The quantities and physio-chemical parameters of materials to be used, transported, produced or stored.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• An outline of procedures for handling, transport, production and storage.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• The management of solid, liquid and gaseous waste streams with potential to generate emissions to air.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals, and buildings that may affect plume dispersion. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. Provide and analyse site representative data on meteorological parameters.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Estimate the resulting ground level concentrations of all pollutants. Where necessary use an appropriate dispersion model to estimate ambient pollutant concentrations.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Describe the contribution that the development will make to regional and global pollution.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	• Provide the emission rates in terms of odour units. Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment
	– Outline specifications of pollution control equipment and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes, including any proposals to reuse and treat emissions and emission levels relative to relevant standards in regulations.	Chapter 14 (Air quality) Technical Report 8 – Air Quality Assessment

Legislation	SEARs requirement	Where addressed in the EIS
Soils and Contamination – In consultation with the EPA	– Provide details of site history and any details needed to describe the existing situation in terms of soil types and properties and soil contamination.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	– Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of: • Disturbing any existing contaminated soil.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Contamination of soil by operation of the activity.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Subsidence or instability.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Soil erosion.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Disturbing acid sulfate or potential acid sulfate soils.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	– Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including: • Erosion and sediment control measures.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Proposals for site remediation.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
	• Proposals for the management of these soils including cleaner production processes, contamination treatment and prevention systems.	Chapter 15 (Soils and contamination) Technical Report 9 –Soils and Contamination Preliminary Site Investigation
Waste and chemicals – in consultation with the EPA	– Describe any existing waste or chemical operations related to the proposal and any approved regional or industry waste plans.	Chapter 16 (Waste and chemicals management) Technical Report 10 – Waste and Chemical Assessment
	– Provide details of liquid waste and non-liquid waste generated, handled, processed, managed or disposed of at the facility. 49. Provide details of spoil disposal.50. Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.	Chapter 16 (Waste and chemicals management) Technical Report 10 – Waste and Chemical Assessment

Legislation	SEARs requirement	Where addressed in the EIS
	– Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.	Chapter 16 (Waste and chemicals management) Technical Report 10 – Waste and Chemical Assessment
	– Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.	Chapter 16 (Waste and chemicals management) Technical Report 10 – Waste and Chemical Assessment
Noise and Vibration – in consultation with the EPA	– Undertake a noise and vibration impact assessment including but not limited to the following: • Determine the existing background noise levels.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• Identify any noise and vibration sensitive locations likely to be affected by activities associated with the project.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• A plan showing the assumed location of each noise and vibration source for each prediction scenario.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• A list of the number and type of noise and vibration sources used in each prediction scenario to simulate all potential significant construction and operating conditions on the site.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• Any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• Methods used to predict noise and vibration impacts including identification of any noise models used.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• The weather conditions considered for the noise predictions.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• The predicted noise and vibration impacts from each noise source as well as the combined noise level for each prediction scenario.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• An assessment of the need to include modification factors as detailed in Fact Sheet C of the NSW Noise Policy for Industry 2017.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment
	• Management and mitigation measures.	Chapter 17 (Noise and vibration) Technical Report 11 – Noise and Vibration Assessment

Legislation	SEARs requirement	Where addressed in the EIS
Land Use	– Undertake a Land Use Conflict Risk Assessment (LUCRA), including clear identification of the lots affected during both construction and operation, all ongoing access arrangements, and any acquisitions and/or easements that may be required. The LUCRA must identify any impacts of the proposal on surrounding land uses and the potential for impacts from surrounding land uses on the proposal. The LUCRA must also include measures to avoid or mitigate potential impacts.	Chapter 18 (Land use and property)
	– Prepare a biosecurity risk assessment outlining the likely plant, animal, and disease risks in relation to surrounding agricultural land uses. The assessment should include details of how the proposal will deal with the identified biosecurity risks as well as contingency plans for any failures. Details of monitoring and mitigation measures for weed and pest management during construction and operation should also be included.	Chapter 18 (Land use and property)
Health and Public Safety	– A Health Impact Assessment of local and regional impacts associated with the project, including those health risks associated with relevant key issues, in accordance with the current guidelines.	Technical Report 12 – Health Impact Assessment
	– An assessment of the likely risks of the project to public safety including flood risk, subsidence risks, bushfire risks and the handling and use of dangerous goods.	Chapter 19 (Hazard and risk)
	– A bushfire assessment report which identifies the extent to which the proposed development conforms with or deviates from the relevant provisions of Planning for Bushfire Protection 2019.	Technical Report 14 – Bushfire Risk Assessment
Visual and Design	– An assessment of the visual impact of the project and any ancillary infrastructure during construction and operation on: • The existing visual environment of the area, including views.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	• Key sites and buildings.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	• Heritage items.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	• The local community and public amenity.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	– Provide details and illustrations of how the project has minimised adverse visual impacts.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	– Address the scale and design of the proposed development, considering impacts upon the visual amenity of the sites, including: • Identify how services and plant are integrated into the overall design of the proposed development.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment

Legislation	SEARs requirement	Where addressed in the EIS
	• Provide details of any proposed landscaping, including the number of trees to be removed and the numbers of trees to be planted.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
	• Identify any services to be relocated or rerouted to facilitate the development.	Chapter 21 (Landscape character and visual amenity) Technical Report 13 – Landscape Character and Visual Impact Assessment
Crown Lands	– Consider and assess any impacts to Crown Lands resulting from the project, in consultation with NSW Crown Lands who have identified that the rifle range and Racecourse may be affected. Consideration must include what approvals and licenses may be required.	Chapter 18 (Land use and property)
NSW Health	– Consider and assess any requirements that NSW Health may provide (yet to be provided by NSW Health and advice to be provided separately).	Not provided. However, a Health Impact Assessment has been prepared for the project – refer to Technical Report 12 – Health Impact Assessment and Chapter 19.
Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Part 8 of the Regulation. Provide these as part of the EIS rather than as separate documents. In addition, the EIS must include the following: – high quality files of maps and figures of the subject site and proposal. – Technical details and associated data for any completed surface and groundwater modelling. – Geo-referenced file formats as per the GIS Data Specifications as detailed in the State significant development guidelines – preparing an environmental impact statement 2022. – An Appendix with legible, electronic portable document format engineering plans.	This EIS.
Engagement	During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with: – Environment and Heritage Group (Department of Planning and Environment) – National Parks and Wildlife Service – Heritage NSW – Environment Protection Authority – NSW Department of Health – Department of Primary Industries-Fisheries – NSW Food Authority – Transport for NSW – Department of Primary Industries-Agriculture – Essential Energy – Local Aboriginal Lands Councils – Port Macquarie Oyster farmers – Rural Fire Service – NSW State Emergency Service – Crown Lands	Chapter 5 (Community and stakeholder consultation) Appendix C – Community Engagement Table

Legislation	SEARs requirement	Where addressed in the EIS
	The EIS must detail the engagement undertaken and demonstrate how it was consistent with the Undertaking Engagement Guidelines for State Significant Projects. The EIS must detail how issues raised and feedback provided have been considered and responded to in the project.	

Appendix B

Statutory Compliance

B-1 EIS statutory requirements

This appendix outlines the statutory requirements for consideration in the environmental assessment of the project. Table B.1 summarises the statutory compliance requirements for an EIS and the section of the EIS in which they are addressed.

Table B.1 EIS Statutory Compliance Table

Statutory reference	Consideration	EIS Section
EP&A Act		
Section 1.3	Objects of the Act The objects of this Act are as follows—	
(a)	to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	6-21
(b)	to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	6-21
(c)	to promote the orderly and economic use and development of land	10
(d)	to promote the delivery and maintenance of affordable housing	N/A
(e)	to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	11, 12
(f)	to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)	8, 9
(g)	to promote good design and amenity of the built environment	N/A
(h)	to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants	N/A
(i)	to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State	N/A
(j)	to provide increased opportunity for community participation in environmental planning and assessment	5
EP&A Regulation		
Section 190	Form of an environmental impact statement	
(1)	An environmental impact statement must contain the following information:	
(a)	The name, address and professional qualifications of the person by whom the statement is prepared,	Page i
(b)	The name and address of the responsible person,	Page i
(c)	The address of the land: In respect of which the development application is to be made, or On which the activity or infrastructure to which the statement relates is to be carried out,	Section 3.1
(d)	A description of the development, activity or infrastructure to which the statement relates,	1-3
(e)	An assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule,	Page i
(2)	**The person preparing the statement must consider—**	
(a)	For State Significant Development – the State Significant Development Guidelines or	N/A

Statutory reference	Consideration	EIS Section
(b)	For State Significant Infrastructure – the State Significant Infrastructure Guidelines	Whole report
(3)	**An environmental impact statement must also contain a declaration by the person who prepared the statement of the following—**	Page i
(a)	The statement has been prepared in accordance with this Division and;	
(b)	The statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates; and	
(c)	That the information contained in the statement is neither false nor misleading; and	
(d)	for State significant development or State significant infrastructure—the statement contains the information required under the Registered Environmental Assessment Practitioner Guidelines.	
Section 192	**Content of an environmental impact statement**	
(1)	An environmental impact statement must contain the following:	
(a)	A summary of the environmental impact statement,	Executive summary
(b)	A statement of the objectives of the development, activity or infrastructure,	1.2
(c)	An analysis of the feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	2.6
(d)	An analysis of the development, activity or infrastructure, including:	
(d)(i)	A full description of the development, activity or infrastructure, and	3
(d)(ii)	A general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	6-21
(d)(iii)	The likely impact on the environment of the development, activity or infrastructure, and	6-21
(d)(iv)	A full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	6-21
(d)(v)	A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Appendix B-6
(e)	A compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Appendix D
(f)	The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in Section 193	Appendix B
(2)	This section is subject to the environmental assessment requirements that relate to the environmental impact statement.	Appendix A

B-2 Approval pathway and permissibility

B-2-1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and *Environmental Planning and Assessment Regulation 2021* (EP&A Act Regulation) establish the framework for development assessment in NSW. They contain provisions that ensure that the potential environmental impacts will be considered in the decision making and assessment process.

The project involves the construction and operation of new WWTP at Thrumster including recycled water treatment facility (RWTP) and associated infrastructure. Pursuant to section 5.12(2) of the EP&A Act the project is declared State significant infrastructure (SSI) under section 10 of schedule 4 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP).

B-2-2 Approvals not required for an approved SSI

Under section 5.23 of the EP&A Act, certain other approvals are integrated into the SSI approval process and are not required to be separately obtained for the project. Such approvals are listed in Table B.2.

Table B.2 Approvals that do not apply to Thrumster Water Supply Scheme (approved SSI)

Legislation	Purpose/description	Relevance to the project
Fisheries Management Act 1994	A permit under Sections 201, 205 and 219 of the *Fisheries Management Act 1994*.	The project's potential impacts on ecological values have been assessed. Further information is provided in Technical Report 6 (Aquatic Ecology Assessment) and is summarised in Chapter 12.
Heritage Act 1977	An approval under Part 4, or an excavation permit under Section 139 of the *Heritage Act 1977*. Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent of interfere with the carrying out of approved State Significant Infrastructure.	The project's potential impacts on non-Aboriginal heritage have been assessed. Further information is provided in Technical Report 3 (Non-Aboriginal Heritage Assessment) and summarised in Chapter 9.
National Parks and Wildlife Act 1974	An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974*.	The potential impacts on Aboriginal Heritage have been assessed. Further information is provided in Technical Report 2 (Aboriginal Heritage) and is summarised in Chapter 8.
Rural Fires Act 1997	A bushfire safety authority under section 100B of the *Rural Fires Act 1997.*	The potential bushfire impacts have been assessed. Further information is provided in Technical Report 14 (Bushfire Assessment) and is summarised in Chapter 19.
Water Management Act 2000	A water use approval under Section 89, water management work approval under Section 90, or an activity approval (other than an aquifer interference approval) under Section 91 of the *Water Management Act 2000.*	The potential hydrological impacts have been assessed. Further information is provided in Technical Report 1 (Water Resources and Flooding Assessment Assessment) and is summarised in Chapter 7.

B-2-3 Approvals required and that should be consistent with approved

Under section 5.24 of the EP&A Act provides that certain authorisations under other acts cannot be refused if it is necessary for carrying out approved SSI and is to be substantially consistent with the approval. Such approvals are outlined in Table B.3.

Table B.3 Approvals that must be consistently applied for Thrumster Water Supply Scheme (approved SSI)

Legislation	Purpose/description	Relevance to the project
Fisheries Management Act 1994	An aquaculture permit under section 144 of the *Fisheries Management Act 1994*	Not applicable. The project does not include the establishment of an aquicultural activity, therefore does not require approval.
Coal Mine Subsidence Compensation Act 2017	An approval under the *Coal Mine Subsidence Compensation Act 2017*, section 22	Not applicable. The project is not located within a mine subsidence district, therefore does not require approval.
Mining Act 1992	A mining lease under the *Mining Act 1992*	Not applicable. The project would not include mining for mineral resources or any activity which would require a lease under the Act.
Petroleum (Onshore) Act 1991	A production lease under the *Petroleum (Onshore) Act 1991*	Not applicable. The project would not include any activity which would develop any petroleum resources that would require a production lease.
Protection of the Environment Operations Act 1997	An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act)	The facility is likely to trigger a need for a licence under Clause 36 of Schedule 1. Council currently holds five EPLs for its wastewater treatment plants operating in the LGA (EPLs No. 594, 589, 805, 804, 10339). The requirement for a new EPL for the project would be determined during the EIS process and in discussion with the EPA. Section 5.24 of the EP&A Act provides that an EPL cannot be refused if it is necessary for carrying out an approved SSI project and is consistent with the project approval. Early engagement with NSW EPA established that a new EPL would be required for the project covering both the treatment and discharge of treated effluent and recycled water production, distribution and reuse. It was noted the future EPL application may include requirements to demonstrate the adequacy of containment measures at site such as wet weather controls and sedimentation basins with baffles.
Roads Act 1993	A consent under section 138 of the *Roads Act 1993*	The project would potentially require temporary/partial closure(s) of roads during construction. Consent from the relevant roads authority to undertake work in, on or over classified roads is required.
Pipelines Act 1967	A licence under the *Pipelines Act 1967*	The project meets the definition of a prescribed pipeline for which a licence is required, as described under section 5(1)(d) and 5A of the *Pipelines Act 1967.*

B-2-4 Approval authority

Under Section 5.14 of the EP&A Act the approval authority for SSI is the Minister for Planning. Therefore, Council must obtain approval from the Minister for Planning before carrying out the project.

B-2-5 Environmental assessment requirements

As the project is declared SSI, it is subject to the environmental assessment requirements outlined in Part 5, Division 5.2 of the EP&A. section 5.16(1) of the EP&A provides that once an application is made for the Minister's approval for SSI, the Planning Secretary is to prepare environmental assessment requirements in respect of the infrastructure (SEARs).

Section 5.17(1) of the EP&A Act provides that the proponent is to submit to the Planning Secretary an EIS to carry out the SSI. The final SEARs for the project, issued on 28 April 2023, sets out the matters the Secretary requires addressing in the EIS. The requirements detailed in the SEARs, together with where they are address in the EIS, are provided in Appendix A.

B-2-6 EP&A Regulation

Part 8 of the EP&A Regulation describes the requirement for an EIS. Section 190 outlines the required form for an EIS, while section 192 outlines the required content. This EIS has been prepared in accordance with the form and content requirements of the EP&A Regulation. These requirements and where they are address in the EIS are outlined in Table B.1.

Clause 193 of the EP&A Regulation outlines the principles of ecologically sustainable development (ESD). The project's response to these principles is described in detail in Appendix V.

B-3 Environmental Planning Instruments

B-3-1 State Environmental Planning Policy (Planning Systems) 2021

The *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) identifies development that is considered to be of state significance and includes the provisions for SSI. Clause 2.14 of the Planning System SEPP states:

'Development specified in Schedule 4 of the Planning Systems SEPP is declared, pursuant to section 5.12(4) of the Act, to be State significant infrastructure for the purposes of the Act.'

Clause 10 of schedule 4 of the Planning Systems SEPP declares the project to be SSI as follows:

Development for the purposes of the Thrumster Wastewater Scheme on land in the Port Macquarie-Hastings local government area, including the following—

a. *construction of a wastewater treatment plant at 433 Fernbank Road, Thrumster*
b. *construction of sewer rising mains and recycled water mains,*
c. *works at certain existing sewer pump stations for purposes of reducing sewer load on the existing system.*
d. *ancillary development*

In accordance with section 5.12(4) of the EP&A Act and Clause 10 of schedule 4 of that Planning Systems SEPP, the project is specified development on specified land declared as SSI.

B-3-2 State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.126(2) of the Transport and Infrastructure SEPP provides that development for the purpose of sewage treatment plants may be carried out without consent on land in a prescribed zone in the prescribed circumstances.

Section 2.126(6) of the Transport and Infrastructure SEPP provides that development for the purpose of sewage reticulation systems may be carried out without consent on any land in prescribed circumstances.

Section 2.126(4) of the Transport and Infrastructure SEPP provides that development for the purpose of water recycling facilities may be carried out without consent on land in a prescribed zone in the prescribed circumstances.

Clause 2.159(1) of the Transport and Infrastructure SEPP provides that development for the purpose of water reticulation systems may be carried out by or on behalf of a public authority without consent on any land.

The project is being carried out by a public authority, and as such the project development is permitted within consent in accordance with the abovementioned sections of the Transport and Infrastructure SEPP.

The project has been declared SSI as specified development on specified land pursuant to Section 2.14 and Schedule 4 of the Planning System SEPP, and therefore may be undertaken without development consent in accordance with Section 5.12(4) of the EP&A Act.

B-3-3 State Environmental Planning Policy (Resilience and Hazards) 2021

State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) sets the regulatory framework for coastal management, hazardous and offensive development, and remediation of land within NSW.

Chapter 2 – Coastal management

Chapter 2 aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the *Coastal Management Act 2016*. The objectives of Chapter 2 are to manage development in the coastal zone and establish a framework for land use planning and decision making in the coastal zone.

Sections of the following associated pipeline components of the proposed WWTP intersect areas mapped as Coastal Wetland under the Resilience and Hazards SEPP:

– Recycled water
– Power
– Sewer rising main
– Emergency discharge
– Return effluent to Kooloonbung Creek
– Foolproof weather access road
– Sewer diversion from SPS 7
– Sewer diversion from southwestern pump stations

The project is defined as development permissible without consent under the Planning System SEPP. However clause 2.7(2) of that SEPP states:

Except as provided by subsections (3) and (4), if there is an inconsistency between a provision of this Chapter and any of the following provisions of another environmental planning instrument, the provision of the other instrument prevails to the extent of the inconsistency—

(a) clauses 10, 11 and 19 of State Environmental Planning Policy (Coastal Management) 2018,

(b) all of the provisions of State Environmental Planning Policy (State Significant Precincts) 2005.

State Environmental Planning Policy (Coastal Management) 2018 is now repealed with all provisions contained within the Resilience and Hazards SEPP. Clause 10 relates to Coastal Wetland and therefore the requirement for development consent prescribed under clause 2.7(2) of the Resilience and Hazards SEPP applies to the project.

However, as described above, the project has been declared SSI under clause 2.14 and Schedule 4 of the Planning System SEPP. Clause 2.5 of that SEPP states:

Subject to section 74(1) of the Act, in the event of an inconsistency between this Chapter and another environmental planning instrument, whether made before or after the commencement of this Chapter, this Chapter prevails to the extent of the inconsistency.

Therefore, the SSI declaration prevails and the project is permissible without development consent.

Chapter 3 – Hazardous and offensive development

Chapter 3 aims to regulate, amongst other matters, the determination of development applications to carry out development for the purposes of a potentially hazardous industry or potentially offensive industry. Part 2 and 3 of the SEPP define hazardous or offensive development and potentially hazardous and offensive development and describe matters for consideration by consent authorities.

A hazard and risk assessment, incorporating a Quantitative Risk Analysis (QRA), has been undertaken as part of the EIS and includes an assessment of potential hazards associated with the construction and operation of the project (see Chapter 7 and Appendix M).

Chapter 4 – Remediation of land

Chapter 4 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment and provide a state-wide planning approach to the remediation of contaminated land. A preliminary site investigation was carried out for the project to inform the design and EIS process. The assessment concluded the overall likelihood for significant chemical contamination to be present along the proposed project is considered low. There is a high probability of encountering ASS during construction along Segments 1, 2, 3, 4 and beginnings of Segment 5. There is also low NOA potential located in portions of Segment 2, 6 and 7. Measures to manage this impact are provided in Chapter 15 (Soils and contamination) and the assessment is appended in Technical Report 9 – Soils and Contamination Preliminary Site Investigation.

B-3-4 State Environmental Planning Policy (Biodiversity and Conservation)

State Environmental Planning Policy (Biodiversity and Conservation) Policy 2021 (Biodiversity and Conservation SEPP) contains provisions for the preservation of areas of high biodiversity value. Chapter 4 of the Biodiversity and Conservation SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

While the requirements of the Biodiversity and Conservation SEPP would not apply to the project (as development consent is not required), potential impacts on koala populations have been considered as part of the EIS. Consideration of the potential impacts to koalas has been included in Chapter 11 (Biodiversity) and Technical Report 5 (Biodiversity Development Assessment Report).

B-3-5 State Environmental Planning Policy (Primary Production) 2021

State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP) aims to facilitate the orderly economic use and development of land for primary production and reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity, and water resources. The Primary Production SEPP also intends to identify land which has been declared to be State significant agricultural land (SSAL). A draft SSAL map has been published by the NSW Department of Primary industries and has been considered in the EIS to assess the potential impacts on high value agricultural land. The project largely avoids SSAL areas, however sections of the associated pipeline components do intersect land mapped as SSAL in few locations.

The project has been designed to minimise impact on important agricultural land in the areas in which it is intersected, and where practicable, use previously disturbed corridors. The impact of the project on SSAL is assessed in detail in Chapter 18.

B-3-6 Port Macquarie Hastings Local Environmental Plan 2011

The Port Macquarie Hastings Local Environmental Plan 2011 (LEP 2011) sets out the environmental planning provisions administered by Port Macquarie Hastings Council within the Port Macquarie Hastings Local Government Area (LGA).

The following outlines the projects' land zoning and permissibility in accordance with the LEP 2011.

The proposed WWTP and recycled water treatment facility (Lot 14, DP1139180) would be located on land zoned RU1 Primary Production. Wastewater treatment plants are prohibited in their current zone under the LEP 2011.

The sewer rising main and associated infrastructure would be located on land zoned:

- RU1 Primary Production
- R1 General Residential
- R2 Low Density Residential
- B5 Business Development
- B7 Business Park
- SP2 Infrastructure
- RE1 Public Recreation
- RE2 Private Recreation
- C2 Environmental Conservation
- C4 Environmental Living

The recycled water mains would be located on land zoned:

- RU1 Primary Production
- R1 General Residential
- R5 Large Lot Residential
- C2 Environmental Conservation
- C3 Environmental Management

Apart from SP2, the current land zoning prohibits development for the sewer rising main and recycled water mains under LEP 2011. However, the project has been specifically declared SSI and may be undertaken without development consent in accordance with section 5.12(4) of the EP&A Act. Section 5.22(2) of the EP&A Act provides that EPIs do not apply to or in respect of SSI.

B-4 Other relevant NSW legislation

B-4-1 Aboriginal Land Rights Act 1983

The purpose of the *Aboriginal Land Rights Act 1983* is to provide land rights for Aboriginal persons and create representative Aboriginal Land Councils in NSW. This Act applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. This Act recognises and acknowledges the statutory role and responsibilities of the NSW Aboriginal Land Council (NSWALC) and Local Aboriginal Land Councils (LALCs).

The project does impact on Crown land (as identified in Chapter 17 – Land use and property). No Aboriginal land claims made under the *Aboriginal Land Rights Act 1983* have been identified within the project footprint.

The project is located within the Birpai and Bunyah LALC areas, who have been consulted during the development and assessment of the project (see Chapter 8 (Aboriginal heritage) and Technical Report 2 – Aboriginal Cultural Heritage Assessment.

B-4-2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) aims to conserve threatened species, populations and ecological communities through ensuring appropriate assessment, management and regulation of actions that may damage critical or other habitat for a listed threatened species, or may otherwise significantly affect a threatened species, population or ecological community.

Under section 7.9 of the BC Act, SSI projects are required to prepare a Biodiversity Development Assessment Report (BDAR) to identify and assess biodiversity impacts under the provisions of the Act and offset those impacts by retiring biodiversity credits, determined using the Biodiversity Assessment Methodology (BAM).

The biodiversity impacts associated with the project have been assessed in accordance with the requirements of the BC Act the BAM. The results of this assessment are presented in Technical Report 5 - Biodiversity Development Assessment Report and summarised in Chapter 11 (Terrestrial biodiversity).

B-4-3 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) provides for the prevention, elimination, minimisation and management of biosecurity risks in NSW posed by biosecurity matters, which are defined in section 10 of the Biosecurity Act.

Under the Biosecurity Act, a General Biosecurity Duty under Section 22, which required any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated, or minimised, so far as is reasonably practicable.

Any biosecurity matters encountered during the project would be managed in accordance with the Biosecurity Act. The EIS includes an assessment of biodiversity impacts, including consideration of weeds (refer to Chapter 11 (Terrestrial biodiversity) and Technical Report 5 - Biodiversity Development Assessment Report).

B-4-4 Coastal Management Act 2016

The *Coastal Management Act 2016* (CM Act) establishes a strategic framework and objectives for managing coastal issues in NSW. The CM Act defines the coastal zone as four coastal management areas and establishes management objectives specific to each of these areas. As outlined above, the Resilience and Hazards SEPP provides an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the CM Act.

B-4-5 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CL Act) outlines the circumstances under which notification to the NSW Environment Protection Authority (EPA) is required in relation to the contamination of land. In accordance with the requirements of section 60 of the CL Act, the EPA would be notified in writing of any contamination identified within the project area during construction activities.

A Preliminary Site Investigation (Contamination Assessment) (refer to Technical Report 9 - Soils and Contamination Preliminary Site Investigation) has been undertaken for the project to inform the continued development of the project design and EIS process. The site is not a registered contaminated site on the NSW EPAs contaminated sites register and is deemed suitable for the proposed land use. Further consideration of contamination risks, including any requirements for notification of the EPA and proposed measures to mitigate and manage those risks, are summarised in Chapter 15 (Soils and contamination).

B-4-6 Crown Lands Management Act 2016

The *Crown Land Management Act 2016* (CLM Act) provides the legislative framework for the administration and management of Crown land. The project will directly impact on Crown Land (Crown Reserve ‘Port Macquarie Racecourse’ and ‘Rifle Range’). A licence or easement will be sought for the construction and operation of the project over Crown Land. Further details on the potential impacts to Crown Land are discussed in Chapter 18 (Land use and property).

B-4-7 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. One of the key objectives of the FM Act is to conserve fish stocks and key fish habitats.

Part 7 of the FM Act establishes that a permit is generally required to dredge, reclaim, obstruct fish passage, harm marine vegetation, use explosives or electrical devices in a waterway that is classified as key fish habitat. The project would involve work within and near aquatic habitats however no net loss of key fish habitat is anticipated to occur as a result of the project. However, as SSI, the project is exempt from the need to obtain permits under Sections 201, 205 and 219 of the FM Act.

To assist in applying the legislative requirements of the FM Act in assessing developments in NSW, NSW DPI Fisheries have prepared the 'Policy and guidelines for fish habitat conservation and management' (Fairfull 2013). Listings of threatened species, populations and ecological communities gazetted under the FM Act are relevant to this assessment. Threatened biota impacted by the project must be assessed with consideration of the factors identified in Section 5A of the EP&A Act. Impacts from the project have been assessed and details are provided in Chapter 12 (Aquatic ecology) and Technical Report 6 – Aquatic Ecology Assessment.

B-4-8 Heritage Act 1997

The *Heritage Act 1977* (Heritage Act) is concerned with all aspects of heritage conservation ranging from basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement.

Section 139 of the Heritage Act specifies that a person must not disturb or excavate land knowing, or suspecting, that the action may result in the discovery, exposure, movement, damage or destruction of a relic, unless the work is undertaken in accordance with an excavation permit. Additionally, Section 146 of the Heritage Act requires that the discovery or location of a relic must be notified to the Heritage Council of NSW unless the Heritage Council of NSW is aware of the relic's location.

Under the SSI provisions for the project, exemptions and permits that would otherwise be required under Part 4 and section 139 of the Heritage Act are not required by reason of section 5.23 of the EP&A Act. The construction of the WWTP and associated infrastructure will not directly or indirectly impact any heritage item or relic, and therefore would not require approval under the Heritage Act. Notwithstanding the application of the SSI provisions, the potential heritage impacts of the project have been assessed in accordance with the Heritage Act (see Chapter 9 (Non-Aboriginal heritage) and Technical Report 3 – Historical Heritage Assessment).

B-4-9 Land Acquisition (Just Terms Compensation) Act 1991

The *Land Acquisition (Just Terms Compensation) Act 1991* controls the acquisition of land on just terms by authorities of the State with the objective of simplifying and expediting the compulsory acquisition process while ensuring compensation on just terms for the owners of land that is acquired by an authority of the State when the land is not available for public sale.

Further discussion of potential land acquisition with the project is discussed in Chapter 18 (Land use and property).

B-4-10 Local Government Act 1993

The *Local Government Act 1993* (LG Act) provides the legal framework for the system of local government in NSW. In accordance with section 60 of the LG Act, Council must seek the approval of the Minister for construction of sewage and water treatment works.

B-4-11 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) establishes statutory provisions for the management of national parks, nature reserves, historic sites, state conservation areas and certain other areas. The NPW Act also provides for the conservation of elements of the natural environment, as well as the conservation of objects, places or features of cultural value to Aboriginal people and the people of NSW.

Section 86 of the NPW Act states it is an offence to harm or desecrate an object the person knows is an Aboriginal object unless authorised by an Aboriginal heritage impact permit (AHIP) issued under section 90 of the NPW Act.

The project does not intersect any NPWS estate. The project traverses a range of land uses and ground disturbance levels with varying potential for Aboriginal heritage significance. Despite the requirements of the NPW Act, an AHIP is not required for SSI projects under Section 5.23(1) of the EP&A Act. Notwithstanding these provisions under the EP&A Act, a detailed assessment of potential impacts to Aboriginal heritage associated with the project has been undertaken in the form of an Aboriginal Cultural Heritage Assessment Report (ACHAR).

Aboriginal heritage factors are discussed further in Chapter 8 (Aboriginal heritage) and Technical Report 2 – Aboriginal Cultural Heritage Assessment.

B-4-12 Protection of Environment Operations Act 1997

The *Protection of the environment Operations Act 1997* (POEO Act) is a key piece of environment protection legislation administered by the NSW EPA, which enables the Government to establish instruments for setting environmental standards, goals, protocols, and guidelines. The objects of this Act include to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development.

An environment protection licence (EPL) is required for scheduled activities or development work listed by the POEO Act. The facility is likely to trigger a need for a licence under Clause 36 of Schedule 1. Clause 36 states:

1. This clause applies to sewage treatment, meaning the operation of sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that involve the discharge or likely discharge of wastes or by-products to land or waters.
2. The activity to which this clause applies is declared to be a scheduled activity if it has a processing capacity that exceeds—
    a. 2,500 persons equivalent, as determined in accordance with guidelines established by an EPA Gazettal notice, or
    b. 750 kilolitres per day, whichever is the greater.

The project is a scheduled activity listed in Schedule 1 of the POEO Act and would require an EPL under this schedule.

In accordance with section 5.24 of the EP&A Act, such a licence cannot be refused for an approved SSI project and is to be substantially consistent with the approval granted to the project.

Additionally, in accordance with Section 43(d) of the POEO Act, an EPL may also be issued to control the carrying out of non-scheduled activities for the purpose of regulating water pollution. Construction activities must comply with the requirements for the POEO Act, including but not limited to the following sections:

– Sections 115 and 116 (regarding disposal of waste, leaks, spillages and other escapes)
– Section 120 (regarding pollution of waters)
– Sections 124 and 126 (regarding operations that result in air pollution)
– Section 139 (regarding noise pollution)
– Section 167 (regarding the appropriate maintenance and operation of plant and equipment)

The POEO Act is relevant to the project as it has the potential to cause air, land, noise and water pollution. For projects assessed as SSI, an EPL cannot be refused and must be granted on terms which are substantially consistent with the approved development.

B-4-13 Roads Act 1993

The purpose of the *Roads Act 1993* (Roads Act) is to make provisions and regulations for carrying out various activities on public roads. Part 9 of the Roads Act nominates the requirements for undertaking works within a public road, including the requirement to obtain consent under section 138 (road occupancy licence) for carrying out works in, on or over a public road (this includes the erection of structures), and the digging up or disturbance of the surface of a public road. Clause 5(1) of schedule 2 of the Roads Act exempts public authorities from requiring approval to carry work on unclassified roads other than a Crown road.

The project would carry out work on or over, a public road for the connection to utilities and construction of the transfer main. The project would require temporary/partial closure(s) of roads during construction. Council would require consent from the relevant roads authority under section 138 of the Roads Act to undertake work in, on or over classified roads. For projects assessed as SSI, a road occupancy licence cannot be refused and must be granted on terms which are substantially consistent with the approved development.

As outlined in Chapter 5 (Community and stakeholder consultation), Council has initiated discussions with Transport for NSW regarding the project and consultation would continue as Council seek the necessary approvals. The potential impacts to the existing roads as a result of the construction and operation of the project are discussed in Chapter 13 (Traffic and transport) and Technical Report 7 – Traffic and Transport Assessment.

B-4-14 Rural Fires Act 1997

The objects of the *Rural Fires Act 1997* (RF Act) are focused on the prevention, mitigation and suppression of bush and other fires in rural fire districts, and the co-ordination of firefighting and prevention across NSW.

Section 100B applies to bushfire prone land and empowers the Commissioner of the NSW Rural Fire Service (RFS) to issue a bushfire safety authority. The bushfire safety authority authorises certain types of development, subject to compliance with matters considered by the Commissioner to be necessary to protect persons, property and/or the environment. Under the provisions of section 5.23(1) of the EP&A Act, this authority that would otherwise be required under section 100B of the RF Act is not required for approved SSI projects.

Council however has a duty under the RF Act to take steps to prevent the occurrence of bushfires on land under its control and operation. Potential hazards associated with bushfire risk to and from the project (including during construction), have been considered in Technical Report 14 – Bushfire Risk Assessment and summarised in Chapter 19 (Hazard and risk).

B-4-15 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) encourages the most efficient use of resources to reduce environmental harm in accordance with the principles of ESD. Waste resulting from the project would be managed in accordance with this Act and classified in accordance with the Waste Classification Guidelines 2014 (EPA, 2014).

The project would consume some natural resources and would produce a number of waste streams. Waste impacts and management are outlined in Technical Report 10 – Waste and Chemical Assessment and summarised in Chapter 16 (Waste and chemicals management).

B-4-16 Pipelines Act 1967

Under Section 5(1)(d) and 5A of the *Pipelines Act 1967* (Pipelines Act), a licence is required for a pipeline constructed or to be constructed for the purpose of the supply of water (including for irrigation), the drainage of land or the conveyance of wastewater, mine water, aqueous slurries of minerals, mineral concentrates or mineral tailings.

An application is made to the Minister for Energy under Section 12 of the Pipelines Act, with the content of the application described in Section 13 of the Pipelines Act. As SSI, a pipeline licence cannot be refused and must be granted on terms which are substantially consistent with the approved development.

B-4-17 Work Health and Safety Act 2011 and Work Health and Safety Regulation

This main objective of the *Work Health and Safety Act 2011* is to provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces. The health and safety of construction workers would be managed in accordance with Council's existing management systems.

Further consideration of issues relevant to work health and safety are discussed in Chapter 19 (Hazard and risk).

B-5 Commonwealth legislation

B-5-1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act* (EPBC Act) provides a legal framework to protect and manage nationally important flora, fauna, ecological communities and heritage places defined as matters of national environmental significance (MNES). Part 3 of the EPBC Act requires a referral to the Commonwealth Minister for the Environment and Water for a project that is likely to have a significant impact on the following:

– MNES.
– An action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment.
– An action which has, will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

The Minister will determine whether the action is a controlled action and therefore requires approval under the EPBC Act. The Minister will also determine the method under the environmental impact of the action will be assessment.

A referral under the EPBC Act was lodged on 12/03/24 (EPBC 2023/09582). The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined that the project is not a controlled action under section 75 of the EPBC Act on 03/05/2024. No further assessment and approval under the EPBC Act are required before it can proceed.

Matters of National Environmental Significance

As detailed in Technical Report 5 – Biodiversity Development Assessment Report and summarised in Chapter 11 (Terrestrial biodiversity), the assessment concluded the project is unlikely to have a significant residual impact on any EPBC Act listed fauna or flora species or communities.

A summary of the potential impacts on MNES as a result of the project is presented in Table B.4.

Table B.4 MNES matters relevant to the project

MNES	Relevance to the project
World heritage properties	Not applicable
National heritage places	Not applicable
Wetlands of international importance (Ramsar sites)	The nearest Ramsar site is approximately 113 km south of the project and will not be impacted.
Nationally listed threatened ecological communities	One endangered ecological community, Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, was recorded within the Subject Land. The Protected Matters Search Tool identified four other threatened ecological communities that could occur within the Subject Land. Each of these was considered as part of the survey process and excluded based on the conditions within the Vegetation Zone.

MNES	Relevance to the project
	An assessment against the Significant Impact Criteria (Commonwealth of Australia 2013) has been prepared for Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, which concluded that a significant impact was not likely to result from the project, provided the appropriate mitigation measures are adopted (refer to Technical Report 5 – Biodiversity Development Assessment Report and Chapter 11 (Terrestrial biodiversity).
Nationally listed threatened species	18 flora species and 63 fauna species listed under the EPBC have been recorded or are precited to occur in the assessment area. The following threatened species, were not recorded within the subject land, however, were assumed to be present in certain areas (DeWitt, 2024): – Swift Parrot (*Lathamus discolor*) – Leafless Tongue Orchid (*Cryptostylis hunteriana*) – Slender Marsdenia (*Marsdenia longiloga*) – Koala (*Phascolarctos cinereus*) The following species were identified during works undertaken for this project but are not considered to be at risk for this project (DeWitt, 2024): – Scented Acronychia (*Acronychia littoralis*) – Biconvex Paperbark (*Melaleuca biconvexa*) – Scrub Turpentine (*Rhodamnia rubescens*) – Native Guava (*Rhodomyrtus psidioides)* Assessments against the Significant Impact Criteria (Commonwealth of Australia 2013) have been prepared for these species and concluded that a significant impact was not likely to result from the project, provided the appropriate mitigation measures are adopted (refer to Technical Report 5 – Biodiversity Development Assessment Report and Chapter 11 (Terrestrial biodiversity). Based on the level of disturbance and the nature of the project, the habitat present within the Subject Land does not constitute limiting habitat for the above threatened species. Therefore, a referral is not required.
Migratory species	57 migratory species have been recorded or are predicted to occur in the locality. Surveys of the Subject Land did not detect any of these species. These species are unlikely to be impacted by the project. Many of the species identified would only have marginal foraging habitat within the subject land, such as Wandering Albatross (*Diomedea exulans*) and Far Eastern Curlew (*Numenius madagascariensis*) For further detail of potential impact refer to (refer to Technical Report 5 – Biodiversity Development Assessment Report and Chapter 11 (Terrestrial biodiversity).
Commonwealth marine areas (including great Barrier Reef Marine Park)	Not applicable
Nuclear actions	Not applicable
A water resource, in relation to coal seam gas development and large coal mining development.	Not applicable
Commonwealth Land	Not applicable
Commonwealth Heritage Places	Not applicable
Commonwealth or Commonwealth Agency	Not applicable

B-5-2 Native Title Act 1993

The *Native Title Act 1993* provides for the recognition of native title and establishes ways in which future dealings affecting native title may proceed, sets the standards for those dealings, and establishes a mechanism for determining claims to native title. Section 8 states that the *Native Title Act 1993* is not intended to affect the operation of any law of a state or a territory that is capable of operating concurrently with the Act. The Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010) stipulates that, where relevant, consultation must be conducted with native title holders or registered native title claimants.

The *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) stipulates that, where relevant, consultation must be conducted with native title holders or registered native title claimants.

At the time of preparing the EIS, no land within the project footprint was found to be the subject of an application or determination made under the *Native Title Act 1993*. In addition, no Aboriginal land claims made under the *Aboriginal Land Rights Act 1983* have been identified within the project footprint.

B-6 Summary of approvals required

Approvals required for the project, based on the review in the preceding sections, are summarised below in Table B.5.

Table B.5 Summary of approvals required the project

Legislation	Approval required	Approval authority	Description
Roads Act 1993	A consent under section 138 of the *Roads Act 1993*	Transport for NSW or Council (roads authority)	The project would potentially require temporary/partial closure(s) of roads during construction. Consent from the relevant roads authority to undertake work in, on or over classified roads is required.
Pipelines Act 1967	A licence under section 12 of the *Pipelines Act 1967*	NSW Minister for Energy	The project meets the definition of a prescribed pipeline for which a licence is required, as described under section 5(1)(d) and 5A of the *Pipelines Act 1967*.
Land Acquisition (Just Terms Compensation) Act 1991	Any land acquisition would be in accordance with *Land Acquisition (Just Terms Compensation) Act 1991*	Council	The project would require land acquisition for the flood proof access road to the WWTP. This is currently being agreed between the private landowner and Council.
Local Government Act 1993	Approval under section 60 of the *Local Government Act 1993*	NSW Minister for Water, Property and Housing	Approval is required for the construction of sewage and water treatment works.
Water Management Act 2000	Water access licence (WAL) Clause 7 of Schedule 4 *Water Management (General) Regulation 2018*	NSW Natural Resources Access Regulator (NRAR) and WaterNSW.	The project is expected to result in dewatering of more than 3 ML during construction activities for establishment of the WWTP and pipeline infrastructure in areas of high groundwater level and a WAL is therefore expected to be required to account for water take from the aquifer interference activities.

Appendix C

Community Engagement Table

Table C.1 Community Engagement Table

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Aboriginal Heritage Site Inspection – Registered Aboriginal Parties (RAPs). ACHAR process.	7 August 2023	Email to known local Indigenous and associated organisations	Port Macquarie-Hastings Council, Bunyah and Birpai LALCs, North Coast LLS, Native Title Tribunal, Heritage NSW, the Registrar, and Native Title Services Corporation were all contacted seeking details of any Aboriginal people with cultural knowledge.	As a result of the enquiries, nine organisations and/or individuals, registered as RAPs for the Project.	Technical Report 2 – Aboriginal Cultural Heritage Assessment
	1 September 2023	Notification of project and request for RAPs to register interest	In accordance with Section 4.1.3 of the ACHCRP (NSW DECCW 2010), a newspaper advertisement was placed in Port Macquarie News.	As a result of the Stage 1 enquiries, nine organisations and/or individuals, registered as RAPs for the Project.	
	12 March 2024	Draft methodology submitted	The draft methodology was submitted to the RAPs.	The RAPs provided feedback on the project information and assessment methodology.	
	9-11 April 2024	Site walk through	A cultural heritage survey was completed over three days with representatives of the RAPs.	Conducted site inspection and survey with RAPs. Throughout the field assessment process, RAPs provided feedback regarding the cultural values and Aboriginal cultural heritage potential of the Subject Area. During the survey, landscape features and areas of archaeological and Aboriginal heritage potential were assessed.	

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Near neighbours from/around Fernbank Creek Road	10 October 2023	Face to face	The project team invited neighbours to the project to meet and discuss the project, including any concerns or feedback.	Concerns about odour impacts. Concerns about noise impacts. Concerns about traffic impacts. Concerns about flooding impacts and/or overflow from the site.	Technical Report 8 Air Quality Assessment Technical Report 11 Noise and Vibration Assessment, and Chapter 17 Noise and Vibration Technical Report 7 Traffic and Transport Assessment and Chapter 13, Traffic and Transport Technical Report 1A Water Resources and Quality Assessment, and Chapter 7 Water Quality and Hydrology
	21 May 2024	Face to face	The project team invited neighbours to the project to meet and discuss the project, including any concerns or feedback, including any new information available since the previous meeting about potential impacts.		
	Received 12 June 2024 Responded 2 July 2024	Letter emailed to Mayor and CEO, responded to by PMHC	Residents of Fernbank Creek road compiled a letter detailing concerns and questions.	Subject matter concerned: – Odour and wind modelling: Explained process and guidelines, provided available modelling and information from draft report. – Noise: Explained process and guidelines, provided available modelling and information from draft report. – Human error: Explained conservative nature of assessments and modelling. – Mechanical failures: Explained maintenance procedures, redundancy of critical equipment, inspections and monitoring, emergency responses etc. – Environmental factors: Explained flood modelling including climate change scenarios and raised base of WWTP. – Geographical concerns: Explained change of effluent discharge location after earlier consultation with this group, oversized storage capacity. – Road safety: Explained Traffic modelling, road dilapidation survey and traffic management. – Requested measures. These were addressed in the response, but not considered a part of the consultation for the proposal.	Technical Report 8 Air Quality Assessment Technical Report 11 Noise and Vibration Assessment, and Chapter 17 Noise and Vibration Technical Report 7 Traffic and Transport Assessment and Chapter 13, Traffic and Transport Technical Report 1A Water Resources and Quality Assessment, and Chapter 7 Water Quality and Hydrology

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Community Drop-In Session	10 October 2023	Face to face	Community consultation focused around investigations and potential impacts of the project to seek feedback for the development of the EIS.	Seven attendees.	Technical Report 1A Water Resources and Quality Assessment, and Chapter 7 Water Quality and Hydrology
Port Macquarie Community	11 October 2023	Drop-In Session Face to face	Community consultation focused around investigations and potential impacts of the project to seek feedback for the development of the EIS.	Eleven attendees. Concerns raised around flooding and hydrology particularly around Partridge Creek being blocked.	Technical Report 1A Water Resources and Quality Assessment, and Chapter 7 Water Quality and Hydrology
Port Macquarie Community	22 May 2024	Drop-In Session Face to face	Community consultation focused around investigations and potential impacts of the project to seek feedback for the development of the EIS.	Four attendees at the two drop-in sessions held on this day. All were members of Friends of Kooloonbung Creek. They were all primarily interested in the impacts from discharge into Kooloonbung Creek. These concerns were mainly allayed when told that volumes would not change significantly and only gradually as the population grew in the area. Also that water recycling initiatives are likely to help manage any growth in volumes.	Technical Report 1A Water Resources and Quality Assessment, and Chapter 7 Water Quality and Hydrology
Port Macquarie Community	16 July 2024	Drop-In Session Face to face	Two drop-in sessions on this day focused on the Cowarra water Supply Scheme EIS exhibition, with information on the Thrumster project available for viewing.	Two attendees took interest in the information available on the Thrumster proposal, with no concerns noted.	Chapter 5 – Community and Stakeholder Consultation
Friends of Kooloonbung Creek	5 February 2024	In person interview	SIA consultation	Captured in the Key Findings section of the Social Assessment	Social Assessment
Hastings Birdwatchers	5 February 2024	In person interview	SIA consultation	Captured in the Key Findings section of the Social Assessment	Social Assessment
Port Macquarie Horse Racing Club	8 June 2022	Email	Introducing project and seeking meeting.		Chapter 5 – Community and Stakeholder Consultation
	30 June 2022	Online briefing	Initial briefing to describe the proposal.		Chapter 5 – Community and Stakeholder Consultation

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
	4 July 2022	Meeting and onsite walk through	Dialogue to understand project and any on-ground constraints.	Seeking to remain informed and that any construction does not impact operations.	Chapter 5 – Community and Stakeholder Consultation
	13 July 2022	Feedback received	Feedback received from the club.		Chapter 5 – Community and Stakeholder Consultation
Northside Progress Association	Late 2022	Emailed letter	North Side Progress Association wrote asking a range of questions.	– Concerns about the environmental condition of the Hastings River and resulting impacts on the oyster industry – Communication between oyster growers and PMHC – Discharge points to be licenced – Seeking open stakeholder engagement especially with oyster growers – Notification of Councillors re river closures – Location of the proposal – Treated effluent discharge point – Results of dye testing – Environmental sensitivity – Consultation period – Recycled treated effluent and beneficial reuse – What other sites were proposed? – Why has it been kept so quiet? – Is proposed site susceptible to flooding? – What water monitoring does council undertake? – Council plans for promoting oyster farmers	Chapter 2 - Project justification Chapter 3 - Project description Technical Report 1A - Water Resources and Flooding Assessment. Assessment, and Chapter 7 Water Quality and Hydrology Chapter 5 – Community and Stakeholder Consultation
	2 February 2023	Emailed response	PMHC Response to questions.	– A main objective of the WWTP is environmental improvement of the river by preventing overloading of the Port Macquarie WWTP. – Notification process updated after a meeting in April 2021. Modelling results submitted to PMHC in December 2022. – Engagement is mandatory with large infrastructure projects. – Councillors to be briefed on the project and issues. – Ecological, environmental and hydrological assessments are underway. – Explained formal consultation periods.	Chapter 2 - Project justification Chapter 3 - Project description Technical Report 1A - Water Resources and Flooding Assessment., and Chapter 7 Water Quality and Hydrology

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
				– Explained potential for supply of treated recycled water to recycled water network or treated effluent back to Kooloongbung Creek. Wastewater Servicing Plan to be presented to the public for feedback once drafted, with oyster farmers and NSPA consulted. – Described six potential locations. – Project information has been progressively published on PMHC website. – Described water monitoring parameters for Hastings River and Kooloonbung Creek. – Explained current regional promotion focus.	Chapter 5 – Community and Stakeholder Consultation
	7 February 2024	Telephone interview	SIA consultation	Captured in the Key Findings section of the Social Assessment	Technical Report 4- Social Impact Assessment
Landowners	June 2022	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	Letter was sent to residents of Racewyn Close, Tulloch Road, Tuffins Lane, Boundary Street, Lindfield Park Road and Fernbank Creek Road. Responses requested information on odour from the project, and this was replied to referring to a May 2005 odour impact assessment and to upcoming environmental assessments.	Chapter 5 – Community and Stakeholder Consultation Technical Report 8 - Air Quality Impact Assessment
Rural landowners	May 2022	Briefing	Initial briefing to describe the proposal.	Briefing to nearby farmers. Discussed project and included project timing and flooding, coastal wetland protection.	
Lewis Land Group	9 February 2024	In person interview	SIA consultation	Captured in the Key Findings section of the Social Assessment.	Technical Report 4- Social Impact Assessment
Environmental Funerals Pty Ltd	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	
Bunnings Warehouse	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	
Birdon Marine	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Future Innes Lake Golf Course	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	
Port Macquarie Driving Range and Mini Golf	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	
Grow Lush (West Yard)	18 July 2020	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response received	
Port Macquarie Oyster Farmers Association	May 2022	Briefing	Initial briefing to describe the proposal.	Briefing to local oyster farmers. Discussed project and included project timing and flooding, coastal wetland protection.	Chapter 2 - Project justification Chapter 3 - Project description Technical Report 1A Water Resources and Flooding Assessment, and Chapter 7 Water Quality and Hydrology Chapter 5 – Community and Stakeholder Consultation
	15 September 2022	Meeting	Initial meeting to introduce project.	Provide briefing on the project and understand any concerns.	
Hastings Regional Shooting Complex	8 June 2022	Email	Introducing project and seeking meeting.	No response received	Chapter 5 – Community and Stakeholder Consultation
Port Macquarie Radio Controlled Car Club	15 June 2022	Email	Introducing project and seeking meeting.	Meeting arranged	Chapter 5 – Community and Stakeholder Consultation
	21 June 2022	Meeting	Initial meeting to introduce project.	Provide briefing on the project and understand any concerns.	

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Rifle Range & Port Macquarie Radio Controlled Car Club	May 2022	Briefing	Briefing to describe the proposal.	Discussed return effluent routes, services to site, easements, stakeholder engagement and environmental matters.	Chapter 2 - Project justification Chapter 3 - Project description Technical Report 1A Water Resources and Flooding Assessment, and Chapter 7 Water Quality and Hydrology Chapter 5 – Community and Stakeholder Consultation
Cassegrain Winery	18 July 2022	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.		Chapter 3 - Project description
	19 July 2022	Emailed response	Seeking further information.	Seeking detail on potential connect location, pumping requirements, permissible uses, costs and ongoing requirements.	
Douglas Vale Historic Homestead & Vineyard	18 July 2022	Letter	Letter seeking expressions of interest for potential reuse of treated effluent.	No response.	
Airservices Australia	17 June 2024	Email	Email to Airport Development.	Airservices Australia recommend that the application is submitted to the airport. The airport will then refer the proposal to Airservices Australia and CASA if required. Airservices require coordinates/exact locations to assess developments and cranes. We also require dates and timeframes for the proposed works.	Technical Report 19 - Aviation Impact Assessment
Port Macquarie Airport	22 April 2024	Email	Response from Airport Business Manager and Airport Operation Co-Ordinator at Port Macquarie Airport.	– The report needs to refer to the Biocert agreement lands. – The report needs to refer to the proposed update of the Master Plan. – The report should go into more detail on the proposed procedure for the crane works at the runway end and parallel to the runway. – Significant levels of planning and communication with the airport will be required during the construction phase and will include (but not limited to) the time of day when crane can be active.	Technical Report 19 - Aviation Impact Assessment

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
				– Crane operations that infringe airport surfaces will be severely restricted in operating times and heights. Crane operations are not permitted without significant operational restrictions or potential closure of the runway (i.e. night works). – Port Macquarie Airport is a fully security-controlled airport. Access to all airside areas of the airport land is for works will need to be managed under the Aviation Transport Security Regulations and require the establishment of specific airside exclusion zones to be approved by The Department of Home Affairs.	
Crown Lands NSW	16 May 2024	Email	Letter seeking input to EIS.	GHD wrote to Crown Lands describing the project and seeking input to the EIS.	Chapter 18 – Land use and property
	31 May 2024	Email	Consultation regarding proximity to Crown Land.	Return letter received from Crown Lands. Transfer of (unnamed) road required to Council's management. Consultation required with nearby occupiers of Crown Land – being Port Macquarie Race Club and Police NSW.	Chapter 18 – Land use and property
Department of Health	16 May 2024	Letter	Letter seeking input to EIS.	GHD wrote to the Department of Health describing the project and seeking input to the EIS.	Technical Report 12 – Health Impact Assessment
DPE – Biodiversity Conservation Division (now DCCEEW NSW)	16 May 2024	Letter	Letter seeking input to EIS.	GHD wrote to the DCCEEW NSW describing the project and seeking input to the EIS.	Technical Report 5 – Biodiversity Development Assessment Report
DPI Agriculture	16 May 2024	Letter	Project overview and advice of SSI provided.	Input was previously provided to the SEARs requesting: – Details of any proposed effluent reuse on agricultural land or for agricultural production – Identify any agricultural land uses along the route of the pipeline and detail the potential impacts on – These agricultural land uses as a result of pipeline construction or any ongoing operational requirements – A biosecurity risk assessment outlining the likely plant, animal, and community risks to agricultural land uses that may result from the construction of the environmental discharge pipeline Option 2 or ongoing operational requirements should be prepared	Appendix A SEARs
	16 May 2024	Letter	Letter seeking input to EIS.	GHD wrote to the Department of Fisheries describing the project and seeking input to the EIS.	

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
Department of Regional NSW - DPI Fisheries			Meeting with DPI Shellfish Program Manager NSW Food Authority.	Discussion of project and associated water quality modelling, options for treated effluent discharge points, quality, location etc. Concerns from oyster growers. Dye tracing study. Communication of activities.	Technical Report 1A – Water Resource and Flooding Assessment Technical Report 1B – Operational Water Quality Impact Assessment
Environment Protection Authority (EPA)	30 April 2024	Meeting	Discussion of emergency discharge options assessment and decision around discharge location	– Discussed discharge Option Assessment. – Discharge location changed to Kooloonbung Creek. – Critical elements to remain above probably maximum flood level. – During 1-100 Flood Event - Flood level will be 500 mm below the Storm storage pond's wall, and the sandplain will be under water all the way to the Hastings River. – EPA to inform PMHC if any emergency discharge options were categorically unacceptable to EPA to reduce effort required in further assessment.	Technical Report 1A – Water Resource and Flooding Assessment Technical Report 1B – Operational Water Quality Impact Assessment Chapter 7 – Water quality and hydrology
	1 May 2024	Email	Email describing project, advising of SSI status and seeking input to EIS	GHD wrote to the EPA describing the project and seeking input to the EIS.	Appendix A SEARS
NSW Food Authority	16 May 2024	Email	Email describing project, advising of SSI status and seeking input to EIS	GHD wrote to the NSW Food Authority describing the project and seeking input to the EIS.	Appendix A SEARS
	30 May 2024		Email response	Response received acknowledging receipt of the email.	
NSW State Emergency Service (SES)	16 May 2024	Email	Email describing project, advising of SSI status and seeking input to EIS	GHD wrote to the NSW State Emergency Service describing the project and seeking input to the EIS.	
	30 May 2024	Email	Response providing recommendations for the EIS	Consideration of flooding issues to be undertaken in accordance with the requirements of NSW Government's Flood Prone Land Policy. EIS should include: – Consideration of the flood risks at the site, including risk to life and property during both the construction and operation phases of the development, including up to the Probable Maximum Flood (PMF) and under climate change conditions.	Technical Report 1A – Water Resource and Flooding Assessment Chapter 7 Water quality and hydrology

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
				– Preparation of a Flood Risk Impact Assessment addressing: • Impact of floodwater on the infrastructure • Impact of the proposal (including the fill and access road changes) on flood flow and neighbouring properties • Impact under climate change conditions • Modelling to understand duration and extent of flooding In addition, the SES: – Supports the proposal to create all-weather flood free access and recommend seeking advice from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) with regard to road-raising and any fill. – Recommends the development of robust, thorough, and detailed flood emergency management plans to satisfy the need for ongoing worker awareness and the importance of early evacuation when the development is being constructed and once it is complete. – Highlights the need for flood resilient site design and supporting infrastructure. Where possible, critical infrastructure should be located above the PMF, to minimise disruption to essential services and reduce risks of exposing persons onsite or downstream to polluted floodwater.	
Port Macquarie Base Hospital	24/07/2024	Meeting in person	Consulted regarding the project.		Chapter 5 – Community and Stakeholder Consultation.
Rural Fire Service	22 May 2024	Meeting	Consulted regarding bushfire assessment and APZ at the WWTP site.	CEMP needs to define: – The measure to prevent ignitions relating to underground power and possible peat fire risk. – Ignition sources need to be identified including hot works or if any peat soil is open to any exposure. Accidental ignitions should be mitigated. – Operations plan. Chlorine storage needs to be compliant and segregated from possible sources of ignition and other hazardous materials on site. Large skip bins for storage, could be enclosed or not to be stored near hazardous materials. Site to be kept clean. – APZ, elevated WWTP needs to have a trafficable /defendable area to protect the assets.	Technical Report 14 – Bushfire Assessment Report

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
				– There should be signage for water use of firefighting. To eliminate use/spreading of any contaminated water. – Suitable contact (24hrs) for advice as to what open water storage is available for use if required.	
SafeWork NSW	-	-	Notification of SafeWork NSW is required by Council due to the quantity of chlorine expected to be used during operation. Consultation to be undertaken prior to construction.	-	Technical Report 15 - Preliminary Hazard Analysis
Essential Energy	1 May 2024	Letter	Letter to Essential Energy seeking input to EIS.	GHD wrote to Essential Energy describing the project and seeking input to the EIS.	
Transport for NSW	17 May 2024	Email	Email to TfNSW seeking input to EIS.	GHD emailed Transport for NSW describing the project and seeking input to the EIS.	Technical Report 7 - Traffic and transport assessment.
	20 June 2024	Email	Email from TfNSW providing input to the Traffic Impact Assessment required for the EIS.	The Transport Impact Assessment should include: – Identification of all types of heavy and oversize/over mass vehicles to be used by the project. – A logistics route analysis. – A map of the surrounding road network identifying the site access, nearby accesses, intersections and transport related facilities. – A map of the proposed transport route/s identifying all public roads proposed to obtain access from the classified (State) road/s to the development site. – The total impact of existing and proposed development on the road network with consideration for a 10-year horizon. – Capacity analysis to identify an acceptable Level of Service at intersections with the classified (State) road/s, and where relevant, analysis of any other intersections along the proposed transport route/s.	Technical Report 7 - Traffic and Transport assessment.

Stakeholder	Date	Type	Details	Response Received Summary	Addressed in EIS
				– A review of crash data along the identified transport route/s for the most recent 5-year reporting period and an assessment of road safety along the proposed transport route/s considering the safe systems principles adopted under Future Transport 2056. – Strategic (2D) design drawings of all proposed road works and the site access demonstrating scope, estimated cost and constructability of works required to mitigate the impacts of the development on road safety, traffic efficiency and the integrity of transport infrastructure. Works must be appropriately designed for the existing posted speed limit. – Site plan demonstrating site access, internal manoeuvring, servicing and parking areas consistent with the relevant parts of AS2890 and Council requirements. – Details of measures to address impacts and/or provide connections for public transport services and active transport modes, such as, public and school bus services, walking and cycling. – Details of measures to ameliorate the impacts of road traffic noise, dust, and/or glare generated along the proposed transport route/s. – Details of any Traffic Management Plan (TMP) proposed to address the construction and operation phases of the proposed development. – Community consultation measures proposed for peak periods.	

Appendix D

Summary of Mitigation Measures

Table D.1 Summary of Mitigation Measures

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
Water Quality and Hydrology				
WQ1	Surface water, geomorphology	Implementation of a CEMP, a SWMP, an Acid Sulfate Soils Management Plan, and an ESCP in accordance with the Blue Book. This includes the staging of the WWTP, recycled water facility and pipeline construction into manageable portions.	Council / contractor	Pre-construction
WQ2	Soil and Water	During construction, collection of onsite runoff in established surface water drains and sediment basins.	Council/ contractor	Pre-construction and construction
WQ3	Surface water	A Pollution Incidence Response Management Plan (PIRMP) would be implemented to manage operational impacts, including the management of emergency leaks and bursts.	Contractor	Construction
WQ4	Water quality	Baseline water quality monitoring will be undertaken targeting parameters related to potential erosion and sedimentation during construction. Matching datasets would be collected during and following construction and compared to the baseline data. See Section 1.6.1 for more details.	Council/ contractor	Pre-construction, construction and post-construction
WQ5	Water quality	Water quality monitoring will continue to be undertaken by Council in receiving waters as outlined in Section 1.6.1.	Council	Operation
WQ6	Water quality	Identify opportunities for reuse of recycled water, which would reduce the volume of effluent discharged to the receiving waters.	Council	Anytime
WQ7	Flooding	A Flood Management Plan (FMP) to be developed as part of the SWMP or CEMP.	Council / contractor	Pre-construction
WQ8	Flooding	Flood proofing to be provided for all parts of the building up to FPL4. Preferably, this is to be achieved by filling the portion of the site containing the critical infrastructure; however, alternative methods may also be considered. These may include raise areas internal to building, bunding or local raising.	Council / contractor	Construction and Operation
WQ9	Flooding	Flood Proofing to be provided to all aspects of the proposed development up to FPL3.	Council / contractor	Construction and Operation
WQ10	Flooding	Compile a site Flood Emergence Response Plan which documents the responsible staff, flood characteristics, flood warnings, flood response including evacuation, emergency contacts, and flood recovery.	Council / contractor	Operation
WQ11	Geomorphology	An OEMP is also required to stipulate ongoing inspection requirements of pipeline corridors / discharge points after rainfall and flood events to identify any areas of erosion, off-site sedimentation, and poor vegetation establishment.	Council / contractor	Operation

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
WQ12	Groundwater	A trigger action response plan (TARP) approach will be implemented to minimise and respond to any groundwater interception such that impacts to existing groundwater are minimised.	Council / contractor	Pre-construction and Construction
WQ13	Groundwater	A trigger action response plan (TARP) approach will be implemented to minimise and respond to any groundwater interception such that impacts to existing groundwater are minimised. The Emergency Storage Pond will be constructed with an impermeable HDPE liner.	Council / contractor	Construction
WQ14	Groundwater	Implementation of an Operation Environment Management Plan which includes the implementation of typical control measures such as bunding, safely storing hazardous materials, and visual inspection of the works area and waterways, as well as pipeline maintenance. A Pollution Incidence Response Management Plan can also be utilized to manage operational impacts.	Council / contractor	Operation
Aboriginal Heritage				
AH1	Consultation with RAPs	The Proponent should continue to consult with the RAPs in regard to the project in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010*. Consultation may include, but is not limited to: – Finalisation of ACHA – Participation in the proposed test excavation/ community collection program – Determination of the long-term management of recovered artefacts under a care and control agreement – Project updates – Unexpected finds Project updates should be sent to all RAPs every 6 months at a minimum to ensure the consultation associated with this ACHA remains active.	Council/ Contractor	Pre-construction/ construction post construction
AH2	Preparation of an Aboriginal Cultural Heritage Management Plan	The Proponent should develop an Aboriginal Cultural Heritage Management Plan (ACHMP) for the project that includes: – The outcomes of the ACHA. – Measures agreed with the Traditional Owners for the protection and management of both tangible and intangible cultural heritage values and mitigation of impacts. – Agreed protocols for the identification, protection and management of any cultural heritage values discovered during the project. – Delivery of cultural awareness training to project staff and contractors to ensure that CHMP measures are implemented. RAPs should be included within the development of the ACHMP.	Council	Pre-construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
AH3	Buffer zones	No-go buffer zone extending 10 m must be established through temporary fencing around E1 (AHIMS ID# 30-3-0321) and a 5 m no go buffer zone established through temporary fencing around Wattoo 2 (AHIMS ID# 30-3-0205) prior to the commencement of works to ensure avoidance and prevention of any indirect impacts during works. If potential impacts to the sites cannot be avoided, the sites should be subject to community collection prior to the commencement of works and would require a subsequent ASIRF submission to update the site status in AHIMS.	Contractor	Pre-construction
AH4	Impacts to identified AHIM sites within, or in proximity, to the project area	An area of PAD associated with Thrumster PAD 1 (AHIMS ID# 30-3-0390) has been identified within the proposed WWTP and associated laydown area. A test excavation of the PAD identified in Figure 7 in Technical Report 2 - Aboriginal Cultural Heritage Assessment should be undertaken to determine the nature and extent of the PAD. The test excavation program should be undertaken prior to any proposed impacts. The Test Excavation Methodology has been prepared, and a copy of this, as reviewed by the RAPs is provided in Appendix 5 of the Technical Report 2 - Aboriginal Cultural Heritage Assessment. A program of community collection is also required at the site to recover surface artefacts present and should be undertaken prior to the proposed impacts.	Council	Pre-construction
AH5		The long-term management of any surface or subsurface artefacts salvaged during the test excavation of Thrumster PAD 1 (AHIMS ID# 30-3-0390) should be formalised in a care and control agreement as determined by the RAPs. Where requested by the RAPs, the feasibility of on-Country reburial of artefacts within a conservation area should be considered by the Proponent.	Council	Construction/ Post-construction
AH6		The desktop assessment of Thrumster Sewerage 1 (AHIMS ID# 30-3-0405) and Partridge Creek Swamp (AHIMS ID# 30-3-0121) have determined that artefacts associated with both sites have previously been salvaged/collected. Aboriginal Site Impact Recording Forms should be submitted to provide details of the ACHA findings and to update the site status of both sites.	Council	Pre-construction
AH7	Staff induction	All workers and contractors associated with the works within the project area should be inducted, so they are made aware of their obligations under the SEARs prior to, during and after works.	Contractor	Construction
AH8	Confidentiality	The Proponent should not publicise the location of Aboriginal cultural heritage sites or other cultural information without prior consent from the Aboriginal community. This includes the public distribution of any mapping, AHIMS data and/or cultural information contained within this report.	Council	Pre-construction/ construction
AH9	Unexpected finds	In the event of unexpected finds, notification is required under section 89A of the NPW Act. During construction, all work in the area must cease immediately and: – The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. – Contact Niche immediately. No further action is to be undertaken until archaeologists have assessed the finds.	Contractor	Construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
AH10	Human remains	In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact must cease immediately and: – The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. – The NSW Police must be contacted immediately. – No further action is to be undertaken until the NSW Police provide written notification. – If the skeletal remains are identified as Aboriginal, the Proponent or their agent must contact: • Heritage NSW's Enviroline on 131 555 and representatives of the RAPs. • No works are to continue until Heritage NSW provides written notification.	Contractor	Construction
Non-Aboriginal Heritage				
HH1	Avoidance of harm to "Farm Dwelling and Shed" site.	If possible, works should be amended to avoid these structures. If not possible to do so, it is recommended that archival recording of the structure is undertaken prior to construction.	Contractor	Pre-construction
HH2	Location of project works	This assessment is confined to within the Subject Area defined in this report. The parameters of project works should not extend beyond these boundaries. Should planned works locations alter, further assessment of the potential impacts would be required.	Contractor	Pre-construction / Construction
HH3	Stop work in case of unexpected archaeological finds	In the event that unexpected historical heritage, including archaeological relics, is discovered during proposed works, all work in the immediate area will cease. A qualified archaeologist and, if necessary, Heritage NSW (in accordance with section 146 of the Heritage Act) should be contacted to assess the significance and advise on further requirements prior to the recommencement of works.	Contractor	Construction
Social				
SE1	Amenity and access impacts for local communities and landholders	A Communication Plan (CP) will be prepared and implemented as part of the Construction Environmental Management Plan (CEMP) to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): – Mechanisms to provide details and timing of proposed activities to affected stakeholders, including changed traffic and access conditions. – Toll free number and email address for enquiries and complaints. – How the project webpage will be maintained for the duration of the proposal. – A complaint's handling procedure. – Consultation activities to be carried out.	Construction contractor	Pre-construction / construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
SE2		Council will continue to consult with the community until completion of the project. This will include approaches to: – Consult with landowners, landholders, emergency services, schools, aged care facilities, businesses, community groups and community and recreation facilities in close proximity to the project to notify them about the project design, construction activities and timing of construction works. During operation of the project, this may include managing responses to enquiries and complaints and providing accurate and accessible information. – Identify and engage with vulnerable persons that might be affected by the proposal. – Communicate information about potential access changes and delays, including targeted communication to affected local stakeholders (e.g., affected residents, businesses, emergency services, bus services, community and recreation facilities).	Council	Pre-construction / construction / operation
S3		Property owners and occupants affected by acquisition will be consulted, and acquisition will be undertaken, in accordance the *Land Acquisition (Just Terms Compensation) Act 1991* and in accordance with the land acquisition reforms announced by the NSW Government in 2016.	Council	Pre-construction
SE4	Impacts on community and recreational facilities	Access to community facilities and infrastructure will be maintained during construction as far as practicable. Where alternate access arrangements need to be made, including changes to access for public and active transport facilities, these will be developed in consultation with relevant stakeholders and service providers, and communicated to users in accordance with the Communication Plan. Any changes to access arrangements will be managed in accordance with the Traffic and Access Management Plan.	Council Construction contractor	Pre-construction / construction
SE5		Council will continue to consult with relevant key stakeholders in relation to community and recreation infrastructure with the potential to be directly affected (by the project's land requirements) and/or indirectly affected (for example, as a result of amenity impacts or access changes). Consultation will be undertaken in accordance with the Communication Plan and will assist with identifying measures to minimise the potential impacts of the project on community and recreation infrastructure as far as possible. Stakeholders to be consulted will include, but not be limited to, Hastings Birdwatchers, Friends of Kooloonbung Creek, Port Macquarie Airport, Port Macquarie Racecourse, Port Macquarie Rifle Club, Newman Senior Technical College, Glenfern Lifestyle Community, emergency services, and residential neighbours.	Council	Pre-construction / construction
SE6	Local and First Nation employment and business opportunities	Council will maximise the participation of local, regional and First Nation businesses in the project, such as: – Preferential local and First Nation participation inclusions in tender documents which outline the sub-contracting and local employment goals that construction contractors would need to deliver – Promotion of supply and employment opportunities through local industry channels and employment organisations	Council Construction contractor	Pre-construction / construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		– Investigation of partnerships with local educational institutions and universities to support local residents to fill jobs during operation – Explore opportunities to commission artwork from the local Aboriginal artists in design of the WWTP and RWTP to support interpretation and celebration of local Aboriginal community and culture.		
Terrestrial Biodiversity				
B1	Biodiversity offsets	A total of 105 ecosystems credits and 895 species credits are required for the project in accordance with the Biodiversity Offset Scheme. Full details of the required ecosystem and species credits for the project are summarised in Table 37 and Table 38 in Technical Report 5 – Biodiversity Development Assessment Report.	Council	Pre-construction
B2	General	All workers are to be provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.	Construction contractor	Prior to clearing / construction works
B3		A Vegetation Management Plan (VMP) will be required for a duration of five years in order to guide the restoration or rehabilitation of the SRM and RWM and construction compounds. All areas of the SRM and RWM shall be revegetated with shallow rooted species of the PCT mapped in the area by this BDAR. Where exotic vegetation is indicated in this BDAR, the restoration may be with suitable native species of a local PCT or suitable exotic species that are not listed on the High Threat Weed list ((NSW DPE, 2022) as per Dorrough, Oliver and Wall (2018)). If areas of nearby conservation lands are impacted, they shall be added to the VMP.	Qualified ecologist or suitable council representative	Prior to clearing/ construction works/ up to and including five years beyond construction completion.
B5		The contact details for the nearest Koala Hospital shall be kept at each site office during construction.	Construction contractor	Prior to clearing/ construction works and during construction works.
B6	Vegetation clearing	Limit disturbance of vegetation to the minimum necessary to undertake the project. Where possible in the implementation stage, undertake further refinement of the infrastructure such as the SRM and RWM to avoid impacts to biodiversity values including native vegetation, particularly Koala feed trees of the species Forest Red Gum (*Eucalyptus tereticornis*), Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) Tallowwood (*E. microcorys*) and Bastard Mahogany (*E. paterntinervis (*a hybrid of *E. robusta and E. tereticornis*)).	Prior to works commencing.	Construction contractor and Project Ecologist
B7		Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Prior to works commencing	Construction contractor and Project Ecologist

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
B8		Signage should be placed at the entrance to sites warning of the potential of Koala's to be present. The signs should contain details of the nearest Koala Hospital to facilitate prompt reporting of sick or injured Koalas.	Prior to works commencing	Construction contractor and Project Ecologist
B9		Native vegetation to be retained on site is to be protected in accordance with Development Control Plan 2014 Guidelines – Tree Preservation and Native Vegetation Management Guidelines (Section 6) and the Australian B9Standard AS4970-2009 – Protection of Trees on Development Sites.	Construction contractor and Project Ecologist	Prior to works commencing
B10		Stockpiles of soil, vegetation etc should be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Construction contractor	Prior to clearing/ construction works.
B11		Sedimentation and erosion control measures including silt fencing, sediment traps, etc. to prevent sediment-laden stormwater exiting the construction areas and to prevent scouring and erosion of land beyond the development footprint. All erosion and sediment control measures are to be constructed and installed in accordance with relevant guidelines, are to be regularly maintained for the duration of the construction period and are to be carefully removed at completion of works. Sediment and erosion control measures should follow recommendations of The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). Dust suppression measures to ensure dust deposition beyond the construction area is minimised.	Construction contractor	Prior to clearing/ construction works.
B12		In line with the Area 13 Koala KPOM (Figure 72), where koala food trees are removed, compensation should be provided by way of a minimum of four replacement trees (that are also preferred koala food trees) for every preferred koala food tree that is to be removed, such trees to be planted within a 100 m radius of those to be removed, and shall comply with Part 3(G)(iv) of the plan. Pre and post clearing reports are to be submitted to Council by the project ecologist for any significant vegetation removal.	Construction contractor and qualified ecologist	During construction works
B13	Introduction of weeds and pathogens	Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor.	Construction contractor	Prior to clearing/ construction works/ project lifespan
B14		The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings.	Construction contractor	Prior to clearing/ construction works

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		All priority weeds identified on the site will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2016* and Council's relevant Weed Control Manuals. Due to the sensitive nature of the lands to be impacted (surrounding wetland TECs and the possible contamination in the water treatment facilities by herbicide chemicals), weed control is not to involve the use of herbicides. Ongoing weed management shall be performed for at least five years following the project. All priority and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. Disposal must be documented, and evidence of appropriate disposal must be kept. Waste management areas and processes are to be clearly identified.		
B15		All machinery entering the site must be appropriately washed down and disinfected prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*), Myrtle Rust (*Austropuccinia psidii*) and Amphbian Chytrid Fungus (*Batrachochytrium dendrobatidis*) in accordance with the NSW hygiene guidelines for Phytophthora, Myrtle Rust and Amphibian Chytrid Fungus (NSW DPIE, 2020) for hygiene control.	Construction contractor	Prior to any plant or machinery being brought onto the site
B16		Incorporate control measures in the design of the project to limit the spread of weed propagules downstream of subject land. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds.	Construction contractor	Prior to clearing/ throughout construction works
B17		Construction activities will be managed through standard practices to avoid further spread of weeds and pests such as ensuring equipment and clothing are free of soil and vegetative matter prior to being brought to site, establishing vehicle cleaning stations with high pressure water hoses and brushes to remove soils, weeds and seeds; conducting regular vehicle inspections and restricting vehicle access zones and designated entry; ensure erosion controls are in place to minimise the spread of weed from run off (NSW Transport 2019).	Construction contractor	Prior to clearing/ throughout construction works
B18		Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor.	Construction contractor	Prior to clearing/ construction works/project lifespan
B19	Removal of fauna habitat	Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECC, 2008b).	Construction contractor	Prior to clearing throughout construction works

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
B20		Staged vegetation clearing shall be performed, commencing with the exotic dominated vegetation to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury. Where higher condition vegetation is to be cleared, this shall be performed such that fauna species are directed away from threats such as roads and developed areas. Staged clearing should avoid creating an 'island' of habitat that is isolated from adjoining habitat.	Construction contractor	During clearing phase
B21		Pre-clearance fauna surveys, undertaken in accordance with the following procedure: – Land shall be broken into small units to stage the clearing activities such that a pre-clearing survey can clear the area with minimal time for mobile fauna (such as the Eastern Grass Owl, Giant Dragonfly and Swift Parrot) to re-establish within an area. The pre-clearing survey should be performed with the intention of flushing all fauna from the unit of land to be cleared within the Subject Land. Habitat features such as logs should also be checked. – Pre-clearing surveys shall ensure that habitat features, such as hollow-bearing trees are clearly identified.	Qualified ecologist	Prior to and during clearing works
B22		Clearing of hollow-bearing trees procedure. If possible, tree hollows should be inspected directly prior to felling. Before felling, the HBTs should be tapped along the trunk by heavy machinery to substantially shake the tree, with the intention of causing fauna to exit. Shaking should stop if fauna is observed to be leaving the tree. Where safe to do so, take the HBT down in stages, beginning with no-hollow bearing branches before moving towards the hollow. Where safe to do so, hollows should be cut around such that they remain intact and can be gently lowered to the ground. Hollows should be thoroughly checked following felling to ensure no fauna have become trapped or injured during operations.	Qualified ecologist and construction contractor	Prior to and during clearing works
B23		Trees should be felled into an already disturbed area to avoid damaging adjacent vegetation.	Qualified ecologist and construction contractor	During clearing works
B24		Consistent with the Area13 KPoM, the clearing of native vegetation and/or earthworks or for any other purpose must be temporarily suspended within a range of 25 m from any tree that is occupied by a Koala and must not resume until the koala has moved from the tree of its own volition. If a Koala does not voluntarily move on, it is to be removed by Port Macquarie Koala Hospital staff.	Qualified ecologist	Prior to and during clearing works
B25		Where appropriate, native vegetation cleared from the Subject Land should be moved into the retained vegetation as habitat or mulched for re-use on the site, to stabilise bare ground. Hollows may be reused elsewhere on site if suitable.	Construction contractor	During clearing phase
B26		A suitably qualified and appropriately licenced ecologist is to be present during clearing of all native vegetation to ensure felling of trees is limited to the least extent and carried out in an appropriate manner, and that any fauna present can be rescued and relocated. Appropriate fauna 'capture and release' techniques will be implemented.	Qualified ecologist	During clearing phase

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
B27		A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. FAWNA or Koala Conservation Hospital Port Macquarie) should be made aware of operations in case any injured fauna is found.	Qualified ecologist	During clearing phase
B28		Security lighting within the construction site is to be minimised and where required, is to be oriented such that light spill beyond the Subject Land and into patches of retained vegetation is minimised.	Construction contractor	During clearing phase
B29		A reduced speed limit should be implemented in the development area, accompanied by appropriate signage indicating the speed limit within the Subject Land. The speed limit determined should be appropriate for the area and potential risk to Koalas from vehicle strike.	Construction contractor	Prior to clearing/ construction works/up to and project lifespan
B30		All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the *NSW Prevention of Cruelty to Animals Act 1979*, including: – Australian code of practice for the care of animals for scientific purposes (NHMRC, 2013). – Code of practice for the welfare of wildlife during rehabilitation (Victoria, 2001). – Animal ethics considerations and protocols outlined in this document. If the project ecologist considers an animal is at risk of injury or undue stress, it is to be gently directed into secure adjoining habitat. Where deemed necessary by the project ecologist, the animal may be required to be captured and released. Capture and release operations will proceed via the following protocols: – All construction activities that are considered by the project ecologist be likely to increase the risk of injury, mortality or stress to the animal will be halted until the animal has been removed, which will be enforced with the co-operation of the Contractor. Construction activities that do not contribute to the risk of injury, mortality or stress to the animal can continue (as determined by the project ecologist). – Only qualified ecologists or wildlife carers are authorised to handle animals. – Animals will be captured (if required) by the project ecologist using a safe and ethical technique, as is appropriate for the particular species. Native animals that are unable to depart of their own accord will be captured and held in a receptacle appropriate for that species until release. All captive-held animals will be provided with food, water and warmth as is appropriate for the species. Each receptacle will only hold one animal at a time and will be cleaned and disinfected between use to avoid the spread of disease. Any fauna relocated from trees, shrubs or other areas would be recorded.	Qualified ecologist	During clearing phase
B31		The construction contractor is to contact the Project ecologist for advice if any unexpected fauna is found during the construction period (i.e. following clearing of native vegetation when the Project ecologist is no longer on site).	Construction contractor	During clearing phase

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
B32	Water quality and aquatic habitats	Erosion and sediment control plans should be prepared in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase.	Construction contractor	Prior to construction commencing
B33		Soil stockpiles are to be placed away from, and ideally downslope of, receiving water bodies and drainage lines.	Construction contractor	During clearing phase
B34		Erosion and sediment control controls would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality.	Construction contractor	Weekly during construction phase or after any significant rainfall event
B35		Stabilised surfaces should be reinstated as quickly as practicable after construction.	Construction contractor	Immediately following clearing
B36		Appropriate speeds are to be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike.	Construction contractor	During construction
B37		Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value.	Construction contractor	Prior to clearing / construction works
B38		All stockpiled material should be stored in bunded areas and, where practicable, kept away from waterways to avoid sediment or contaminants entering the waterway.	Construction contractor	During construction
B39		Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.	Construction contractor	During construction
Aquatic Ecology				
AE1	Trenching	The following recommendations will be considered to minimise impacts to aquatic and riparian habitats: – Any creek channels that require trenching to install the various mains will be re-instated to their original form or long-term stable condition in instances where this cannot be achieved or is undesirable. – Excavated bank and bed material will be stored (for return to the site at the completion of excavation) away from the waterway to minimise potential sedimentation of downstream habitats. – The backfilling of excavated creek banks or beds will use clean fill or the excavated sediments, ensuring adequate topsoil is maintained for revegetation works.	Contractor	Construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		– Where creek bank vegetation is removed or damaged as part of trenching, their rehabilitation will be incorporated into the project Vegetation Management Plan (VMP). – Where established assemblages of native macrophytes are removed, weed management of the area should be included in the project VMP to minimise opportunistic replacement by exotic species. This may include monitoring via macrophyte mapping.		
AE2	Fish passage	Temporary barriers will be in place for less than six to twelve months (Fairfull 2013). Any barrier will be avoided in areas mapped as key fish habitat. Currently, barriers for construction are expected to be in place only if required and for a short period of time. Where temporary barriers are required to be in place for over 3 days, water quality monitoring should be considered upstream and downstream of the barrier to alert to potential detrimental habitat impacts for fauna in the vicinity.	Contractor	Construction
AE3		Where excavation works requiring bunding are to be conducted through waterways, adequate alternate fish passage will be provided for works where fish passage will be blocked for serval weeks or more due to construction. The use of HDD has been implemented as a less invasive methodology in most areas of KFH to avoid the obstruction of fish passage at these more sensitive habitats.	Contractor	Construction
AE4		Where possible, in-stream works will be staged to avoid blocking the entire waterway. If the entire waterway must be blocked, an alternative flow and passage channel should be considered to maintain natural flow conditions of the stream for the duration of construction works.	Contractor	Construction
AE5		Temporary in-stream structures will be installed during periods of low flow, with each structure to have a management plan included in the CEMP for high flow events to prevent erosion and sedimentation.	Contractor	Construction
AE6		Temporary barriers will not be comprised of loose, imported earth fill, with all material to be fully enclosed by geotextile, sheet piling or similar to prevent erosion and sedimentation.	Contractor	Construction
AE7	Dewatering	Prior to the commencement of dewatering inside any temporary barriers, a Dewatering Management Plan (DMP) that includes for translocation of any native fauna and management of exotic species will be prepared and undertaken by (or under the strict supervision of a suitable qualified aquatic ecologists). The DMP is required to address disposal of water, which will include the NSW DPI requirement that de-watering of a temporary in-stream structure will be pumped at least 30 metres from the waterway and not re-enter the waterway. A pre-works inspection will also be conducted by a qualified Aquatic Ecologist. Adequate sediment and erosion control structures will be erected to minimise sedimentation impacts.	Contractor	Construction
AE8	Water quality monitoring	Visual water quality monitoring will be implemented along the proposed HDD footprint during construction to alert to collapse of the creek bed. Council has an existing water quality monitoring program which would be continued. The protocols for management of water and dispersing bed sediments if the case of a collapse must be included in the projects Sediment and Erosion Management Plan.	Council/ Contractor	Construction and operation
AE9	Acid Sulfate Soil	An appropriate Acid Sulfate Soils Management Plan must be prepared and implemented to prevent and minimise potential exposure of Acid Sulfate Soils to adjacent sensitive habitats.	Contractor	Pre-construction, construction and operation

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
A10	Onsite Water, Sediment and Erosion Management	Prepare an implement a Sediment and Erosion Management Plan that includes: – Placement of alternative routes at stable sections of watercourses to minimise additional erosion. – On-site water management to reduce sedimentation and potential pollution of watercourses at both at trenching sites. – Management of stormwater and creek water during periods of high flow, considering the presence of flood prone areas within and in the vicinity of the Study Area. – Installing site drainage infrastructure to lead stormwater away from site, particularly where stormwater may exacerbate soil erosion and pollution of waterways. – Diverting run-on water from disturbance works occurring on upslope land, using non-erosive methods. – Installing protective measures to prevent sheet erosion where large portions of soil will be exposed. These will also need to be located in location where they are not at risk during flooding. – Implementing water management controls as stated above to prevent sedimentation and erosion resulting from movement of water. – Construction of sediment filters or sediment retention traps where appropriate, particularly below fill batters near waterways.	Contractor	Pre-construction, construction and operation
A11	General construction	A CEMP is to be prepared and implemented for the project. The following will be included: – Adequately manage and store waste products and material in designated areas on the site. To prevent injury caused by ingestion or entanglement in debris, an adequate Waste Management Plan (WMP) should be prepared for the project. – All construction work locations are to have designated litter disposal bins to avoid potential for aquatic debris, included in the project WMP. – All machinery should be routinely checked for leaks, with an emergency spill kit to be kept on site at all times. All staff are to be made aware of the location of the spill kit and trained in its use. – All fuels and hydrocarbon-based products are to be stored in a sealed bunded area(s) at least 30 metres away from the water's edge. All vehicles and machinery should not enter the waterway except where absolutely necessary for installation of pipeline. Where they are required to enter the waterway a washdown procedure before doing so should be implemented.	Contractor	Pre-construction / construction
A12	Unexpected encounter procedure	An appropriate unexpected encounter procedure will be included in the project's Flora and Fauna Management Plan (FFMP).	Contractor	Pre-construction, construction and operation
Traffic and Transport				
T1	Design	The design will continue to be refined to avoid or minimise on the surrounding road and transport network and property access, as far as reasonably practicable.	Council	Pre-construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
T2	Construction traffic	A traffic management plan (TMP) will be developed and implemented as part of the construction environmental management plan. The TMP is to include as a minimum: – Confirmation of haulage routes and access point – Measures to maintain access and capacity to existing roads – Measures to minimise conflicts with pedestrians and cyclists – Traffic control measures including signage at appropriate locations to notify road users of increase traffic volumes – A response plan for any construction related traffic incidents – Consultant with emergency to ensure that procedures are in place to maintain safe, priority access for emergency vehicles – Relevant traffic safety measures including driver induction, training, safety measures and protocols	Contractor	Pre-construction, Construction
T3	Induction	All personnel will be inducted on the requirements of the TMP.	Contractor	Pre-construction, Construction
T4	Temporary lane/road closure	Road closures will be undertaken with the approval of the appropriate road authority and under the relevant road occupancy licence to be obtained prior to construction. Where feasible, road closures will be planned outside of the traffic peak to minimise the impact on the road network.	Contractor	Pre-construction, Construction
T5	Car parking	Sufficient car parking spaces will be provided within the project construction site and compounds to accommodate anticipated construction parking requirements.	Contractor	Construction
T6	Road safety – driver related	A Code of Conduct applicable to all construction workers will be developed and implemented which will define acceptable driver behaviour. The purpose of the Code of Conduct is to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised. The Code of Conduct will be developed as part of a wider suite of documents under work health and safety requirements.	Contractor	Pre-construction, construction
T7	Community and stakeholder consultation	Community and stakeholder communication strategies will be established and implemented to notify the affected communities, visitors, emergency services and relevant road authorities in advance of any disruptions to traffic, anticipated delays, disruptions to property access and changes to travel routes. The strategies will be developed including details on communication channels, frequency of communication and response measures in relaying information to the community and stakeholders.	Contractor	Pre-construction, construction
T8	Consultation	Implement face-to-face consultation with landowners and tenants who will be directly affected, explaining construction processes and impacts to the surrounding area, answering questions they may have, and providing contact details that can be used for the project's entirety.	Contractor	Pre-construction, construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
T9	Environmental control	– All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or debris depositing onto the roadway during travel to and from the site, including but not limited to construction rumble strips/wheels wash at the site egress location. – All vehicles leaving the site would be cleaned of materials that may fall on the roadway before they are allowed to leave the site. – The lead contractors will monitor the roads leading to and from the site and take all necessary steps to rectify any road deposits caused by site vehicles to maintain the safety of all road users. – Roads leading to and from the study area to be monitored for any road deposits caused from site vehicles and will be rectified as soon as possible. – Vehicles operating to, from and within the site shall do so in a manner which does not create unreasonable or unnecessary noise or vibration. – Public roads and access points will not be obstructed by any materials, vehicles, refuse skips or the like, under any circumstances. – All subcontractors must be inducted by the lead contractor to encourage that all the relevant procedures are met. – Water trucks will be used to supress dust as required.	Contractor	Construction
T10	Staff induction	All staff and subcontractors engaged on site will be required to undergo a site induction. The induction will outline the requirements on the CTMP, including site access routes, environmental and occupational health and safety responsibilities, emergency procedures, potential carpooling opportunities and vehicle height restriction under the power lines. Additionally, the Site Manager will discuss CTMP requirements regularly as a part of “toolbox talks”.	Site Manager	Pre-construction
T11	Occupational health and safety	– Any workers required to undertake works or traffic control shall be suitably trained and hold the required accreditation to carry out works on site and will also be site inducted. – All traffic control personnel will be required to hold TfNSW accreditation in accordance with the TfNSW TCAWS manual.	Site Manager	Pre-construction
T12	Contact of emergency services	In the event of an emergency related construction traffic incident on the public road network, it will be the responsibility of the Site Manager to ensure that emergency services are notified. The emergency services include but are not limited to: – Fire – Ambulance – Police – Phone “000” in cases of emergency Furthermore, it is the responsibility of the Site Manager to advice the emergency services of any restriction of vehicular access to the public and private areas (1) one week prior to its implementation.	Site Manager	Pre-construction, construction, operation

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
T13	Certificates and approvals	Approval is to be obtained from TfNSW, Council and other relevant authorities as required. Approvals that may need to be obtained for items such as but not limited to: – Roadwork speed zone – Council Road opening permits – Road occupancy approvals – Hoarding/fencing approvals – Crane and barricades – Oversize and Articulated Vehicle use on local roads	Contractor	Pre-construction
T14	Obtaining road occupancy approvals	The Construction Contractor will obtain the necessary approvals, as required by the *Roads Act 1993* and NSW Traffic Acts and regulations, prior to conducting any works. The Construction Contractor is required to seek the concurrence of the relevant road authority prior to undertaking works. The Construction Contractor will ensure that all public roads to be used by construction traffic will be identified prior to construction and that management methods will be undertaken so that construction traffic uses the identified roads. The three specific areas of approval will include: 1. All construction works and/or any changes to existing infrastructure. 2. The installation and/or changes of any regulatory traffic control device. 3. Occupation of the road network to conduct works, and the associated installation of temporary traffic control devices.	Contractor	Pre-construction
T15	Roadwork speed limits	Temporary roadwork speed limits are one of many traffic controls that can be implemented to manage the speed of traffic approaching and passing through a work site. Roadwork speed zones must be logical and credible, as well as enforceable. When considering the use of roadwork speed zones, they will: – Only be used where they are self-enforcing or will be enforced. – Not be used alone but with other traffic control signs and devices. – Not be used in place of more effective traffic controls. – Only be used while road works are in progress or the lower speed road conditions exist.	Contractor	Pre-construction, construction
T16	Driver's code of conduct	A driver's code of conduct described how vehicles associated with construction activities are expected to behave. Typically, they will include: – The designated haulage routes and any restrictions. – Locations of rest stops. – Details around speed limits. – Protocols for dealing with the general public.	Drivers	Pre-construction, construction, operation

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		– Emergency response protocols. – Details of driver responsibilities, including: • Ensuring that they are not suffering from fatigue or under the influence of drugs or alcohol. • Ensuring loads are appropriately covered. • Ensuring the use of appropriate personal and protective equipment. • Understand and abide by all road rules, including speed limits, road signs, use of seatbelts, avoiding taking unnecessary risks. • Required distances between vehicles to prevent convoying.		
Air Quality				
AQ1	Dust	Prepare a dust control protocol that forms part of the Construction Environmental Management Plan (CEMP) to detail management measures, a method for recording dust complaints and monitoring requirements.	Contractor	Construction
AQ2	Dust	On days with forecast and actual high winds (i.e., over 10 m/s) reduce work effort accordingly if windblown dust is observed to be leaving the work area along the pipeline.	Contractor	Construction
AQ3	Dust, exhaust emissions	Plant and equipment should be maintained in good condition to minimise ignition risk, spills and air emissions that may cause nuisance.	Contractor	Construction
AQ4	Dust	Regularly water spraying of exposed areas.	Contractor	Construction
AQ5	Dust	Long term stockpile seeding.	Contractor	Construction
AQ6	Dust	Covering of long and medium term stockpiles and of all stockpiles in high wind periods.	Contractor	Construction
AQ7	Dust	Covering of truck loose material loads.	Contractor	Construction
AQ8	Dust	If the works are creating levels of dust which may significantly impact on residential amenity, the works should be modified or stopped until the dust hazard is reduced to an acceptable level.	Contractor	Construction
AQ9	Dust	On days with high background dust levels (due to fire or offsite dust events for example), increase dust mitigation in the form of watering or reduce dusty construction activities.	Contractor	Construction
AQ10	Dust	Revegetate and regularly water all disturbed areas as soon as practicable.	Contractor	Construction
AQ11	Dust	During construction in higher risk areas (areas within 2 m of the sensitive receptors, shown in Figure 14-1), conduct a daily inspection along all adjacent receptors for evidence of: – Dust deposition on residential private property including cars, letterboxes or balconies. – Evidence of mud or dirt tracked onto roadways. – The worksite adjacent receptors to check stockpiles are covered or the surface is sufficiently moist.	Contractor	Construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
AQ12	Dust	During construction in higher risk areas (areas within 20 m of the sensitive receptors, shown in Figure 14-1) implement additional watering (>2 litres/m^3/hr) when dust is being generated and winds are blowing towards the receptors.	Contractor	Construction
AQ13	Odour	Establish 24 hour emergency maintenance agreements with equipment manufacturers to limit the impact of equipment failures.	Council	Operation
AQ14	Odour	If elevated odour is observed during operation, undertake investigations to identify the source and minimise emissions. Record investigations and actions taken to minimise odour emissions in a log.	Council	Operation
AQ15	Odour	If an OCU is to be installed, implement a variable air flow system to reduce the number of air volume changes per hour through the OCU when works are emitting odour concentrations which may impact the nearby receptors.	Contractor	Operation
Soils and Contamination				
SC1	Contaminated Soil Management Plan (CSMP)	Development of a Contaminated Soil Management Plan (CSMP) to manage any contamination encountered during the construction of the project and to ensure the completed works are suitable for the intended land use.	Council/ contractor	Pre-construction
SC2	Further contamination delineation	Provision for further detailed assessment where appropriate to confirm the conclusions of this preliminary assessment and to determine whether any specific remediation or management of areas is required. The further assessment should be based on the following: – Potential areas and types of contamination identified in this assessment. – The potential for exposure to workers and to end-users based respectively on the nature of the proposed construction works and the final design of the project.	Council/ contractor	Pre-construction
SC3	Contamination exposure	Appropriate management controls to minimise the potential for exposure of contamination to workers and recreational users within the project both during and post construction. Description of appropriate excavation, validation, management and/or disposal requirements for potentially contaminated materials, if identified by further assessment or encountered during the construction of the project.	Council/ contractor	Pre-construction
SC4	Assessment protocols	Sampling and analysis requirements for assessment of potential contaminated soils for re-use or for waste classification prior to offsite disposal.	Contractor	Construction
SC5	Contingency plans	Contingency plans including unexpected finds protocols for potentially contaminated soils (if encountered) including landfill or anthropogenic waste and PACMs.	Council/ contractor	Pre-construction
SC6	NOA Management Plan	Development of an NOA Management Plan to provide a framework for safely working with NOA encountered during the construction and operation of the project.	Council/ contractor	Pre-construction
SC7	Acid Sulfate Management Plan	An Acid Sulfate Soil Management is to be implemented for pipe infrastructure installations during excavation works.	Contractor	Construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
SC8	Documentation	Any future contamination reports should be prepared and reviewed by an appropriately qualified environmental consultant.	Council/ contractor	Pre-construction
Waste and Chemicals Management				
WC1	Waste generation	Ensure that detailed design includes measures to minimise excess waste generation. Include a focus on optimising earthworks design to minimise excess spoil volumes and maximise the reuse of material on site and minimising the WWTP construction footprint. Pipe and pump wells will be retained and relined to reduce construction waste.	Council / contractor	Detailed design
WC2	Waste classification	Classify waste in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014) and manage in accordance with the POEO Act and associated regulations.	Contractor	Construction and operation
WC3	Emergency response	Prepare an emergency response plan prior to construction of the project, detailing hazardous materials, emergency procedures, resources, activation of the plan, reporting and termination of an emergency, etc.	Contractor	Pre-construction, construction
WC4	Construction waste	Prepare a Construction Waste Management Plan (CWMP) prior to construction of the project. Adopt the circular economy principles and the waste hierarchy contained in the *Waste Avoidance and Resource Recovery Act 2001*. Detail processes, responsibilities, and measures to manage waste and resource use, and minimise the potential for impacts during construction.	Contractor	Pre-construction, construction
WC5	Chemical storage	Prepare a Chemical Storage and Management Plan prior to operation of the project, detailing the safe handling procedures, labelling requirements, training and responsibilities. Prepare an emergency response plan would be developed prior to the operation, outline hazardous materials, emergency procedures, resources, activation of the plan, reporting and termination of an emergency, etc.	Contractor / Council	Operation
WC6	Operational waste	Prepare an Operation Waste Management Plan prior to operation of the project. Adopt the circular economy principles and the waste hierarchy contained in the *Waste Avoidance and Resource Recovery Act 2001*. Detail processes, responsibilities, and measures to manage waste and resource use and minimise the potential for impacts during operation.	Contractor / Council	Operation
WC7	Sludge management	Ensure dewatered sludge is stored properly in covered areas to minimise the risk of odour, runoff and potential contamination.	Council	Operation
Noise and Vibration				
Airborne noise/ground-borne noise and vibration				
NV1	Implement stakeholder consultation measures	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receptors at least 7 days prior to commencement of relevant works. In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis: – Project specific website	Contractor/ Council	Pre-construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		– Project Infoline – Construction response line – Email distribution list – Web-based surveys – Social media – Community and stakeholder meetings – Community based forums (if required by approval conditions)		
NV2	Register of noise and vibration sensitive receptors	A register of most affected noise and vibration sensitive receptors (NVSRs) would be kept on site. The register would include the following details for each NVSR: – The address of the receptor – Category of receptor (e.g., Residential, Commercial etc.) – Contact name and phone number The register may be included as part of the Project's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.	Contractor	Pre-construction
NV3	Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction
NV4	Construction respite period	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.	Contractor	Construction
NV5	Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: – All relevant project specific and standard noise and vibration mitigation measures. – Relevant license and approval conditions. – Permissible hours of work. – Any limitations on noise generating activities with special audible characteristics. – Location of nearest sensitive receptors. – Construction employee parking areas.	Contractor	Pre-construction, construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		– Designated loading/unloading areas and procedures. – Site opening/closing times (including deliveries). – Environmental incident procedures.		
NV6	Update Construction Environmental Management Plans	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.	Contractor	Pre-construction, construction
Source measures				
NV7	Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking, and loading/unloading areas to minimise reversing movements within the site.	Contractor	Pre-construction, construction
NV8	Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, where piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques in lieu of sheet piling, will have significant noise and vibration benefits.	Contractor	Construction
Airborne noise				
NV9	Behavioural practices	– No swearing of unnecessary shouting or loud stereo/radios on site. – No dropping of materials from height, throwing of metal items and slamming of doors. – No excessive revving of plant and vehicle engines. – Controlled release of compressed air.	Contractor	Pre-construction, construction
NV10	Maximum noise levels	The noise levels of plant and equipment must have operating Sound Power or Sound pressure levels compliant with the allowable noise levels in Appendix C of CNVG.	Contractor	Pre-construction, construction
NV11	Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used onsite unless compliant with the allowable noise levels in Appendix C of CNVG.	Contractor	Construction
NV12	Use and siting of plant	– Simultaneous operation of noise plant within discernible range of a sensitive receptor is to be avoided. – The offset distance between noise plant and adjacent sensitive receptors is to be maximised. – Plant used intermittently to be throttled down or shut down. – Noise-emitting plant to be directed away from sensitive receptors.	Contractor	Pre-construction, construction
NV13	Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles.	Contractor	Pre-construction, construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
NV14	Minimise disturbance arising from delivery of goods to construction sites	– Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receptors. – Select site access points and roads as far as possible away from sensitive receptors. – Dedicated loading/unloading areas to be shielded if close to sensitive receptors. – Delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible.	Contractor	Construction
NV15	Construction related traffic	– Schedule and route vehicle movements away from sensitive receptors and during less sensitive times. – Limit the speed of vehicles and avoid the use of engine compression brakes. – Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.	Contractor	Construction
NV16	Silencers on mobile plant	Where possible reduce noise from mobile plant through additional fittings including: – Residential grade mufflers. – Damped hammers such as “City” Model Rammer Hammers. – Air Parking brake engagement is silenced.	Contractor	Construction
NV17	Prefabrication of materials off-site	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.	Contractor	Pre-construction, construction
NV18	Engine compression brakes	– Limit the use of engine compression brakes at night and in residential areas. – Ensure vehicles are fitted with and maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission’s ‘Inservice test procedure’ and standard.	Contractor	Pre-construction, construction
Path controls				
NV19	Shield stationary noise sources such as pumps, compressors, generators, fans etc.	Stationary noise sources would be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.	Contractor	Pre-construction, construction, operation
NV20	Shield sensitive receptors from noisy activities	Use structures to shield residential receptors from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.	Contractor	Pre-construction, construction, operation
NV21	Additional mitigation measures	Where impacts from construction noise are unavoidable and it is not feasible to achieve the construction noise objectives, additional measures such as letter box drops and phone calls are proposed in line with Table 6.3 in Technical Report 11 – Noise and Vibration Assessment.	Council/ contractor	Pre-construction, construction
Land Use and Property				

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
	Impacts on land use and property	The design will continue to be refined to minimise land requirements and potential impacts on land uses and properties as far as reasonably practicable. Consultation with landowners/landholders will be ongoing to confirm feasible and reasonable measures to minimise impacts on their properties.	Contractor	Pre-construction, construction and operation
	Impacts on land use and property	Construction planning will minimise the duration that land is required to the shortest possible duration, particularly where the land requirements affect recreation/nature reserve areas.	Contractor	Pre-construction and construction
	Land requirements and property acquisition	All property acquisitions will be undertaken in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the land acquisition reforms announced by the NSW Government in 2016.	PMHC	Pre-construction
	Impacts on utilities	The location of all utilities and services, and requirements for access to, diversion, protection and/or support, will be confirmed prior to construction. This will include (as required) undertaking utilities investigations, including intrusive investigations, and consultation and agreement with service providers.	PMHC	Pre-construction and construction
	Rehabilitation of land subject to temporary use during construction	Land subject to temporary use for construction will be rehabilitated as soon as practicable to the pre-construction condition (or as agreed with the landowner/landholder), taking into consideration the existing condition, location and land use characteristics. Rehabilitation will be undertaken in consultation with the relevant landowner/landholder, and in accordance with the rehabilitation strategy.	Contractor	Construction
	Biosecurity	Biosecurity controls will be implemented to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will be in accordance with *Come clean, go clean* (Qld Government, 2022) and include development of specific controls if high biosecurity risks are identified. Appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction via the project. The specific controls applicable to a property will be identified in consultation with the affected landowner. The effectiveness of these controls will be monitored in a manner and time interval consistent with the level of risk on each property. In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per *Biosecurity Act 2015* (NSW) and Biosecurity Regulation 2017.	Contractor and PMHC	Construction and operation
	Property management	A property management plan will be developed for directly impacted properties in consultation with landowners and stakeholders. The property management plans will outline the protocols that will be implemented to address landowner concerns during construction. This may include: – The process for rectification of any damage to property infrastructure caused by construction – The process for rehabilitation and stabilisation of disturbed areas following the completion of construction – Measures to minimise disruption to agricultural practices during construction – Any fencing and gate requirements – Specific biosecurity protocols	Contractor	Pre-construction and construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
Hazard and Risk				
HR1	Personal injury caused by vehicle interactions	– Traffic management plan including standard traffic rules, signage – Site speed limits – One way traffic movement through the site for delivery vehicles – Designated pedestrian areas – Driver competency – Construction management plan	Contractor	Pre-construction
HR2	Natural hazards causing personal injury, plant shut down and possible fire	– Structures and tanks designed to appropriate codes and standards – Housekeeping standards – Site drainage	Council/ contractor	Pre-construction, construction, operation
HR3	Toxic release of chlorine	– Implementation of standard operating procedures for drum transfer and connection and ensure personnel have been trained to reduce risk of drum damage during operation and delivery – Notification to Safework NSW of exceeding 10% of the WHS schedule 15 threshold for chlorine – Standard procedure for delivery of drums – Safe piping design – Inspection and maintenance strategies	Council	Operation
HR4	Contact with chemicals	– Training of staff prior to handling – Staff wear appropriate PPE when handling corrosives – Storage as per appropriate standards – Safe work method statements	Contractor/ Council	Construction, operation
HR5	Spill of chemical solutions leading to soil contamination/ degradation	– Storage as per appropriate standards, including bunding – Design of pipework to standards, corrosion allowances where appropriate – Inspection and maintenance strategies – Spill management procedures – Ensuring regular maintenance schedules are developed to detect leaks and ensure pipe fittings are in good condition	Contractor/ Council	Construction, operation
HR6	Access	Ensuring the site has an emergency plan for onsite staff taking the effect zone of all hazard scenarios into consideration such that the evacuation point is outside the AEGL 3 effect zone	Contractor/ Council	Construction, operation
HR7	Emergency Access	Coordination with emergency services for off-site management if a loss of containment event was to occur	Contractor/ Council	Construction, operation

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
HR8	On-site hot works	Prohibited on all days of Severe, Extreme and Catastrophic Fire Danger At all other times: – Hot works requires inclusion in the Job Safety Analysis (JSA) – All hot work would require issue of a hot work permit – All fire prevention measures (fuel free clearance zone around hot work site; wetting down measures and spark guards) specified in the JSA and/or hot work permit to be undertaken – Fire extinguishers or other fire response apparatus required by the JSA and/or hot work permit must be present at the work site – Upon completion of hot works appropriate checks to be undertaken to ensure no fire or smouldering material remains	Contractor/ Council	Construction, operation
HR9	Vehicle exhaust system contact with long grass	Vehicle access onto areas other than on constructed roads and laydown areas prohibited on all days of Extreme and Catastrophic Fire Danger. At all other times avoid parking in long grass.	Contractor/ Council	Construction, operation
HR10	Sparks from metal on metal or rock friction during ground engaging machinery operation	– Prohibited on all days of Extreme and Catastrophic Fire Danger – Grass fire ignition prevention requires inclusion in the Job Safety Analysis (JSA) for all earthmoving and hole boring works – Fire extinguisher to be carried on all earthmoving machinery and present at all hole boring operations	Contractor/ Council	Construction, operation
HR11	Discarded cigarette butts from smokers	No smoking on project area except in designated smoking areas at the construction office site or laydown areas.	Contractor/ Council	Construction, operation
HR12	Chemical reaction between hazardous materials stores or used on the WTP site	– Separate storage areas for hazardous chemicals – Operating protocols for mixing of chemicals on site – No WTP process which involve mixing of chemicals in the open are adjacent to the site permitter/in proximity to bushfire fuels	Council	Operation
HR13	Bushfire protection	Project to be undertaken to comply with relevant PBP objectives relating to access, water supply and services and emergency and evacuation planning as detailed in Technical Report 15.	Contractor/ Council	Pre-construction, construction, operation
HR14	Obstacle Limitation Surface (OLS)	Detailed planning and communication process need to be undertaken for preparation of CEMP for the Work. And the CEMP to be approved by the Airport Operation. That is more involved than liaison and seeking permissions. As temporary Closure of the airport activities during construction need to be provisioned by the airport operations.	Contractor	Pre-construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
		Prior written approval shall be obtained from the airport operator for any crane that may be used during the construction phase to penetrate the Obstacle Limitation Surface (OLS). To avoid doubt about whether an approval is required, applicants should check with the airport operator as soon as possible. Port Macquarie Airport Operations may be contacted on 0418 408 529 or via email at airport.operations@pmhc.nsw.gov.au (Noted, Port Macquarie Airport has already been contacted and received advice; refer to Section 4).		
HR15	Wildlife hazard	The project would be within a 3 km wildlife control zone (Zone A), which requires wildlife hazards to be mitigated. Where 'mitigate' is indicated, proposed development of this land use type should be assessed by a wildlife hazard expert and potential wildlife attractants be suitably mitigated either before the development is approved or as a condition of the approval. Where approved, information regarding the development should be provided to the relevant airport operator and it should be included in future monitoring activity undertaken by the relevant airport operator.	Contractor/ Council	Pre-construction, construction
Coastal Erosion				
No mitigation or management measures				
Landscape Character and Visual Amenity				
LV1	Lighting	Any lighting during construction would be of short duration. Lighting would not be directed or spill into any adjoining landholding. Occupants of adjoining landholdings will be advised of any unlikely night-time construction and the proposed lighting requirements.	Contractor	Pre-construction
LV2	Lighting	During operation of the WWTP and SPSs, lighting will be provided in accordance with AS 4282 – *Control of the obtrusive effects of outdoor lighting*. This Standard specifically refers to the potentially adverse effects of outdoor lighting on nearby residents. Design of outdoor lighting will be required to control any obtrusive effects to an acceptable degree.	Operator	Operation
LV3	Works areas during construction	During construction, work areas will be kept tidy and clear of rubbish, stockpiles appropriately contained, and equipment, plant and parking managed and contained within identified works areas.	Contractor	During construction
Climate Change				
Greenhouse Gas				
GHG1	Construction related emissions produced by vegetation removal	Reuse vegetation removed from the project area to be mulched or composted where possible.	Council/ Contractor	Construction
GHG2		Consideration of options for revegetation near the project site (beyond any biodiversity offsets required) to reduce the project's carbon impact.	Council	Construction/ operation
GHG3	Construction related emissions produced by vehicle and equipment use	Investigate substitution of fuels with sustainable fuels such as B10 biodiesel or renewable hydrogen.	Council/ Contractor	Construction
GHG4		Use of electric construction plant and vehicles for the construction works where reasonable and feasible.	Contractor	Construction

Ref	Impact/Issue	Mitigation measure	Responsibility	Timing
GHG5	Construction related emissions produced by electricity consumption	Investigate opportunities for on site power generation through solar panels or source electricity from renewable sources.	Council/ Contractor	Construction
GHG6	Operational related emissions produced by methane			
		Explore an alternative to flaring such as using the captured methane as an energy source to substitute a portion of the WWTP's grid electricity requirements or, if possible, piping it into the natural gas supply.	Council	Operation
GHG7	Operation related emissions produced by electricity consumption	Where it's not possible to avoid carbon emissions, reducing emissions should be considered in the first instance. Energy efficient electrical equipment (pumps, treatment equipment etc) should be specified to reduce the electrical consumption of the WTP.	Council	Operation
GHG8		Further investigate options for onsite power generation through solar installations on the roof of the wastewater treatment plant.	Council	Operation
ESD	Sustainability	The project would be designed and constructed in accordance with the sustainability objectives.	Council/ Contractor	Pre-construction, construction
Cumulative Impacts				
CL1	General impact reduction	The mitigation measures presented in Appendix D will be implemented effectively to reduce the project's impact on the environment.		Pre-construction, construction, operation

Technical Report 1

Water Resources and Flooding

Technical Report 1A

Water Resources and Flooding Assessment

Technical Report 1B

Operational Water Quality Impact Assessment

Technical Report 2

Aboriginal Cultural Heritage Assessment

Technical Report 3

Historical Heritage Assessment

Technical Report 4

Social Impact Assessment

Technical Report 5

Biodiversity Development Assessment Report

Technical Report 6

Aquatic Ecology Assessment

Technical Report 7

Traffic and Transport Assessment

Technical Report 8

Air Quality Assessment

Technical Report 9

Soils and Contamination Preliminary Site Investigation

Technical Report 10

Waste and Chemical Assessment

Technical Report 11

Noise and Vibration Assessment

Technical Report 12

Health Impact Assessment

Technical Report 13

Landscape Character and Visual Impact Assessment

Technical Report 14

Bushfire Risk Assessment

Technical Report 15

Preliminary Hazard Analysis Report

Technical Report 16

Ecologically Sustainable Development Assessment

Technical Report 17

Climate Risk Assessment

Technical Report 18

Greenhouse Gas Assessment

Technical Report 19

Aviation Impact Assessment

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