Uralla Shire Council

Bundarra Sewerage Scheme
Review of Environmental Factors

August 2019

Executive summary

Project description

The village of Bundarra, located approximately 73 km to the north west of Uralla NSW, is currently serviced by on-site sewer systems (mainly septic tanks). These systems dispose of household effluent into absorption trenches or on-site irrigation, which introduces environmental and health issues to the community and the Gwydir River catchment. The current service levels in Bundarra village differ from the rest of Uralla Shire Council area, a shortcoming that is being addressed by Council with the present project.

Uralla Shire Council propose to service Bundarra Village via a low pressure sewerage system, and an oxidation pond sewage treatment plant (STP) with effluent re-use by irrigation. The works are partially funded through the Restart NSW Water Security for Regions Program, and it is expected that this reticulated wastewater and treatment system will have a significant beneficial impact on sanitation and public health to the community of Bundarra.

The key objective of the proposal is to upgrade the Bundarra sewerage system to a standard equal to other towns in the local government area (LGA).

Existing environment

The proposed STP site is on rural land on the outskirts of the village of Bundarra. The land is mostly cleared and is used for grazing livestock. From the STP site the sewer rising main would extend approximately 2.6 km into the village of Bundarra, adjacent to Barraba Road and within the road reserve. The majority of the land adjacent to Barraba Road appears to be used for agricultural purposes, however a drainage line and vegetated area are also noted to extend to the north and south of Barraba Road, which the sewer rising main would need to cross.

Within the village of Bundarra, the pipes would be passing through residential areas and property connection would be to residences and commercial properties within the village. Properties within Bundarra currently operate on-site wastewater systems, primarily septic systems.

Statutory position

The proposal is permitted without consent under Division 18 Clause 106(2) of the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) and will therefore be assessed under Division 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act), with Uralla Shire Council as the proponent and determining authority.

Additional licences and permits required for the proposal include:

- Part 7 permit application under the *Fisheries Management Act 1994.*
- Section 60 approval under the *Local Government Act 1993.*
- Consent under Section 138 of the *Roads Act 1993* for works within the road.
- The transfer of the Crown land management of rear lanes to Council and the establishment of an easement over Lot 7301 DP 1149103, in accordance with the Crown Land Management Act 2016.

Construction activities

The construction would consist of two major components – construction of the treatment system and construction of the sewer reticulation network, including the sewer rising main. The following briefly outlines the construction of both.

Sewer reticulation network (including rising main)

The construction of the reticulation network would generally include:

- Establishing storage areas
- Trenching (500 mm wide up to 2.0 m deep trench within a 6 m wide corridor)
- Trenchless techniques would be used, where required (e.g. crossing of Bendemeer Street)
- Installing pipes
- Installing on-site pump units to service private properties
- Backfilling and compacting trench
- Construction of pump station with a construction footprint of 100 m^2

Treatment system

The construction of the treatment system would generally include:

- Site establishment including fencing of the site, installation of construction compounds, storage areas etc
- Clearing groundcover vegetation
- Earthworks and levelling of the site for the construction
- Construction of pits and concrete structures
- Installation of treatment ponds
- Construction of pipelines
- Construction of amenities building and electrical building
- Installation of mechanical and electrical equipment
- Connection to power
- Fencing, access pathways etc

Some of the pits would be delivered as pre-cast units and installed on site.

Irrigation area

The proposed irrigation scheme comprises the following:

- Spray irrigation system, based on impact sprinklers DN20 rotator sprinklers (or equivalent)
- Irrigated area: 4.3 ha, based on 15 set of sections covering a radius of 14 m each sprinkler and including a 2,000 m^2 of exclusion area to account for rock outcrops
- A combination of DN63, DN75 and DN125 irrigation polyethylene pipes
- Irrigation control system: moisture, rain, wind
- Wet weather storage pond (approximately 5.1 ML)

- Effluent transfer pumping station to draw water from the storage pond (one duty + one standby pump, 7.5 kW each)
- Buffer zone of 50 m from the property boundary

Construction of the project would likely commence in 2020 and it is anticipated the construction of would take about 12 months.

Environmental impacts

Construction

The works would involve construction of the STP site, sewer reticulation network, sewer rising main, connecting pipework and property connection, which are anticipated to result in a number of relatively minor impacts, including:

- Clearing of grassland and some vegetation and transforming the landscape from agricultural grazing land to a STP
- Erosion of soil
- Suspension of dust and generation of gaseous emissions
- Elevated noise
- Production of waste
- An increase in vehicle traffic movements on nearby roads
- Potential to impact on items identified as having local or state heritage significance

Operation

During operation of the pipeline, any maintenance activities would be restricted to the road corridor. As such, along the pipeline, no change to land use or services is expected during operation of the STP. However, the proposed STP site would be operating on previously agricultural land, resulting in a significant negative impact to the visual amenity of the area. There is also potential to be significant operational odour from the STP.

The operation of the proposal is expected to result in a positive impact due to:

- Bundarra being provided with reticulated sewer throughout the town
- Minimising risks to the environment and public health that are currently in place as a result of the existing on-site sewer systems
- Removal/decommissioning of on-site wastewater systems reducing negative odour and visual impacts
- Potential employment of personnel to run the STP

Mitigation measures

A number of safeguards and management measures have been identified in order to minimise potential adverse environmental impacts which could arise as a result of the proposal. Prior to commencing work on site, the contractor is required to prepare a CEMP for review and acceptance by Uralla Shire Council, comprising a coordinated and consolidated document that incorporates all the safeguards and management measures for the proposal. The CEMP would also include the following sub-plans:

- Unexpected Finds Protocol
- Soil and Water Management Plan
- Erosion and Sediment Control Plan
- Flora and Fauna Management Plan
- Traffic Management Plan

Conclusion

The proposal is considered justified as it would reduce the risks associated with onsite wastewater systems and upgrade the Bundarra sewerage system to a standard equal to other towns in the local government area. Currently on-site sewage treatment systems are creating pollution issues due to the presence of clay soils which have poor soil permeability, especially during wet weather periods. The proposed STP and sewer reticulation network would address these issues and provide a higher level of service to the Bundarra community.

While there would be some environmental impacts as a consequence of the proposal, these would be avoided or minimised wherever possible through the design development and site-specific safeguards in this REF, which are to be outlined in a CEMP and relevant sub-plans. The beneficial effects listed in this REF are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

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Glossary

Term/Acronym	Definition
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far
ANZECC	Australia and New Zealand Environment and Conservation Council (former)
ARI	Average recurrence interval
Background noise	The underlying level of noise present in the ambient noise when extraneous noise is removed. This is described using the LA90 descriptor (see also Rating background level)
BC Act	Biodiversity Conservation Act 2016
BoM	Bureau of Meteorology
CEMP	Construction Environment Management Plan
CLM Act	*Contaminated Land Management Act 1997*
CNMLs	Construction Noise Management Levels
dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound
dB(A)	Unit used to measure 'A-weighted' sound pressure levels
DBYD	Dial before you dig
DCP	Development Control Plan
DO	Dissolved oxygen. A relative measure of the amount of oxygen that is dissolved or carried in a given medium
DP	Deposited Plan
DPI	Department of Primary Industries
EC	Electrical conductivity. The measure of a material's ability to accommodate the transport of an electric charge
EEC	Endangered Ecological Community
ENM	Excavated natural material
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*. Provides the legislative framework for land use planning and development assessment in NSW
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment protection licence
ESCP	Erosion and Sediment Control Plan
FM Act	Fisheries Management Act 1994. Act to conserve, develop and share NSW fishery resources for the benefit of present and future generations
GHD	GHD Pty Limited
HDD	Horizontal directional drilling
Heritage Act	*The Heritage Act 1977*. Aims to ensure that the heritage of NSW is adequately identified and conserved
ICNG	Interim Construction Noise Guideline
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*. Aims to facilitate the effective delivery of infrastructure across the State
Km	Kilometre
LA90 (Time)	The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise e.g. LA90 (15 min)

Term/Acronym	Definition
LA90(period)	The sound pressure level exceeded for 90% of the measurement period
LAeq (15 hr)	The LAeq noise level for the period 7:00 to 22:00 hours
LAeq (1hr)	The highest hourly LAeq noise level during the day and night periods
LAeq (9 hr)	The LAeq noise level for the period 22:00 to 7:00 hours
LAeq (Time)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring
LAFmax	The maximum sound level recorded during the measurement period using a fast time response
LAmax	The maximum sound level recorded during the measurement period
LEP	Local Environmental Planning Policy
LGA	Local Government Area
m	metres
ML	Megalitres
$\mu g/m^3$	Microgram per cubic metre
Mitigation	Reduction in severity
MNES	Matters of National Environmental Significance
NCA	Noise catchment areas
Noise sensitive receiver	An area or place potentially affected by noise including residential dwellings, schools, child care centres, places of worship, health care institutions and active or passive recreational areas
NPW Act	*National Parks and Wildlife Act 1974*. Act to conserve and manage the State's natural and cultural heritage in reserved lands
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*. Aims to protect, restore and enhance the environment through a range of objectives
RBL	Rating background level. The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes
Receiver	A noise modelling term used to describe a map reference point where noise is predicted. A sensitive receiver would be a home, work place, church, school or other place where people spend time
REF	Review of Environmental Factors
RMS	Roads and Maritime Services
SEPP	State Environmental Planning Policy
STP	Sewage treatment plant
TCP	Traffic Control Plan
The proposal	The activity subject to assessment under the REF
TSS	Total suspended solids. A measure of the mass of fine inorganic particles suspended in the water
VENM	Virgin excavated natural material
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s)
WM Act	*Water Management Act 2000*. Provides for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations
WSP	Water Sharing Plan
µm	Micrometres
^0C	Degrees Celsius

1. Introduction

1.1 Background

The village of Bundarra, located approximately 73 km to the north west of Uralla NSW, is currently serviced by on-site sewer systems (mainly septic tanks). These systems dispose of household effluent into absorption trenches or on-site irrigation, which introduces environmental and health issues to the community and the Gwydir River catchment. The current service levels in Bundarra village differ from the rest of Uralla Shire Council area, a shortcoming that is being addressed by Council with the present project.

Previous investigations by Public Works (Bundarra Sewering Strategy Report, May 2016) identified the following issues for the existing system:

- Pollution from on-site sewage treatment systems due to the presence of clay soils which have poor soil permeability, especially during wet weather periods. Overflows, saturated backyards and diversion to vacant land and drains are likely to occur when the absorption potential is limited.
- Odour generation due to relatively poor condition of the absorption trenches and/or septic tanks.
- Ongoing maintenance requirements for residents.
- Ongoing inspection workload by Council staff.

The 2016 strategy study has also identified that the preferred conceptual option is to service Bundarra Village via a low pressure sewerage system, and an oxidation pond sewage treatment plant (STP) with effluent re-use by irrigation. The above conceptual option forms the basis of the scope of works for the current project.

The works are partially funded through the Restart NSW Water Security for Regions Program, and it is expected that this reticulated wastewater and treatment system will have a significant beneficial impact on sanitation and public health to the community of Bundarra.

1.2 Site location

The project is situated within Uralla Shire Council local government area in the Northern Tablelands region of NSW, approximately 80 km north west of Uralla and Armidale. It is bound by Burnett Street in the north, Darby Street in the south, the Gwydir River to the east, and traverses along rural roads to the west, bound by agricultural farmland.

The study area is linear in nature and traverses various parcels of cleared, partially cleared, disturbed and developed land. The township itself forms the bulk of the study area, particularly in the eastern portion, before the alignment heads south- west into cleared and partially cleared lands to the proposed STP site. Along this route, the study area also traverses alongside a travelling stock route (TSR), which is crown land. Within the township, the proposed pipeline is largely along urban roadside verges, predominantly consisting of managed grasses. The STP site itself is heavily degraded from historical clearing and farming, and current cattle grazing.

The study area, subject to this REF, comprised of the following component areas:

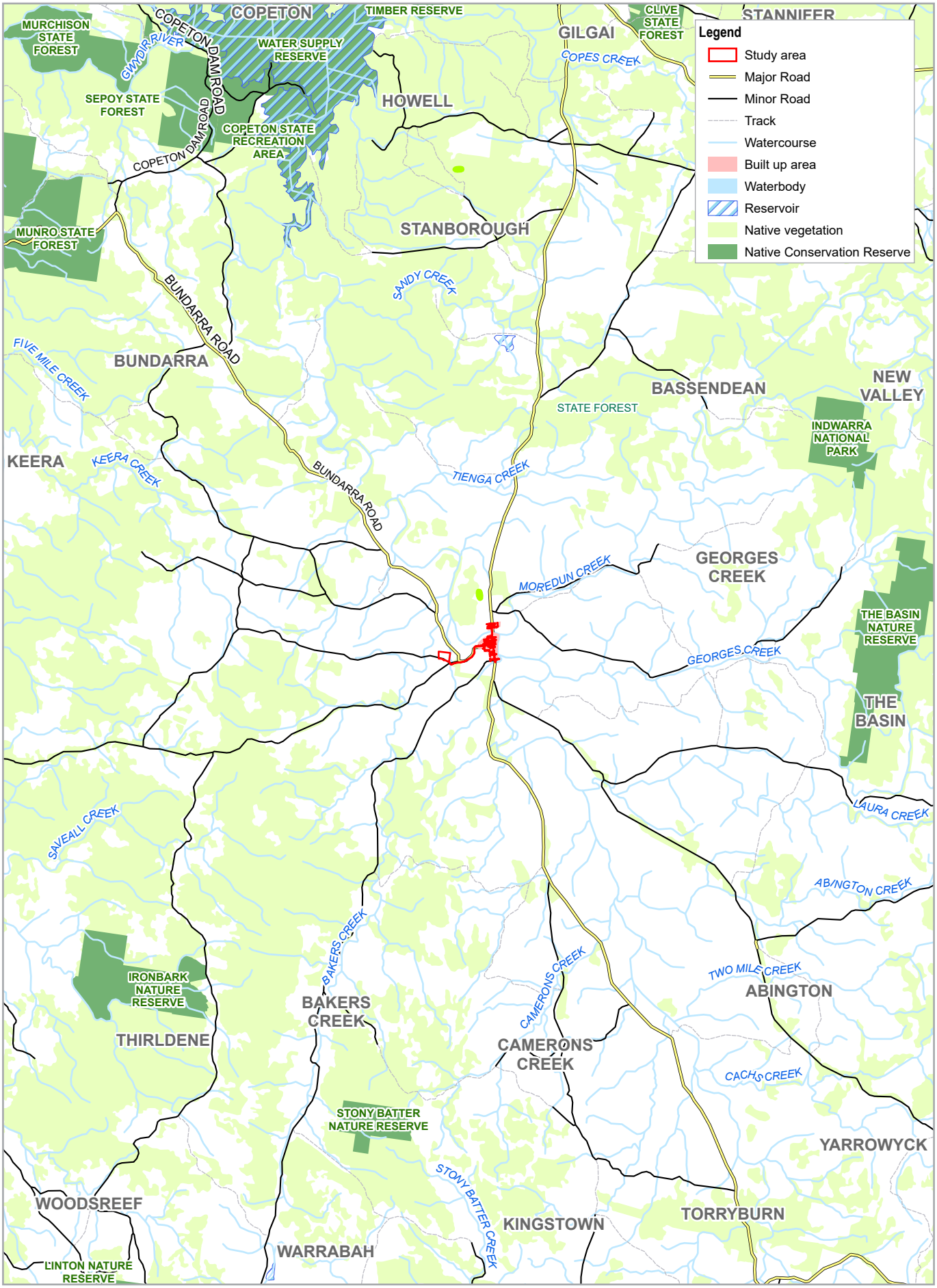
- STP site, representing 20 hectares of Lot 38 DP 753656 within which the ponds treatment system and ancillary facility will be located.
- A fenced pad of approximately 10 m x 10 m where the transfer pump station will be located.
- Five (5) m buffers on either side of pipeline infrastructure.

The combined length of the study area (proposed pipeline from township to the STP) is approximately 12.7 km. The combined area of the study area is approximately 33.7 ha.

The location of the study area is shown on Figure 1-1 and the study area is shown on Figure 1-2.

1.3 Purpose of this report

The purpose of this REF is to provide Council with information on matters affecting, or likely to affect, the environment from the proposal. The REF would allow Council to comply with the legislative requirements, particularly Section 5.5 of the EP&A Act where determining authorities are required to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity”, and Clause 228 of the EP&A Regulation.



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Kilometres

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

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GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Locality

Figure 1-1

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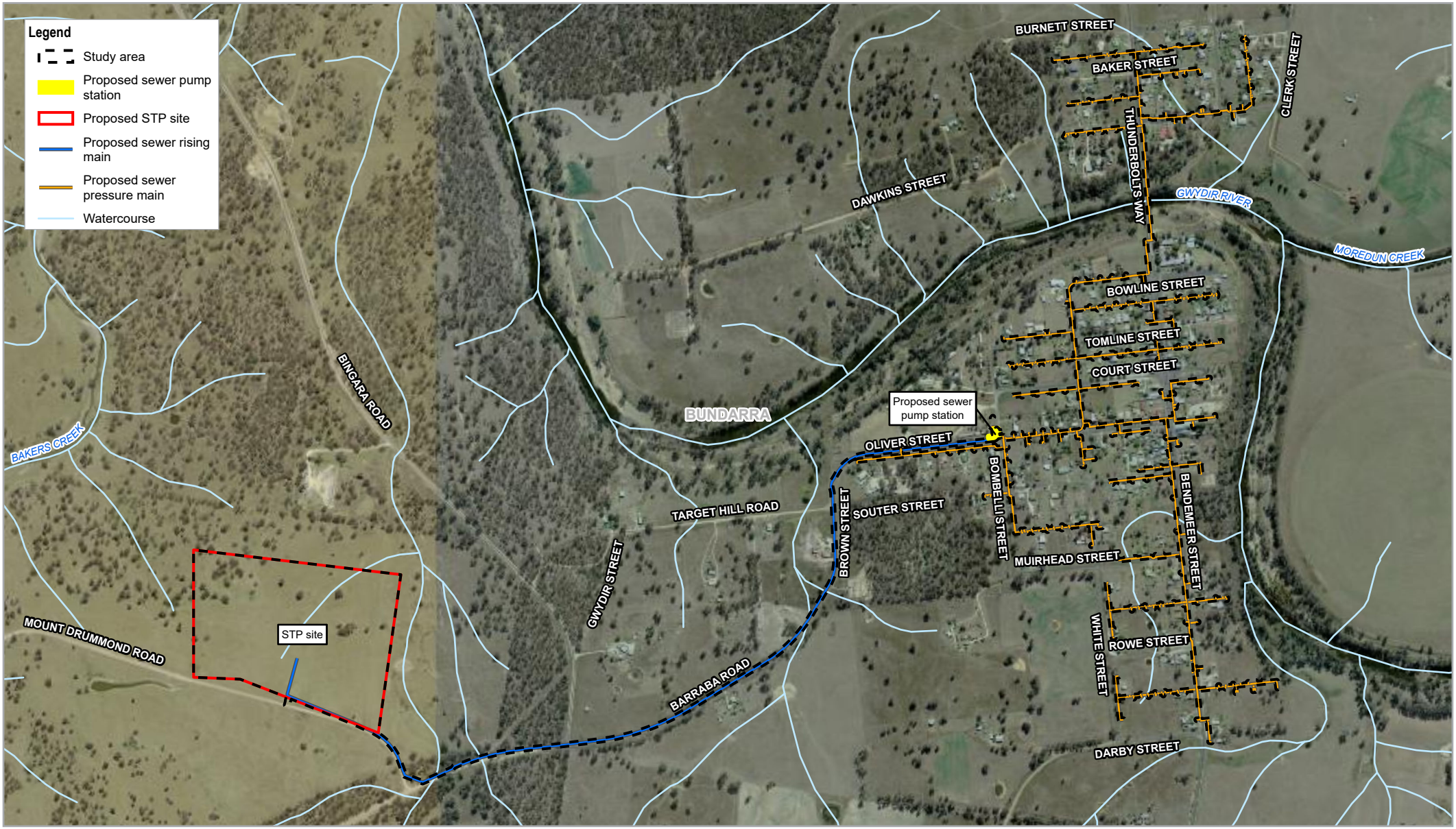

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

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Revision No. **0**
Date **30/07/2019**

Study area

Figure 1-2

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2. Proposal need and justification

2.1 Need for the project

The *Bundarra Sewering Strategy Report* (Public Works 2016) identified the following issues for the existing system:

- Pollution from on-site sewage treatment systems due to the presence of clay soils which have poor soil permeability, especially during wet weather periods. Overflows, saturated backyards and diversion to vacant land and drains are likely to occur when the absorption potential is limited.
- Odour generation due to relatively poor condition of the absorption trenches and/or septic tanks.
- Ongoing maintenance requirements for residents.
- Ongoing inspection workload by Council staff.

The 2016 strategy study also identified that the preferred conceptual option is to service Bundarra Village via a low pressure sewerage system, and an oxidation pond STP with effluent re-use by irrigation.

The works are partially funded through the Restart NSW Water Security for Regions Program, and it is expected that this reticulated wastewater and treatment system will have a significant beneficial impact on sanitation and public health to the community of Bundarra.

The above conceptual option was further developed by GHD during the options phase of the current project (GHD, 2018a) and the outcomes of this stage were endorsed by Council to progress with the concept design phase.

2.2 Option evaluation

A *Bundarra Sewerage Scheme – Options report* (GHD 2018a) considered various options for the:

- Sewer reticulation
- Wastewater treatment
- Effluent reuse
- Electrical control systems
- STP site location

The assessment of options included the engineering feasibility, costs, stakeholder comments, environmental constraints and regulatory approval requirements.

The Options Report provided a series of recommendations and it has since been confirmed, the preferred option includes:

- A pressure sewer system within the service area of the village of Bundarra, with an approximate length of 11 km and pipe sizes ranging from diameter 40 mm up to diameter 110 mm.
- DN63 mm pipe bridge crossing through the Gwydir River.
- A total of 173 pump units installed within the occupied lots (171 lots).
- Pressure sewer lines provision for all the vacant lots (168).

- One pumping transfer station within the town, pumping to the STP.
- A 2.6 km DN125 mm sewer rising main from the pumping transfer station to the STP.
- Treatment works based on two oxidation ponds (3,200 m^2 each) and two maturation ponds (1.0 ML each). Ponds are in a series-mode arrangement.
- Winter storage pond with a total storage volume of 5.1 ML.
- 4.3 hectares of surface irrigation area.

3. Description of the proposal

3.1 Objectives

The main objectives of the proposal are:

- To upgrade the Bundarra sewerage system to a standard equal to other towns in the LGA
- Undertake the development in accordance with environmentally sustainable principles
- Minimise risk to the environment and public health

3.2 Proposed sewage collection and wastewater treatment system

Below is a summary of the proposed sewerage scheme based on the *Detailed Design Report* (GHD, 2019). The detailed design is provided in Appendix A.

3.3 Recommended pressure sewer system

The pressure sewer system comprises the following elements:

- Collection tank with grinder pump installed on each property
- Property discharge line from the collection tank to the connection point on the boundary of each property
- Pressure reticulation sewers installed in the streets

The system starts with the house drain, which is graded to a dedicated collection tank incorporating a grinder pump that macerates sewage (breaks down solids into very small particles) to minimise clogging in the sewer system (see Figure 3-1). Generally, a single collection tank would be located on each property unless the property is classified as non-residential use, where a double pod may be used or a larger single pod.

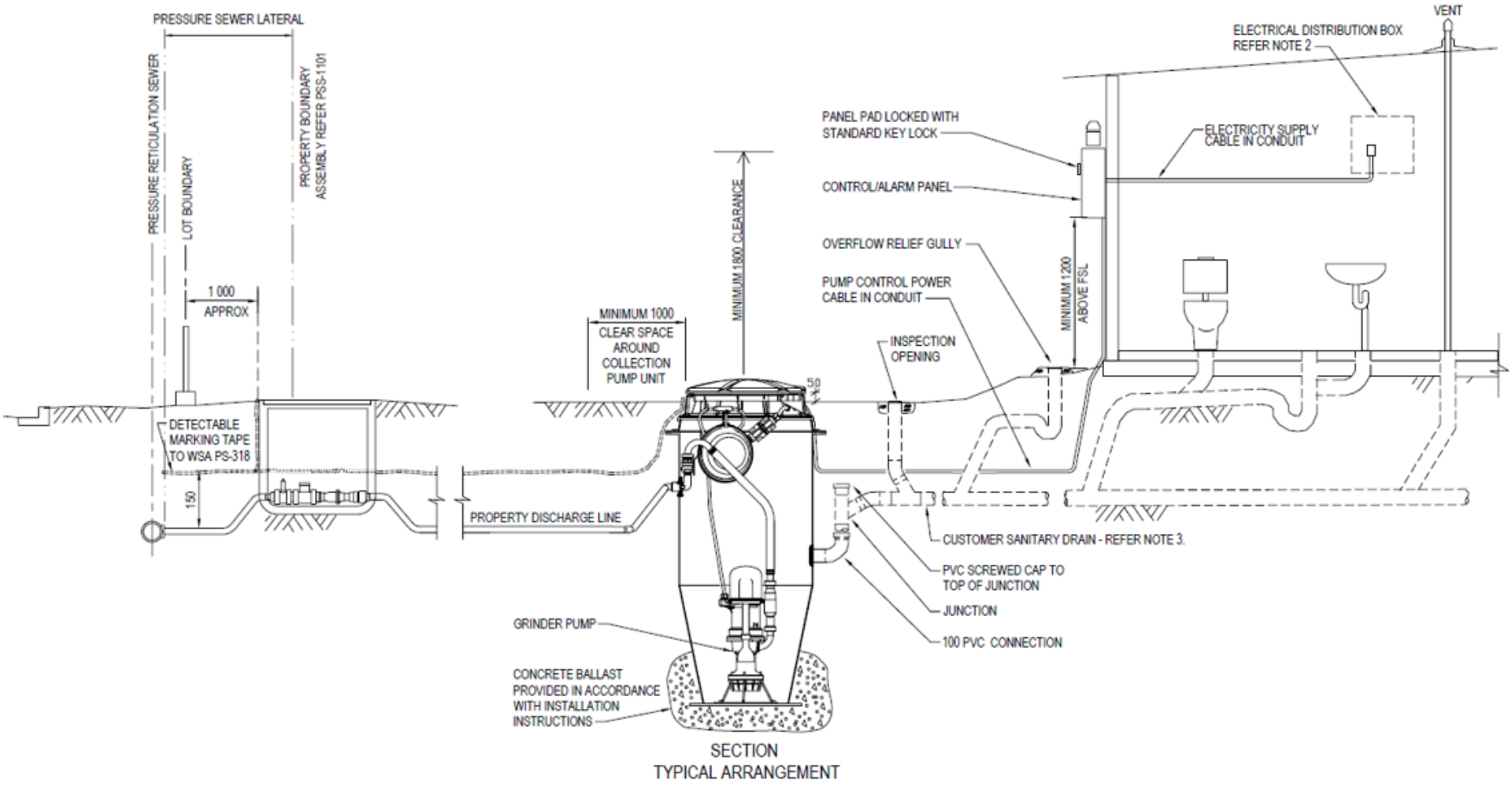


Figure 3-1 Typical pressure sewer section

To connect to the pressure sewer system, each property sanitary drainage is directed to the collection tank and the existing septic tank is decommissioned.

The collection tank would be sized to cater for emergency storage of sewage should pump failure occur or parts of the rising main network require maintenance.

3.3.1 Reticulation system

The reticulation system is designed in accordance with WSA 07-2007 1.1 Pressure Sewerage Code of Australia, the design basis presented in Table 3-1 and the specific design criteria described in the sections below.

Table 3-1 Specific design parameters

Design criteria	value	unit	Comments
Low flow per ET	380	L/ET/day	
Average flow per ET	500	L/ET/day	
Peak flow per ET	975	L/ET/day	
Individual pump unit discharge rate	0.69	L/s	Based on suppliers specifications.
Minimum velocity	0.6	m/s	For self-cleansing.
Detention time	6	hr	Total retention times less than 6 hours will have minimal risk of septicity. Accepted guidelines indicate that networks with total retention times less than 6 hours will have minimal risk of septicity. From 6 to 12 hours the risk of septicity developing is moderate. Greater than 12 hours presents a high level of septicity risk.
Hazen-Williams friction factor	120		

3.3.2 Air Management

The sewer mains have been sized to allow for adequate flow velocity to entrain air in the pipes and carry it through to a high point in the line where it can be vented through the double acting air valves provided. A total of 16 double acting air valves are required within the system, which would be located in road reserves where they would not create an obstruction. The air valves are to be below ground in DN1200 precast pits with gatic covers and are at approximate 1 m depth below ground. Each air valve pit will be connected to a below ground odour filter combined with an adjacent aluminium cowl above ground to mitigate any potential odour issues.

3.3.3 Network Shutdown, Operation and Maintenance

Isolation valves are provided on each line immediately upstream of the connection to the next line or zone. This enables each line to be isolated as required for maintenance or connection of additional boundary kits.

Flushing pits and valves are provided at the end of the proposed lines, generally located within the road reserve to facilitate operational tasks. Within the system, 37 flushing pits are required in the reticulation system and 4 scour pump-out pits with scour valves are required within the rising main system. The system would also have provision for a flushing point integral to each boundary kit, giving an additional 173 flushing points, providing significant operational flexibility.

3.3.4 Pressure sewer reticulation alignment

The reticulation network is approximately 11 km in length with pipe diameters ranging from DN40 to DN90. The proposed alignment and pipe sizing are presented in the design drawings, in Appendix A. The alignment selection took into consideration the following key elements: location of existing services, topography, ease of construction and minimising works along main roads.

Use of laneways and secondary roads

It is proposed to lay the sewer reticulation system mainly along laneways and secondary roads. In most of the cases the existing septic tanks are installed in backyards of the properties facing these access lanes and therefore the services connection length will be minimised. In these secondary streets there is a limited amount of services and main road crossings are minimised. This approach is expected to reduce construction costs for the project

Bendemeer Street

Works along Bendemeer Street, between Souter Street and Bowline Street, have been limited in order to reduce costs and disruptions to the community. It is expected that the alignment would have to be along the road with bitumen cutting/reinstatement being required.

Bendemeer Street crossings are proposed to be constructed using trenchless methodology as shown in the detail design drawings, in Appendix A.

Gwydir River crossing

The northern section of Bundarra will be connected via a DN63 sewer main crossing the Gwydir River via a pipe bridge crossing. In order to minimise disruptions to the heritage listed bridge, the PE DN63 pipe will be laid under the beams supporting the pathway, held with brackets. Figure 3-2 shows the pathway and supporting beams. The crossing details are presented in the detailed design drawings in Appendix A.

Figure 3-2 Gwydir River Crossing

Vertical alignment

The vertical alignment of the reticulation system is governed by the existing geotechnical conditions, services and obstructions. It is proposed the pipelines would have a minimum of 600 mm cover in road reserves and other trafficable areas and 450 mm cover elsewhere.

3.4 Transfer pump station and rising main

3.4.1 Location

The proposed location is adjacent to the existing showground, at Bombelli Street corner of Oliver Street, south of the entrance to the showground. This location would take advantage of the improved geotechnical conditions, close proximity to existing power supply, and the wide road corridors. This increases the ease of access for construction, operation and maintenance, and is sufficiently distant from existing residences and existing underground services (whilst still remaining close to the pressure sewer network) such that minimal disturbance to the community is expected.

However, this location is within the flooding region of the Gwydir River as described in the flood plan (1 in 100 year flood level) provided by USC – thus, the electrical componentry will need to be raised off the ground by 900 mm.

3.4.2 General pump station parameters

The pump station is proposed to be a traditional wet well (with collecting manhole) and submersible pumps to keep operational and maintenance familiarity for Council.

The proposed arrangement for the pump station includes:

- A package pump station constructed and supplied as a complete kit
- A duty/standby arrangement
- Collecting manhole and wet well to provide emergency storage
- Isolation valve located on the suction side of the pump
- Isolation and non-return valves located on the discharge pipework in valve pit
- Pump station bypass connection
- Flowmeter with allowable bypass pipework
- Switchboard, generator stand, vent stack and ground mount odour filter provided adjacent to the wet well
- Barometric loop with a ventilation duct and filter provided at end of the pressure sewer reticulation after a fail safe actuated valve. The barometric loop is to maintain the hydraulic grade line (HGL) above the highest point within the reticulation pipework, keeping the main fully charged at all times, which reduces air entrapment issues within the pressurised network.

3.4.3 Emergency storage and fail safe actuated valve

Adopting 4 hours emergency storage at average dry weather flow (ADWF) requires a volume of 28.8 m^3. The emergency storage is provided between the alarm level and the roof of the wet well (overflowing point). The wet well provides 19.7 m^3, requiring the inlet manhole to store a minimum of 9.1 m^3. Therefore a DN2400 manhole is proposed at 2.6 m depth.

At the maximum modelled inflow rate of 8 L/s this provides approximately 1 hour storage.

Once the level in the wet well rises to RL 652.00 the safe fail actuated valve at the end of the pressure sewer network will begin to close. This will then result in the grinder pumps pumping against a closed head and they will stop and the onsite storage within the collection tank will be utilised. There is approximately 24 hours storage in each collection tank.

The actuated valve is proposed to be a DN80 plug valve with a spring fail safe allowing it to fail closed in the event of a power failure at the SPS site.

3.4.4 Rising main selected route

The rising main will travel along Oliver Street, Brown Street and Barraba Road to the proposed STP location on Mount Drummond Road. The pipe will be within the road reserve on the north side of Oliver Street, the west side of Brown Street as it changes direction, then on the north side of Barraba Road. The rising main will finally turn onto Mount Drummond Road to discharge into the discharge manhole located at the proposed STP.

This route is relatively flat and avoids crossing private land whilst also representing the shortest likely route to the STP.

For the minimum velocity standards to be achieved (0.9 m/s) with an operational flow rate of 8 L/s, the pipe must have an internal diameter of less than 113 mm. Therefore, a DN125 (ID 101.5 m) pipe was selected for the transfer pipeline between the proposed transfer pump station to the proposed treatment plant.

The following cover and gradients have been adopted for the detail design:

- The transfer main is to be constructed at a minimum cover of 600 mm within road reserve and other trafficable areas and 450 mm in other locations except at road crossings and proposed creek crossing where deeper cover is required
- Maximum trench depth is 2 m
- Minimum vertical clearance to services to be 300 mm unless noted otherwise by specific utility requirements
- Minimum gradient to be 0.2 % (or 1 in 500) to allow air pockets to travel towards air valves

3.4.5 Valves and fittings

Air valves

Five air valves are located at localised high points to vent air within the pipeline. These will include the below ground odour filter with above ground aluminium cowl to mitigate any potential odour issues.

Scour valves

Four scour valves with pump-out pits have been included at low points along the water main for draining during maintenance or main breaks.

Scours are proposed with a DN80 offtake, stop valve and a DN1050 pump out chamber. In the event of the scour access chamber not being pumped out when the stop valve is opened, low velocity flows would spill from the access chamber top and flow towards the nearest drainage line.

Scours are to be directed away from the roadways for safety reasons.

Stop valves

Two stop valves have been included at approximate 1 km spacing's along the transfer main to limit the size of the isolation volume when the transfer main is taken out of service for operational purposes or when repairing a break.

Thrust restraint

Thrust restraint is provided at each end of the rising main via an anchor block and the valve pit wall. All bends along the rising main are proposed to be welded HDPE.

3.5 Wastewater treatment

A ponds treatment system comprising two in series oxidation ponds followed by two in series maturation ponds is proposed. The infrastructure associated to the system comprises:

- Barometric Loop to create artificial high point on the inlet rising main to keep the line fully charged during operation. The sewer line will then flow via gravity to the oxidation pond 1.
- Two oxidation ponds pond arranged in series.
- Two maturation ponds, arranged in series, for effluent disinfection.
- A winter storage dam to store effluent flows during low or no reuse demand periods.

Downstream of the Barometric Loop is to be above ground pipework leading to a pipe cross that can divert water to either or both oxidation ponds through the use of stop valves located at each end of the cross. This pipework will provide flexibility to feed both oxidation ponds to facilitate removal of one pond from operation for desludging.

The following future flexibilities are included in the design:

- Provision of space to locate a mechanical screening system including a bypass bar screen facility, if excessive rags accumulation is found to be an issue for the oxidation ponds.
- Ability to provide odour covers to capture odorous gases and discharge via ductwork to a soil bed filter for treatment.

The oxidation pond, also known as facultative pond or stabilisation pond, is a relatively shallow (1.2 m) pond. Stabilisation of sewage within an oxidation pond is achieved by microorganisms and photosynthesis by algae. Solids settlement in the pond results in an anaerobic sludge layer at the bottom of the pond beneath a surface aerobic layer. Organic matter is decomposed by aerobic and facultative bacteria in the upper layer, with the rate of decomposition dependent on temperature, sunlight, algae concentration, hydraulic efficiency, etc.

Two oxidation ponds will be provided, each sized to achieve significant reduction in carbonaceous matter (BOD_5). The surface area of 3,200 m^2 each are proposed. The ponds would operate in series and be 1.2 m to 1.3 m deep with a minimum of 0.5 m freeboard (i.e. total depth from top of bank to floor is 1.7 metres).

The objective of providing two ponds, which are referred to as the primary and secondary ponds, is to improve overall treatment efficiency and minimise the impacts when one pond is taken off line for periodic desludging, which is usually undertaken about every 10 years. Sewage from the inlet chamber is delivered to the primary pond, which subsequently overflows to the secondary pond after being retained for a designated detention time. The primary pond is provided with a deepened section adjacent to its inlet to allow for the larger accumulation of solids deposited in this area. The ponds are configured with an aspect ratio of 2:1 (length to width) to minimise short-circuiting.

Disinfection of effluent from an oxidation pond system will be achieved by providing maturation ponds immediately downstream. The maturation, or tertiary, ponds are sized to provide 20 days detention time to allow natural die off of pathogens. Disinfection occurs by exposure of micro-organisms to natural ultraviolet radiation and their detention in a "food-starved" environment. Two maturation ponds in series would be provided to maximise effluent detention without short-circuiting of flow.

The disinfected effluent would be stored in a winter storage dam for reuse application.

The layout and sizing of the STP is presented in the design drawings in Appendix A.

3.5.1 Effluent quality

Table 3-2 provides the effluent quality limits the proposed STP would achieve. The limits are based on the DEC (2004) *Environmental Guidelines: Use of Effluent by Irrigation*.

Table 3-2 Effluent quality limits

Design criteria	value	unit	Comments
Biochemical oxygen demand (BOD_5)	< 40	mg/L	
Total nitrogen (TN)	< 50	mg/L	Irrigation rate to be balanced annually with crop requirement
Total phosphorus (TP)	< 10	mg/L	Irrigation rate to be balanced annually with crop requirement
Faecal coliforms, FC	< 1,000	Org/100 mL	Based on expected type of agricultural irrigation as per DEC (2004) NSW Environmental Guidelines for Use of Effluent by Irrigation
pH	6.5 – 8.5		

3.5.2 Clay liner

The treatment lagoons would have a 300 mm thick clay liner. The lagoons have been designed in order to optimise the earthworks balance between cut, fill, available/required clay and rock levels.

3.5.3 Sludge management

It is estimated, sludge would be removed from the ponds every 10 years. Disposal of sludge accumulated in the ponds will be carried out in accordance with the NSW biosolids guidelines (EPA 1997) and in consultation with the EPA. The guidelines set out a number of classes of biosolids, based on the concentrations of metals, organic compounds and nutrients and on the treatment processes used for pathogen, vector and odour control. Following classification of biosolids in accordance with contaminant and stabilisation grading requirements, the beneficial reuse or disposal method may be selected.

3.5.4 Irrigation area

The proposed irrigation scheme comprises the following:

- Spray irrigation system, based on impact sprinklers DN20 rotator sprinklers (or equivalent)
- Irrigated area: 4.3 ha, based on 15 set of sections covering a radius of 14 m each sprinkler and including a 2,000 m^2 of exclusion area to account for rock outcrops
- A combination of DN63, DN75 and DN125 irrigation PE100 PN12.5 pipes
- Irrigation control system: moisture, rain, wind
- Wet weather storage pond (approximately 5.1 ML)
- Effluent transfer pumping station to draw water from the storage pond (one duty + one standby pump, 7.5 kW each)
- Buffer zone of 50 m from the property boundary
- V-drain on the eastern side of the property to capture overrun flows to be directed to the natural drainage line

The irrigation area is shown on the design in Appendix A.

3.5.5 Winter storage

The outcomes of the water balance indicate that a total irrigation area of 4.3 hectares and a winter storage pond of 5.1 ML are required to contain a wet weather events for a 50th percentile rainfall year. This means that after an extended period of rain event (greater than the mean event), the irrigation area will not be able to receive more reuse water and the winter storage pond will be full. Winter storage overflow (tertiary treated water) may occur to the nearest drainage line, which finally discharges to the Gwydir River, downstream of the town. It is expected that this may occur every 2 years. Once the wet weather event ends, irrigation water reuse would start to operate again and no discharge would be experienced from the winter storage pond.

3.6 Construction

The construction would consist of two major components – construction of the treatment system and construction of the reticulation network. The following briefly outlines the construction of both.

3.6.1 Treatment system

The construction of the treatment system would generally include:

- Site establishment including fencing of the site, installation of construction compounds, storage areas etc
- Clearing groundcover vegetation
- Earthworks and levelling of the site for the construction
- Construction of pits and concrete structures
- Installation of treatment ponds
- Construction of pipelines
- Construction of amenities building and electrical building
- Installation of mechanical and electrical equipment
- Connection to power
- Fencing, access pathways etc

Some of the pits would be delivered as pre-cast units and installed on site.

3.6.2 Sewer reticulation network (including rising main)

The construction of the reticulation network would generally include:

- Establishing storage areas
- Trenching (500 mm wide up to 2.0 m deep trench within a 6 m wide corridor)
- Trenchless techniques would be used, where required (e.g. crossing of Bendemeer Street)
- Installing pipes
- Installing on-site pump units to service private properties
- Backfilling and compacting trench
- Construction of pump station with a construction footprint of 100 m^2

3.6.3 Construction equipment

The types of equipment likely to be required for the construction work would include the following:

- Excavator or similar earthmoving equipment
- Horizontal directional drilling rig
- Bulldozers
- Cranes
- Dump trucks
- Concrete agitators and pumps
- 1-2 tonne compactor
- Grader
- Delivery vehicles including trucks
- Worker's transport vehicles
- Pumps for dewatering

3.6.4 Materials

The type of materials and source would be:

- Concrete from local batch plants
- Fill (if required) from local quarries
- Equipment/pipes/machinery from manufacturers

3.6.5 Ancillary facilities

It is anticipated there would be an ancillary facility located within the STP site and two within the Bundarra town. The exact location and layout of the ancillary facilities would be determined by the construction contractor but is likely to consist of:

- Site sheds
- Parking
- Equipment laydown areas
- Waste receptacles
- Spoil (sub and topsoil) stockpile areas
- Storage areas for construction materials (could include some hazardous materials such as fuels and chemicals)

All ancillary facilities would be located in areas clear of vegetation and drainage lines and 100 m from any sensitive receivers.

During the construction of the reticulation network, materials and equipment would be transported from the ancillary facility and back each day. Upon completion of the works, everything from the ancillary facility would be removed and the area rehabilitated.

3.6.6 Construction Environment Management Plan (CEMP)

Prior to commencing work on site, the contractor would prepare a CEMP. The CEMP would provide a coordinated and consolidated document that incorporates all the environmental management sub plans for the project and define the mitigation measures to be implemented. The mitigation measures would include, as a minimum, those identified in this REF.

The CEMP would generally be in accordance with the *Guideline for the Preparation of Environmental Management Plans* (DIPNR, 2004).

3.7 Timeframe

Construction of the project would likely commence in 2019 and it is anticipated the construction of would take about 12 months.

Working hours for all construction activities would be:

- Monday to Friday 7:00 a.m. to 6:00 p.m
- Saturday 8:00 a.m. to 1:00 p.m
- No work on Sundays or Public Holidays

Once operational, the STP would operate on a 24 hour, 7 days per week basis.

3.8 Employment

The construction workforce would vary according to the work being carried out, the construction method and contractor's program. Indicative average staff numbers during construction would be in the order of 20-25 employees.

During operation, the STP would require one part-time staff. The staff will attend site most days Monday to Friday and be on call 24 hours 7 days a week for emergencies.

3.9 Traffic

It is estimated that the construction would involve an average of 5-10 truck movements per day plus about 40 additional traffic associated with construction employees during the peak of construction period. Particular operations may require more frequent truck movements, e.g. earthworks operations.

During operation, the main traffic would be associated with employees. It is estimated, on average, there would be one light vehicle per day.

4. Statutory framework

4.1 Environmental Planning Instruments

The EP&A Act provides for the creation and implementation of State Environment Planning Policies (SEPPs) and Local Environment Plans (LEP). Collectively they are referred to as Environmental Planning Instruments (EPIs) and can be used to determine whether an activity is permissible. The EP&A Act and the EP&A Regulation provide the framework for development assessment and approval in NSW and include provisions to ensure that the potential environmental impacts of a development are considered in the decision making process prior to proceeding to construction.

The EP&A Act contains three parts that impose requirements for planning approval. These are generally as follows:

- Part 4 provides for control of “development” that requires development consent from the local councils, a regional planning panel or the state government.
- Part 5 provides for control of ‘activities’ that do not require approval or development consent under Part 4.
- Part 5.1 provides for control of State Significant Infrastructure.

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

Division 18 Clause 106(2) of the ISEPP allows development for the purpose of sewage treatment plants to be carried out in a prescribed zone without development consent. A prescribed zone is defined as any of the following land use or equivalent zones:

(a) RU1 Primary Production

(b) RU2 Rural Landscape

(c) RU4 Rural Small Holdings

(d) IN1 General Industrial

(e) IN3 Heavy Industrial

(f) SP1 Special Activities

(g) SP2 Infrastructure

Clause 3C of the ISEPP permits sewage reticulation systems without consent on any land.

Comment: The proposed location of the STP is zoned RU1 (Primary Production) under the Uralla LEP 2012, indicating that development consent is not required. The development will therefore be assessed under Part 5 of the EP&A Act. In accordance with Section 5.3 of the EP&A Act Uralla Shire Council is the proponent and determining authority for this assessment.

4.1.2 Other SEPPs

A review of all SEPPs was completed to assess for relevance or influence on the proposal. This confirmed no other SEPPs are relevant to the proposal, primarily due to the policies not applying to the locality.

4.1.3 Environmental Planning and Assessment Regulation 2000

Clause 228 (2) of the EP&A Regulation outlines the factors to be taken into account when considering the impact of an activity on the environment under Division 5.1 of the EP&A Act, which are addressed in Table 4-1 below. Impacts are classified as follows:

- Negative – the activity has an overall detrimental effect on the environment.
- Nil – there is neither a detrimental nor beneficial effect on the environment by the activity.
- Positive – the overall effect on the environment is beneficial.

Table 4-1 Clause 228 factors

Factor	Comment	Impact
a. Any environmental impact on the community?	The environmental impact on the community from the proposal would be minor and short term during construction. Impacts can be mitigated through the measures summarised in Section 7.2. Long-term positive impacts would include an improved and safer wastewater management for local residents.	Short term minor negative Long term positive
b. Any transformation of a locality?	There would be short-term localised visual impacts associated with construction. Within Bundarra, there would be minimal long-term impacts. The STP site would be transformed from a rural setting by the construction of the associated infrastructure.	Short term minor negative Long term negative
c. Any environmental impact on the ecosystems of the locality?	Most of the study area has been disturbed in the past and therefore a long-term impact on the ecosystems of the locality is not anticipated. However, a short-term minor negative impact is likely during construction.	Short term minor negative
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	During construction, the proposal would result in a minor reduction in the aesthetic quality of the locality as a result of potential dust generation, noise and vibration, visual impacts and traffic movements. These impacts would be minimised through implementation of the management measures and safeguards summarised in Section 7.2. The proposal would not reduce recreational, scientific or other environmental qualities of the locality. During operation, the proposed STP would impact the aesthetic of the locality. However, other environmental qualities of the locality would be improved by the proposal.	Short term negative Long term positive
e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	A number of heritage listed buildings exist in Bundarra but as discussed in Sections 6.5 and Appendix B, the proposal is not expected to impact on any of these.	Nil

Factor	Comment	Impact
f. Any impact on the habitat of any protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)?	The proposal may impact on some threatened fauna species by the Ecological Assessment in Section 6.4 and Appendix C indicated that the project is unlikely to have a significant impact on these species.	Nil
g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	The proposal has the potential to impact on up to 18.3 hectares, some of which is considered to be TEC. However, the Ecological Assessment in Appendix C, indicated that the project is unlikely to have a significant impact on these species	Short term minor negative
h. Any long-term effects on the environment?	The upgrade of wastewater management in Bundarra would result in a long-term positive impact. Negative impacts from construction are all considered short term, with recovery to previous conditions anticipated following rehabilitation.	Long term positive
i. Any degradation of the quality of the environment?	Construction of the proposal has the potential to result in short term impacts on water quality, soils and geology, noise and dust. Construction impacts would be managed through the implementation of mitigation measures outlined in this REF and are expected to be minor.	Short term minor negative
j. Any risk to the safety of the environment?	The proposal would improve the management of wastewater within Bundarra and result in a reduction of risks to the safety of the environment	Long term positive
k. Any reduction in the range of beneficial uses of the environment?	The proposal would not reduce the range of beneficial uses of the environment.	Nil
l. Any pollution of the environment?	The proposal has the potential to pollute the environment during construction and during operation but these impacts are expected to be minor and short term. Overall the proposal will reduce the pollution being discharged to the environment.	Short term negative Long term positive
m. Any environmental problems associated with the disposal of waste?	The proposal would generate some waste during construction and operation but the volume of waste is expected to be relatively minor and able to be disposed at landfill.	Minor negative
n. Any increased demands on resources, natural or otherwise, which are, or are likely to become in short supply?	The proposal would not place increased demands on limited resources. All resources required for the works are readily available and able to be sourced locally.	Nil
o. Any cumulative environmental effect with other existing or likely future activities?	It is unknown if there are any other construction works occurring in Bundarra at the same time as the proposal, if so, it is considered the cumulative impact would be minor and short-term. The long-term effect is considered to be positive.	Short term negative Long term positive
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	The proposal is not expected to result in any direct or indirect impacts to coastal processes.	Nil

4.1.4 Local Environmental Plans

Uralla Local Environmental Plan 2012

The Uralla LEP aims to make local environmental planning provisions for land in Uralla, in accordance with the relevant standard EPIs. A review of the land use mapping in the Uralla LEP identified that the proposal crosses through two land zones, as follows:

- RU1 – Primary Production
- RU5 – Village

In accordance with Clause 5.12(1) of the Uralla LEP, as the proposal is permitted without consent under ISEPP, the development standards and criteria's of the Uralla LEP are not triggered and are therefore not considered further in this REF.

4.1.5 Development Control Plans

Uralla Development Control Plan 2011

The *Uralla Development Control Plan 2011* (Uralla DCP) establishes the standards, controls and guidelines that apply when carrying out development or building work within the Uralla LGA. As development consent is not required, the Uralla DCP is not directly relevant. Nevertheless, relevant sections of the Uralla DCP have been considered.

4.2 NSW and Commonwealth legislation

A summary of other relevant legislation that may apply to the proposal is provided in the following sub-sections. The majority of the relevant legislation is State legislation, with the exception of the *Environment Protection and Biodiversity Conservation* Act 1999, which is commonwealth legislation.

4.2.1 Local Government Act 1993

Under Section 60 of the *Local Government Act 1993*, local water utilities are required to obtain ministerial approval for the construction or modification of water or sewage treatment works, including water recycling schemes. The Section 60 approval provides an independent assessment of the proposed works to ensure they are fit for purpose and provide robust, safe, cost-effective and soundly based solutions that meet public health and environmental requirements.

The proposal requires a Section 60 approval from the Minister for the proposed STP and water recycling scheme.

4.2.2 Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future. The BC Act lists threatened species, populations and ecological communities as well as critical habitat and key threatening processes that must be considered when assessing the effects of an activity.

The BC Act outlines the factors to be considered when making an assessment. If a significant impact is deemed likely following this assessment, a Species Impact Statement or a Biodiversity Development Assessment Report may be required. The proposal is not considered to result in a significant impact to biodiversity, hence no further consideration of species or ecological communities listed as threatened under the BC Act is required. Further detail is provided in Section 6.4.

4.2.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) is administered by the NSW Office of Water and aims to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It also provides formal protection and enhancement of the environmental quality of waterways and in-stream uses as providing protection of catchment conditions.

The WM Act applies where a Water Sharing Plan (WSP) issued under the Act has commenced. The proposal is located within the area subject to the Water Sharing Plan for the *Gwydir Unregulated and Alluvial Water Sources 2012*, which commenced on 3 August 2012 and regulates the interception and extraction of unregulated and alluvial water sources in the area. The proposal is therefore subject to the requirements of the WM Act and all water extraction or use must be undertaken in accordance with the Water Sharing Plan for *Gwydir Unregulated and Alluvial Water Sources.*

Section 56 of the WM Act establishes access licences for the taking of water within a water management area. It is not expected that construction activities for the proposal will require extraction of groundwater and therefore would not require a Water Access Licence (WAL) under the WM Act.

The WM Act also requires controlled activity approvals to carry out specified controlled activities on or under waterfront land. The proposal would be undertaken on waterfront land (within 40 m of the bed of a river or estuary) and as such comprises a controlled activity under the WM Act. However, public authorities such as Council, are exempt from obtaining a controlled activity approval under Clause 41 of the *Water Management (General) Regulation 2011*.

Aquifer Interference Policy 2012

The Aquifer Interference Policy 2012 is administered by the NSW Office of Water and defines the regime for protecting and managing the impacts of aquifer interference activities on NSW's water resources. It details the requirements for aquifer interference projects to determine their potential impacts on water resources. It also explains the information and modelling that proponents will need to provide to enable the impacts to be assessed.

The purpose of the policy is to explain the role and requirements of the Minister administering the *Water Management Act* 2000 in the water licensing and assessment processes for aquifer interference activities under the Water Management Act 2000 and other relevant legislative frameworks. The policy aims to assist proponents of aquifer interference activities in preparing the necessary information and studies to be used by the Minister in the assessment of project proposals that have some level of aquifer interference. This policy has been reviewed and considered during the preparation of this REF.

4.2.4 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) establishes a process for investigating and (where appropriate) remediating land that is considered to be contaminated.

Section 59(2) of the Act requires notification of contaminated sites.

Section 60 of the Act requires landowners to report any contamination that represents a significant risk of harm to human health or the environment to the NSW Environment Protection Authority (EPA).

A search of contaminated land record of notices and sites notified to the EPA identified no contaminated sites within proximity to the proposal site. Site contamination is further addressed in Section 6.2.

4.2.5 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 4, 'critically endangered' species and communities listed under Schedule 4A, and vulnerable species and communities listed under Schedule 5.
- The listing of 'Key Threatening Processes' (under Schedule 6).
- Diseases affecting fish and marine vegetation (under Schedule 6B).
- Noxious fish and noxious marine vegetation (under Schedule 6C).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements or otherwise for the preparation of a SIS.

One of the objectives of the FM Act is to 'conserve key fish habitats' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. The project requires works within a creek or waterway.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the project and hence may occur subject to the habitats present.
- Assessment of aquatic habitats during terrestrial field surveys.
- Assessment of impacts on aquatic habitats.
- Identification of suitable impact mitigation and environmental management measures to avoid or mitigate impacts on the aquatic environment.

Part of the proposal also crosses over a third order stream mapped as Key Fish Habitat. A permit under section 200 of the Act will be required in order to trench the pipeline into the bed of this creek.

4.2.6 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. 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.

Three species listed as priority weeds for the Uralla region were recorded within the study area:

- Fireweed (*Senecio madagascariensis*
- Tiger Pear (*Opuntia aurantiaca*)
- Blackberry (*Rubus fruticosus* species aggregate)

Mitigation measures to control the spread of priority weeds are discussed in Section 6.4.

4.2.7 Roads Act 1993

The *Roads Act 1993* (Roads Act) sets out the requirements for the management and use of public roads. Section 138 of the Roads Act requires that a person obtain the consent of the appropriate roads authority for the erection of a structure, or the carrying out of a work in, on or over a public road, or the digging up or disturbance of the surface of a public road.

The proposal would require underboring of Bendemeer Street. Works would be undertaken within the road reserves of Bendemeer Street, Bowline Street, Tomline Street, Oliver Street, Bombelli Street, Brown Street, Court Street, White Street, Souter Street, Murhead Street and Barraba Road. A Section 138 permit would be required prior to the commencement of works within these road reserves. Uralla Shire Council would be the consent authority for the permit.

4.2.8 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to ensure that the heritage of NSW is adequately identified and conserved. The Heritage Act provides protection to items such as places, buildings, works, relics, moveable objects, precincts or land that have been identified, assessed and listed on the State Heritage Register.

A search of the State Heritage Inventory and Register revealed the Bundarra Police Station and Courthouse, located on the corner of Oliver Street and Bendemeer Street, Bundarra was listed. A detailed heritage assessment concluded the proposal would not significantly detrimentally impact on the listed heritage items. A summary of the heritage assessment is provided in Section 6.6 and a copy of the report is provided in Appendix B.

4.2.9 Crown Land Management Act 2016

The objects of the Crown Land Management Act 2016 (CLM Act) is to provide direction in regards to the ownership, use and management of Crown Land of New South Wales. This includes considering environmental, social, cultural heritage and economic issues in regards to Crown Land management, with the intent of providing consistent, efficient, fair and transparent management of Crown land for the benefit of the people of New South Wales, including the use and co-management by Aboriginal people.

As some of the reticulation system is over Crown land, the management of the Crown land will need to be transferred to Council and an easement established, as per the CLM Act.

4.2.10 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. The NPW Act also aims to foster public appreciation, understanding and enjoyment of nature and cultural heritage, and provides for the preservation and management of national parks, historic sites and certain other areas identified under the NPW Act. The NPW Act is administered by the NSW Office of Environment and Heritage (OEH).

The Gwydir River National Park is located approximately 28 km to north west of the proposal. The proposal would not significantly impact on this National Park.

An aboriginal heritage assessment of the study area revealed a scar tree, located south east of Bundarra, was listed but would not be impacted. No other items of aboriginal heritage significance were identified.

Potential impacts on Aboriginal cultural heritage protected under the NPW Act are discussed in Section 6.5 and Appendix B.

4.2.11 Protection of the Environment Operations Act 1997

The POEO Act establishes a licensing regime for pollution generating activities in NSW. Under Sections 47 and 48, an environment protection licence (EPL) is required for scheduled development work and scheduled activities respectively.

The proposal would provide for 470 equivalent persons and 0.9 kilolitres per day therefore it does not meet the definition of a scheduled activity under Clause 36 of Schedule 1 of the POEO Act and an EPL is therefore not required.

However the EPA will be the regulatory authority for the STP in accordance with Clause 6 of the POEO Act. The POEO Act also regulates pollution in general during the construction and operation of the proposal.

4.2.12 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government (Department of the Environment (DotE)) for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land.

The proposal is unlikely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land, as summarised in Table 4-2. Accordingly, the proposal has not been referred to DotEE. Potential impacts from the proposal on matters of national environmental significance are discussed further in Section 6.4.

Table 4-2 EPBC Act protected matters search results

Protected matter	Matter located within search radius	Comments	Potential impact
World Heritage Properties	None	No World Heritage properties within the 10 km search radius.	None
National Heritage Places	None	No National Heritage places within the search radius.	None
Wetlands of international importance (Ramsar sites)	Four wetlands of international importance: • Banrock station wetland complex • Gwydir wetlands: gingham and lower Gwydir (big leather) watercourses • Riverland • The coorong, and lakes Alexandria and albert wetland	The Banrock station wetland complex is located 1000 km south west of the proposal site. The Gwydir wetlands: gingham and lower Gwydir (big leather) watercourses is located 150 km upstream of the proposal site. Riverland wetland is located 1000 km south west of the proposal site.	None

Protected matter	Matter located within search radius	Comments	Potential impact
		The coorong, and lakes Alexandria and albert wetland is located 1200 km south west of the proposal site. No impacts on the Ramsar sites as a result of the proposal is anticipated.	
Threatened ecological communities	Three threatened ecological communities: • New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands • Weeping Myall Woodlands • White Box-Yellow Box-Blakley's Red Gum Grassy Woodland and Derived Native Grassland.	Approximately 3.48 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland CEEC occurs within the study area and has potential to be directly impacted. However the majority of this is the portion within the STP site (3.13 ha), which is not anticipated to be removed.	No significant impact
Threatened species	25 threatened species, including six birds, one fish, one frog, six mammals, two reptiles and nine plant species.	The proposal is located within a predominantly disturbed area within the Bundarra village. Due to the nature and quality of the potential habitat present in the study area, the proposal would not result in a significant impact on any threatened or listed migratory species.	No significant impact
Listed migratory species	11 migratory species, including marine, terrestrial and wetland species of birds, mammals and reptiles.		No significant impact
Commonwealth Marine Areas	None	No Commonwealth marine areas are located within the search radius.	None
Great Barrier Reef Marine Park	None	The Great Barrier Reef Marine Park is outside the search radius.	None
Commonwealth land	1 Commonwealth property – Telstra Corporation Limited	The proposal would not directly or indirectly impact on any Commonwealth land.	None

4.3 Confirmation of the statutory position

The review of relevant legislation undertaken in the preceding sections confirms that consent for the proposal is not required under Division 4.1 of the EP&A Act. Assessment under Division 5.1 of the EP&A Act, in the form of this REF, is required. The determining authority for the proposal is Uralla Shire Council. This REF has been prepared to comply with the requirements for Division 5.1 assessment including the matters to be considered under Section 5.5 of the EP&A Act and Clause 228 of the Regulations.

Additional licences and permits required for the proposal include:

- Part 7 permit application under the *Fisheries Management Act 1994*
- Section 60 approval under the *Local Government Act 1993*
- Consent under Section 138 of the *Roads Act 1993* for works within the road
- The transfer of the Crown land management of rear lanes to Council and the establishment of an easement over Lot 7301 DP 1149103, in accordance with the Crown Land Management Act 2016

5. Stakeholder and community consultation

5.1 Community consultation

5.1.1 Residents and community

The residents of Bundarra have been informed of the proposal by Council and a community meeting held on 14 December 2017. The community meeting was attended by 11 residents and covered:

- Description of pressure sewer systems
- The service area
- Town reticulation
- Site layout
- Operation and maintenance
- Site inspection
- Consultation process

In mid 2018 an audit of individual properties was undertaken which provided an opportunity for informal discussions regarding the proposal.

The community have not raised any major issues and are generally in support of the proposal.

5.2 Government agencies

5.2.1 ISEPP consultation

A checklist of consultation requirements for infrastructure projects in NSW, such as the proposal, is provided in Clauses 13 to 16 of ISEPP. Clauses 13, 14 and 15 outline the circumstances under which consultation with the local council is required, while Clause 16 outlines the requirements of when to consult with other public authorities.

As the works are being carried out by Council, in accordance with Clause 17(1), Clauses 13, 14 and 15 do not apply. A checklist of Clause 16 is provided in Table 5-1, which found that ISEPP consultation is not required for the proposal. However, due to the type and scale of the project, consultation with public authorities was also conducted, even though not specifically triggered under ISEPP, as described below.

Table 5-1 Infrastructure SEPP consultation

Clause 16 - Consultation with public authorities other than councils	Yes	No
Do the works involve:		
a. development adjacent to land reserved under the National Parks and Wildlife Act 1974 or to land acquired under Part 11 of that Act—the Office of Environment and Heritage		✓
b. development on land in Zone E1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone—the Office of Environment and Heritage		✓
c. development adjacent to an aquatic reserve or a marine park declared under the Marine Estate Management Act 2014—the Department of Industry		✓

Clause 16 - Consultation with public authorities other than councils	Yes	No
d. development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998—the Sydney Harbour Foreshore Authority		✓
e. development comprising a fixed or floating structure in or over navigable waters—Roads and Maritime Services		✓
f. development for the purposes of a health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act)—the NSW Rural Fire		✓
g. development that may increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map—the Director of the Observatory		✓
h. development on defence communications facility buffer land within the meaning of clause 5.15 of the Standard Instrument—the Secretary of the Commonwealth Department of Defence		✓
i. development on land in a mine subsidence district within the meaning of the Mine Subsidence Compensation Act 1961—the Mine Subsidence Board		✓

5.2.2 Agency consultation

Due to the type and scale of the project, the relevant government agencies were consulted with via phone calls and emails advising them of the proposal objectives, preparation of the REF and providing the Options Report and Concept Design report. Agencies were invited to make comments on the proposal.

A copy of the emails issued and their responses are provided in Appendix D, while a summary of the agencies responses is provided in Table 5-2.

Table 5-2 Agency consultation

Agency	Summary of Response	Where addressed
DoI Crown Lands	DoI Crown Lands have identified part of the reticulation system is on crown land. Crown Lands do not object to the project but want the management of the rear lanes transferred to Council and an easement and/or road opening to authorise the route of the rising main over Lot 7301 DP 1149103 between Barraba Road and Mount Drummond Road.	Refer to Section 6.1
Department of Primary Industries (DPI) - Water	DPI – Water have been contacted but have not provided any comments to date.	N/A
DPI Fisheries	The works cross a 3rd order stream along Barraba Road. This creek is considered *Key Fish Habitat* and will require a permit for any dredging/reclamation works (under s.200 of the *Fisheries Management Act* 1994) to trench the pipe into the bed of the creek.	Refer to: Section 4.2.5
Environment Protection Authority (EPA)	The EPA have indicated they support the proposal to convert Bundarra from on-site wastewater systems to a reticulated system. While acknowledging that the proposal does not require an Environment Protection Licence, the EPA confirmed they are the appropriate regulatory authority under the POEO Act and therefore have an interest in the proposal. EPA will continue to be involved in the design process.	N/A

Agency	Summary of Response	Where addressed
Office of Environment and Heritage (OEH)	OEH recommended: • Engage with the local Aboriginal community and undertake archaeological surveys over the areas proposed for ground works, Specific surveys for the entire impact zone of the preferred option should be undertaken to ensure that all identifiable Aboriginal objects and intangible cultural constraints are accounted for prior to finalising the plans for this project. • Include an unexpected finds protocol in the proposal to deal with incidental discover of suspected Aboriginal objects during future construction, This should include a procedure for cessation of works and seeking further advice if discovery of Aboriginal objects occurs. OEH recommends that local Aboriginal knowledge holders and the OEH are contact in such an event and that the local NPWS Office would likely be the most useful initial point of contact. • Ensure the preferred option assessment considers all the impacts on biodiversity for the selected preferred feeder main routes option. • Note that a high potential exists for impact to EEC vegetation along some of the road reserves in the locality and that the proposal should be designed to minimise such impacts.	Section 6.5 Section 6.5 Section 6.4 Section 6.4
Roads and Maritime Services (RMS) Asset Management	GHD have liaised with the Roads and Maritime Service during the different stages of the project (RMS are the owners of the Gwydir River bridge) regarding feasibility of the installation of the pipeline crossing. RMS has indicated that the proposed concept alignment where the pipe was shown on top of the footpath beams is not preferred, as RMS has plans to upgrade (widen) the footpath bridge in the near future. The gap between the bridge and footpath will be used for this upgrade. The detailed design proposed a new alignment where the sewer main is bracketed to the underneath of the footpath beams. Figure 3-2 shows the pathway and supporting beams. The crossing details are presented in the detailed design drawings in Appendix A. These details have been accepted by RMS on email sent by RMS on 01 February 2019 (Peter G McRae, A/Bridge Maintenance Planner - Northern Region Asset Management | Regional & Freight, T 02 6640 1062) stating the following: *Roads and Maritime Services concurs with the proposed works subject to the below conditions being met:* • *Should the proposed works vary in any way you must advise Roads and Maritime Services.* • *The licence agreement be completed and signed before work commences.*	Section 6.1

5.2.3 Service provider consultation

Consultation with relevant service providers was undertaken to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions, which have the potential to impact on existing land use. A summary of the consultation and outcomes is provided in Table 5-3.

Table 5-3 Service provider consultation

Agency	Response
Essential Energy	Preliminary discussions have commenced with Essential Energy, with these to continue throughout the design process.
Telstra	A Dial Before You Dig search has been undertaken and before works commence a detailed site plan and engage a Telstra Accredited Plant Locator to determine the exact location of the assets. Once the precise location of the Telstra assets has been established, either arrange for the Telstra assets to be relocated or re-align the proposal to ensure they are no longer impacted. If the proposal is to be re-aligned, the proposal will have to be re-evaluated.

6. Environmental assessment

6.1 Land use and services

6.1.1 Existing environment

The proposed STP site would be installed on rural land on the outskirts of the village of Bundarra. The land is mostly cleared and is used for grazing livestock. From the STP site the sewer rising main would extend approximately 1.7 km into the village of Bundarra, adjacent to Barraba Road. The indicative construction footprint for this sewer rising main is 6 m, and would be contained within the road reserve. The majority of the land adjacent to Barraba Road appears to be used for agricultural purposes, however a drainage line and vegetated area are also noted to extend to the north and south of Barraba Road, which the sewer rising main would need to cross. These are discussed further in Sections 6.3 and 6.4.

Within the village of Bundarra, the pipes would be passing through residential areas and property connection would be to residences and commercial properties within the village. Properties within Bundarra currently operate on-site wastewater systems, primarily septic systems.

With regard to services, underground services in Bundarra are known to include water and Telstra and overhead services include power.

6.1.2 Impact assessment

Construction

The works would involve construction of the STP site, sewer rising main, connecting pipework and property connection.

The construction of the STP site would result in significant change of the land use, with the site being transformed from agricultural grazing land to a STP. This is considered to be a significant, permanent impact, although it is anticipated that the STP site and the water re-use irrigation area would only disturb 5 ha of the 20 ha site. Construction of the pipeline would result in short term disturbance to the road reserve from the STP into the village of Bundarra. Connecting residential properties to the sewer main would result in short term disruption, although the existing on-site wastewater systems would be negated, with decommissioning/removal of these the responsibility of the land owner.

DoI Crown Land have identified that part of the reticulation system is on Crown Land. To address this issue, DoI Crown Land have requested the management of the rear lanes be transferred to Council and an easement and/or road opening to authorise the route of the rising main over Lot 7301 DP 1149103 between Barraba Road and Mount Drummond Road.

Roads and Maritime Services own the bridge that crosses the Gwydir River, which the pipeline would be attached to. Roads and Maritime have been consulted throughout the design process and have agreed to the proposal, subject to a couple of conditions, refer to Section 5.2.2.

Construction activities have the potential to impact on existing utilities and services, in particular underground services such as water and telecommunications. Council would consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions which have the potential to impact on existing land use.

Operation

Changes in land use to the STP site would have occurred during construction and would be unlikely to change during operation. During operation of the pipeline, any maintenance activities would be restricted to the road corridor. As such, along the pipeline, no change to land use or services is expected during operation of the STP.

6.1.3 Mitigation measures

Mitigation measures provided in Table 6-1 would be implemented to minimise potential impacts on land use and property.

Table 6-1 Proposed mitigation measures – land use and services

Impact	Mitigation measure	Timing	Responsibility
Resident impacts	Reduce the number and extent of affected properties as much as possible and minimise the construction corridor.	Pre-construction	Council/Consultant
Crown Land	Consult with DoI Crown Lands to transfer the management of the rear lanes to Council and resolve the mechanism to authorise the route of the rising main over Lot 7301 DP 1149103.	Pre-construction	Council
Roads and Maritime	Should the proposed works vary in any way you must advise Roads and Maritime Services. The licence agreement be completed and signed before work commences.	Pre-construction	Council
Service provider impacts	Consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions during construction.	Pre-construction	Council/Consultant
	Complete dial before you dig and pot holing to confirm location of services and reduce the potential for accidental strike.	Pre-construction	Contractor
	Mark out services to prevent accidental strike. This includes any overhead cables.	Construction	Contractor

6.2 Soils and geology

6.2.1 Existing environment

Topography

Southern Bundarra lies on a small hill with the crest at approximately 660 m Australian Height Datum (AHD) lying approximately at the intersection of Oliver Street and Bendemeer Street. From this point the surface gradually slopes in every direction at an estimated 1° to 5°.

Northern Bundarra lies on the slope of a small hill that slopes approximately 5° in a southerly direction from approximately 670 m AHD at Burnet St to approximately 650 m AHD at the Gwydir River.

The proposed STP site is on relatively flat land with an elevation of approximately 670 m AHD.

Geology

Reference to the 1:250,000 scale Manilla geology series sheet SH 56-9 indicates the site lies in an unnamed unit with bedrock likely to comprise mudstones, lithic sandstones, hornfels and pebbly conglomerates.

An excerpt of the 1:250,000 Manilla geological sheet is shown in Figure 6-1 with the relevant geological subgroup and site location labelled.

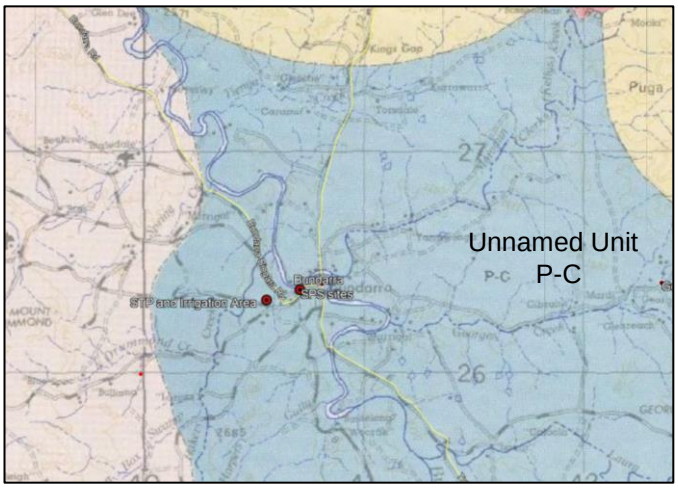


Figure 6-1 Excerpt of 1:250 000 Manilla Geology Sheet

Soil landscapes and profile

A prior investigation and report on the proposed Bundarra Sewage Scheme was undertaken by NSW Public Works for Uralla Shire Council. The report presents an options analysis for the proposed Bundarra Sewage Scheme. As part of the options analysis a geotechnical investigation comprising the excavation of 17 test pits was undertaken by Uralla Shire Council. Test pits were excavated at various locations throughout Bundarra and at locations being considered for the sewage treatment works.

Generally the subsurface conditions encountered at the site can be summarised as comprising:

- Topsoil to depths of up to 0.5 m; overlying
- Clay to depths of up to 4.0 m; overlying
- Bedrock in 11 of the 17 locations, generally described as shale, shale/clay, sandstone/clay, gravelly rock or broken rock

A geotechnical investigation of the proposed STP site was undertaken by GHD on behalf of NSW Public Works in June 2018 (GHD, 2018b). The investigation comprised:

- Excavation of ten (10) test pits by a 4 tonne tracked excavator to a depths ranging from 0.85 to 2.75 m
- Dynamic penetrometer testing at TP101, TP102, TP103, TP105 and TP106. Pocket penetrometer testing at regular intervals within all encountered cohesive materials
- Collection of disturbed samples for laboratory testing

Subsurface conditions encountered in the test pits were relatively variable at the sites. The subsurface units may be summarised as:

- FILL: Silty GRAVEL, Sandy SILT, brown to pale brown and dry
- Alluvium/residual: CLAY, Clayey SAND, medium to high plasticity/fine to coarse grained, generally hard/medium dense and dry

- Alluvium: CLAY/SAND, medium plasticity/fine to coarse grained, generally hard/dense, dry
- Residual: CLAY/gravelly CLAY, medium to high plasticity, hard and dry
- Bedrock

It is noted that iron oxide cemented sands recovered as fine to coarse gravel sized fragments were encountered in TP107 and TP108 at depths of 1.0 m and 1.20 m respectively.

Sandstone bedrock exposures were noted at the STP site in the vicinity of TP101 and are shown in Figure 6-2.

Figure 6-2 Bedrock exposure

Results of the laboratory testing on samples from TP101 indicate that the subsurface materials were dry of optimum moisture content at the time of investigation. Permeability testing on the clay soils encountered at TP101 indicate the soils are of a low hydraulic conductivity.

Soil investigation

Soil investigations were undertaken during the detailed design (GHD, 2019) to determine the suitability of soils, at the proposed STP site, for effluent irrigation. The results of these investigations, along with the Environmental Guidelines for soil properties are presented in Table 6-2.

Table 6-2 Soil constraints for effluent irrigation systems

	Limitation			Restrictive feature	Bundarra irrigation area
	Nil or slight	Moderate	Severe		
Exchangeable sodium percentage (0-40 cm)	0–5	5–10	>10	Structural degradation and waterlogging	2.0-4.1
Salinity measured as electrical conductivity (ECe) (dS at 0–70 cm)	<2	2–4	>4	Excess salt may restrict plant growth	4.5-7.4
Depth to top of seasonal high water table (metres)	>3	0.5–3	<0.5	Poor aeration, restricts plant growth, risk to groundwater	0.5–3
Depth to bedrock or hardpan (metres)	>1	0.5–1	<0.5	Restricts plant growth, excess runoff, waterlogging	>1 (surface outcrop area is considered an exclusion zone)
Soil pH ($CaCl_2$)	>6–7.5	3.5–6.0 >7.5	<3.5	Reduces optimum plant growth	4.9-5.9
Effective cation exchange capacity (ECEC, cmol(+)/kg, average 0–40 cm)	>15	3–15	<3	Unable to hold plant nutrients	5.8-14.6
Emerson aggregate test (0–100 cm)	4,5,6,7,8	2,3	1	Poor structure	3

Site contamination

A review of historical aerial imagery from Google Earth (accessed 2 August 2018) shows that the proposed STP area and village of Bundarra has not changed since prior to 2003. It is considered likely that the proposed STP site would have been used for agricultural grazing land for some time and prior to that was likely vegetated. The road reserve from the proposed STP site into Bundarra may contain small amounts of discarded household rubbish. The township of Bundarra was established in the mid to late 1800s and has always had a relatively small population and commercial centre. Potentially contaminating activities/businesses within the township of Bundarra are considered to comprise potential asbestos in buildings, potential lead paint on houses or the bridge, the garage and agricultural supplies store. Any potential contamination at these sites would likely be isolated, small scale and unlikely to be exposed during the works. As a result, it is considered unlikely that significant contamination would be present in soils at the proposed STP site, within the pipeline corridor or within the township of Bundarra.

A search of contaminated land record of notices and sites notified to the EPA indicates there are no contaminated sites within or in the vicinity of the proposal site.

6.2.2 Impact assessment

Construction

Exposure of soil to erosion

The proposal would require earthworks and stockpiling of soil material and movement of trucks and machinery across the ground surface. This would expose and disturb soil that is currently covered with either vegetation or the compacted road corridor. Soil erosion could cause downstream impacts, including siltation of watercourses and water storages and reduction in the water quality of creeks and other waterways.

The pipeline would be constructed progressively with trenching and installation to be completed in sections. Progressive stabilisation and revegetation would be undertaken to minimise the amount of soil exposed at any one time.

The pipeline crosses four unnamed tributaries of Gwydir River and crosses the main channel of Gwydir River via the bridge on Bendemeer Street. Working in waterways has the potential to cause erosion of the banks and subsequent sedimentation issues and cause unnatural alteration of bed and bank stability. Works would be undertaken when these watercourses are dry and rainfall is not predicted for three days. Construction works would be isolated from any stream flows if they were present. Stabilisation and rehabilitation of creek crossings would be undertaken immediately following completion of works to ensure a protected bed and bank in the event of flows in the waterways.

There would be the potential for erosion to occur from incorrectly managed stockpiles. Measures to mitigate and avoid soil erosion impacts from this are critical and are provided in Section 6.2.3.

Accidental contamination

During construction, there would be a requirement for a number of fuel-powered vehicles and equipment as well as some chemicals and lubricants. There is potential for accidental spillage or leaks of hydrocarbon or chemicals during works or from any stored hazardous materials in the compound areas. While this would present a negative impact, the volumes of potential spillages would be relatively minor so would not be anticipated to result in a significant impact. However, mitigation measures including the preparation of an incident emergency spill plan would be developed and implemented before any construction commences.

Unexpected discovery of contaminated soils

A potential exists for unexpected contaminated soils or wastes to be identified during excavations for pipeline installation. In particular, there is a potential for previously unidentified contaminated materials to be present within deeper fill materials. The key risk would be the accidental spreading or mobilisation of unexpected contaminated soils. As such, in the event of discovering any unexpected contamination, further investigation should be undertaken prior to continuing with works to determine the impacts and mitigation measures required.

Soil structure

Construction activities such as backfill of trenches, long-term stockpile of materials and heavy vehicle traffic have the potential to cause soil compaction. This can be exacerbated when these activities are undertaken when soils are wet and more susceptible to compaction. Soil compaction can cause damage to the soil structure, which determines the ability of a soil to hold and conduct water, nutrients, and air necessary for plant root activity.

Operation

Table 6-2 indicates the salinity of the soils at the STP site present a severe limitation in regards to accepting irrigated effluent, which may restrict plant growth. This should be managed via adequate plant selection. pH, cation exchange capacity and dispersability of the soils are a moderate limitation. According to the Environmental Guidelines a soil with:

- Nil or slight limitations (as defined in Table 6-2) will in general require no soil amelioration (soil improvement).
- Moderate limitations will highlight the requirement for amelioration e.g. lime for acidic soils or careful management of irrigation to manage impacts to hydraulic conductivity.
- Severe limitations indicate where soils may be deemed unsuitable for irrigation or careful risk management will be required to maintain environmental sustainability of the scheme.

Based on the results in Table 6-2, the soils will require careful management, especially in relation to salinity.

6.2.3 Mitigation measures

Mitigation measures provided in Table 6-3 would be implemented to minimise potential impacts on soils and geology.

Table 6-3 Proposed mitigation measures – soils and geology

Impact	Mitigation measure	Timing	Responsibility
General	Include provisions in the construction contract for suspension of work until adequate controls are in place to encourage pre-emptive action, not reaction.	Pre-construction	Council/ Consultant
Contamination	Preparation of a contingency plan for unexpected finds/contaminated soils within the CEMP. This section would include details of excavation, segregation, stockpiling, remediation, validation and disposal requirements for any contaminated matter.	Pre-construction	Contractor
Exposure of soil to erosion	Prepare a Soils and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) in accordance with *Blue Book - Managing Urban Stormwater: Soils and Construction* (4th ed, Landcom, March 2004) and Volume 2A: Installation of Services, which must include the following: • Establish all erosion and sediment control measures before ground disturbance work commences and these are to remain in place until all surfaces have been fully restored and stabilised. • Inspect and maintain controls regularly to ensure effectiveness over the entire duration of the project, and clean out before 30% capacity is remaining. • Provide a clean water diversion around disturbed areas.	Pre-construction, construction and operation	Contractor

Impact	Mitigation measure	Timing	Responsibility
	• Locate controls to protect sensitive receiving environments such as the Gwydir River • Stockpiles would be located outside of drainage lines and the dripline of trees and would have appropriate controls installed to prevent erosion, control runoff and prevent sedimentation. • All excavations are to be progressively backfilled and stabilised within ten working days during the course of construction works to minimise the potential for erosion. • Stabilise stockpiles against erosion and flood management in instances where they would be in place for greater than twenty working days. Revise the ESCP throughout the proposed works covering all stages.		
Accidental contamination from leaks or spills of fuels / chemicals etc.	Prepare an incident emergency spill plan as part of the CEMP to be implemented during construction. Further, procedures for the storage and handling of hazardous materials including fuel and chemicals will be prepared and included within the CEMP and will include: • No refuelling to occur on-site unless appropriate bunded hardstand and spill protection/spill plan is prepared. • Storage of hazardous materials on-site will be kept to a minimum. Any that are stored must be stored in accordance with national guidelines and the Safety Data Sheets relating to bunding, coverage, storage of incompatible materials, etc. • A 'spill kit' would be kept on site at all times for potential chemical or fuel spills. • Construction contractors will be trained in the correct use of the spill kit.	Pre-construction	Contractor
Rehabilitation	Minimise disturbance areas during construction and progressively stabilise and rehabilitate disturbed areas following completion of construction activities. Monitor and inspect rehabilitated areas on a regular basis.	Construction Construction	Contractor Contractor
Irrigation	Prepare and implement a soil monitoring program of the irrigation area, in accordance with *Environmental Guidelines – Use of Effluent by Irrigation* (DEC, 2004)	Operation	Council/Consultant

6.3 Hydrology, flooding and groundwater

6.3.1 Existing environment

Surface water

The proposal is located in the Gwydir River catchment, with the alignment crossing four minor ephemeral unnamed tributaries and the main channel of Gwydir River. The proposal site is located on the north and south of the Gwydir River, with drainage occurring across the floodplain to the main channel of the Gwydir River. The local hydrology is shown in Figure 1-2.

Northern Bundarra lies on the slope of a small hill that slopes approximately 5° in a southerly direction towards the Gwydir River. Southern Bundarra lies on a small hill with the crest lying approximately at the intersection of Oliver Street and Bendemeer Street. From this point the surface gradually slopes in every direction at an estimated 1° to 5°. The proposed alignment passes through a medium density residential area of Bundarra.

Water quality in the ephemeral watercourses is likely to be typical of residential and agricultural land uses, with potentially slightly elevated suspended solids and nutrients due to disturbance such as cultivation and fertiliser application. Inspection of aerial imagery indicates the immediate downstream water users include grazing and broad acre agriculture.

Previous investigations by Public Works (Bundarra Sewering Strategy Report, May 2016) identified pollution from the existing on-site sewage treatment systems due to the presence of clay soils which have poor soil permeability, especially during wet weather periods.

Groundwater

A review of existing groundwater borehole records using the Department of Primary Industries NSW Office of Water database was carried out on the 21 November 2017. The search was conducted to identify registered groundwater boreholes within Bundarra area and to record information such as groundwater use and standing water level. Five registered groundwater bores are located within the area and the details are summarised in Table 6-4.

The limited information suggests groundwater is at a depth of less than 10 m but these are at locations with a lower elevation than the sites, so it is expected the groundwater depth at all proposed sites is greater than 10 m.

Table 6-4 Registered groundwater bore details

Bore ID	Purpose	Depth of Bore (m)	Standing Water Level (m)	Location
GW059735	Domestic	28.0	22.0	In Bundarra town, north of the Gwydir River
GW047644	Irrigation	22.9	7.6	About 1km west of Bundarra on southern side of Gwydir River
GW068062	Test bore	16.8	6.3	
GW068063	Test bore	16.8	5.3	
GW965143	Irrigation	16.0	3.0	

The geotechnical field investigation was completed in June 2018 by GHD (GHD, 2018b). The investigation comprised 10 test pits to a maximum depth of 2.75 metres.

No free groundwater was encountered during the test pit investigation and test locations were noted to be dry on completion. It is noted that groundwater levels are anticipated to vary based on climatic conditions and rainfall.

Flooding

Part of the proposal is located within the Gwydir River floodplain and Figure 6-3 shows the proposal in relation to the flood planning area defined by the Uralla Local Environmental Plan 2012. Although the flood planning layer does not appear to cover the area of the proposed STP site, based on the topography, it is considered unlikely that the site is subject to flooding.

6.3.2 Impact assessment

Construction

Surface Water

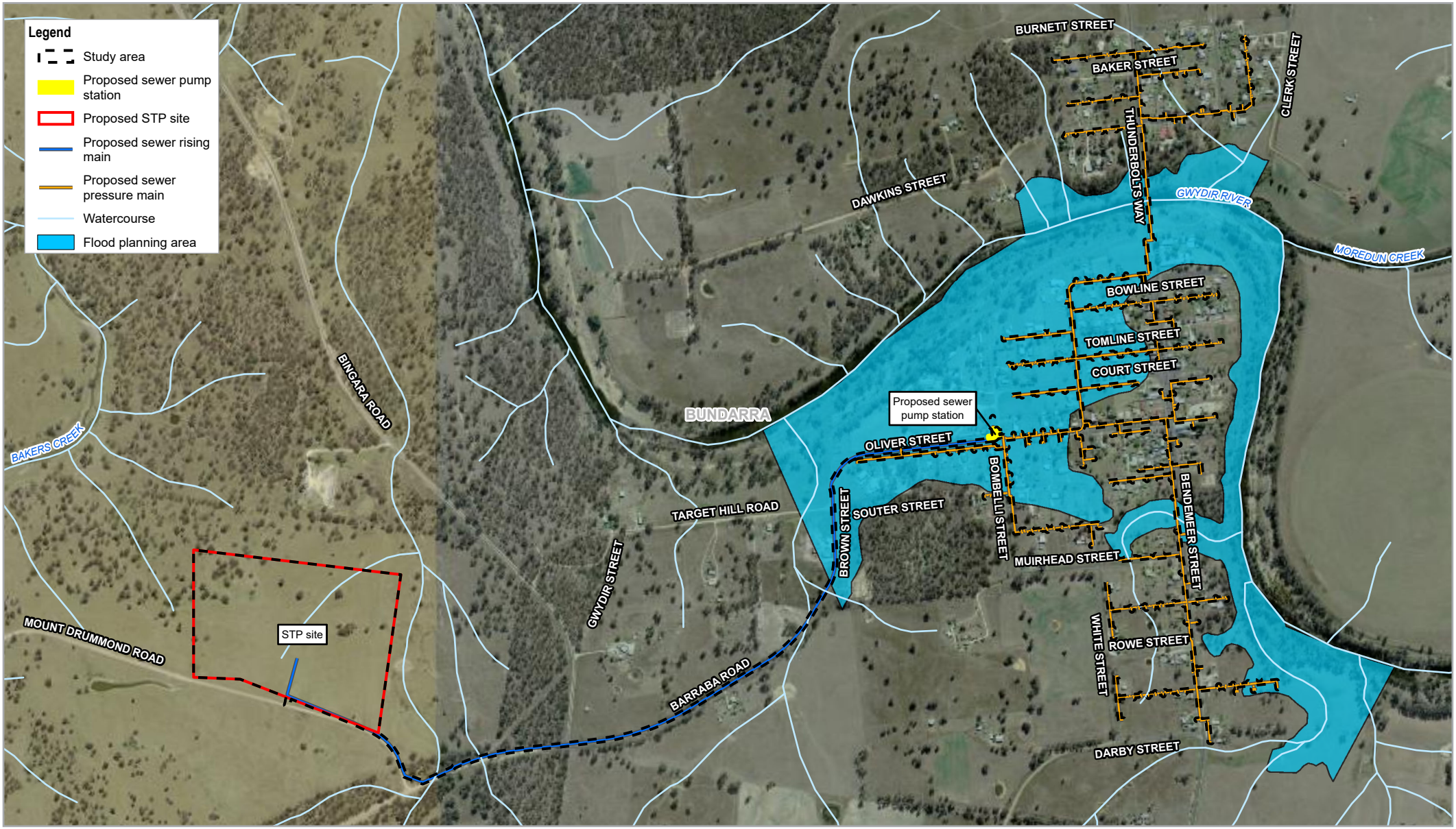
The proposal has the potential to increase temporarily sediment-laden runoff to the ephemeral watercourses and the Gwydir River during construction as a result of disturbance during construction works. Working in waterways has the potential to cause erosion of the banks and subsequent sedimentation issues, particularly when water is flowing in the waterways. As such, earthworks in these sections would be undertaken when the waterways are dry and rainfall is not predicted for three days.

During construction and installation of the pipeline, there is an increased risk of soil erosion, which has the potential to result in the mobilisation of soils and suspended particulates during a rain event, or within discharged groundwater. Should this sediment-laden water be allowed to drain into nearby waterways without mitigation, it could cause a significant increase in turbidity and suspended solids within the drains and waterways.

Without implementation of erosion and sediment control measures, there is the potential for sedimentation of waterways, with associated detrimental impacts on aquatic flora and fauna. However, stringent implementation of erosion and sediment control measures described in Section 6.3.3 would significantly reduce the impacts, particularly in areas of stockpiling and treatment. Further, rapid rehabilitation upon completion of earthworks would minimise the impact of waterway sedimentation.

Any chlorinated water discharged during the flushing of the pipeline would be either collected in a tank or discharged onto land. Water would not be discharged directly to any permanent waterway. Water discharged overland would have a minimum travel time to the nearest receiving water of at least 4 minutes to assist in dechlorination. If this travel time cannot be achieved, alternative methods of dechlorination at the outlet may be used.

The proposal would not result in permanent changes to existing surface drainage patterns and is not expected to result in any significant impacts on surrounding water quality if appropriate erosion and sediment controls are implemented (refer to Section 6.3.3).



Paper Size ISO A4

0 100 200 300 400

Metres

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

N

GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Bundarra flood planning area

Figure 6-3

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\2219174_REF005_Flood_0
Print date: 30 Jul 2019 - 11:11

Data source: LPI: DTDB / DCDB 2017; Planning/EPI_Protection_Layers: public_NSW_Imagery: . Created by: fmackay

Groundwater

As discussed in Section 6.3.1, construction of the proposal would require a depth of excavation to a minimum of 0.85 metres and generally between 0.9 and 1 metre. A maximum trench depth of 2.0 metres would be associated with connecting the pipeline at trenchless crossings. These trench depths are less than the depth of excavation for the geotechnical assessment, where no groundwater was encountered. As such, groundwater is not expected to be encountered during construction and dewatering is unlikely to be required.

Flooding

The proposal area is located within the flood planning area defined by Uralla Local Environmental Plan 2012. Where practicable, excavations would be avoided during periods of intense rainfall to reduce the potential for local drainage issues. The construction contractor would ensure that erosion and sediment controls are installed progressively ahead of construction works and removed progressively following construction works. No trenching is to be left open and appropriate temporary stabilisation measures are to be installed at the completion of daily construction activities.

Open trench construction of the pipeline through the ephemeral watercourses would be undertaken during dry conditions, where possible, and stabilised and revegetated as soon as possible following construction in those sections.

During construction, stockpiles would be located outside of flood conveyance areas (typically drainage lines) to minimise impacts to flow paths and patterns.

Operation

Surface water

A detailed water and nutrient balance was prepared during the detailed design (GHD, 2019) to determine how to sustainably manage the effluent from the proposed STP.

The water balance was undertaken based on a 50th percentile rainfall year, in accordance with the expected effluent quality categorised as “low strength” as per the *Environmental Guidelines: Use of Effluent by Irrigation* DEC (2004).

The irrigation demands were largely determined by the interaction between:

- Evaporative demand and its seasonal trend from low in winter to high in summer.
- Rainfall pattern and the extent to which it satisfied the evaporative demand. The variation in rainfall between years gave rise to differences in irrigation volumes between dry and wet years.

The outcomes of the water balance indicate that a total irrigation area of 4.2 hectares and a winter storage pond of 5.1 ML are required to contain a wet weather events for a 50th percentile rainfall year. This means that after an extended period of rain event (greater than the mean event), the irrigation area will not be able to receive more reuse water and the winter storage pond will be full. Winter storage overflow (tertiary treated water) may occur to the nearest drainage line, which finally discharges to the Gwydir River, downstream of the town. It is expected that this may occur every 2 years. Once the wet weather event ends, irrigation water reuse would start to operate again and no discharge would be experienced from the winter storage pond.

In regards to nitrogen (N) and phosphorus (P), applications were taken to be sustainable if they caused no nutrient leaching below 1 m depth (or the soil depth if less than 1m) over the long term (20 years). Leaching below 1 m was taken as an indication that nutrients were moving beyond the reach of plant roots.

Budgets were prepared for the mean total-N and total-P expected effluent concentrations of 24 mg N/L and 5 mg P/L and assuming a harvested pasture.

The area required to balance nutrients is as follows:

- Total Nitrogen: 2.7 hectares
- Total Phosphorus: 1.5 hectares

As a 4.3 hectare irrigation area is proposed, it is anticipated the water and nutrient load from the proposed STP would have minimal impact on the surrounding environment. When the capacity of the system is exceeded (i.e., about every 2 years), it will be entering a wet environment with a large assimilation capacity. The effluent quality discharged will also be low strength, so it is not expected to have a detrimental impact on the local water quality and likely be an improvement on the current situation.

Groundwater

Based on the water and nutrient balances explained above, plus the depth to groundwater, the operation of the proposed STP is not expected to impact on the groundwater.

Flooding

There would be no impacts to flooding during operation of the proposal as all proposed infrastructure would be located below the current ground level. Excess spoil would be removed from site and disposed offsite appropriately.

6.3.3 Mitigation measures

Mitigation measures provided in Table 6-5 would be implemented to minimise potential impacts on hydrology and flooding.

Table 6-5 Proposed mitigation measures – hydrology, flooding and water quality

Impact	Mitigation measure	Timing	Responsibility
General	Prepare a Soil and Water Management Plan as described in Section 6.2.3.	Pre-construction	Contractor
Surface flows	In all open trenched sections of the proposal, the ground level must be reinstated to a similar level to pre-construction to ensure no changes to drainage or flow patterns occurs.	Construction	Contractor
Flooding	Place material stockpiles and ancillary facilities outside of flood conveyance areas and drainage lines.	Construction	Contractor

6.4 Biodiversity

This section summarises the results of the *Ecological Impact Assessment* contained in Appendix C.

6.4.1 Existing environment

Flora species

A total of 44 species of flora from 24 families were recorded within the study area during the field survey, including 32 native and 12 exotic species. The Poaceae family was the most diverse family recorded (13 species including 11 native and two exotic) followed by Asteraceae (3 native and 3 exotic species) and Myrtaceae (5 native species). One threatened flora species, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint), was detected immediately adjacent to the study area. This species is listed as vulnerable under both the BC and EPBC Acts. It is extremely likely that those specimens in the study area are planted street trees and are not naturally occurring. Appendix C provides a complete list of all flora species identified within the study area.

Priority and environmental weeds

Three species declared as priority weeds in the Uralla region were identified within the study area, these are detailed in Table 6-6.

Table 6-6 Priority weeds recorded during the field survey

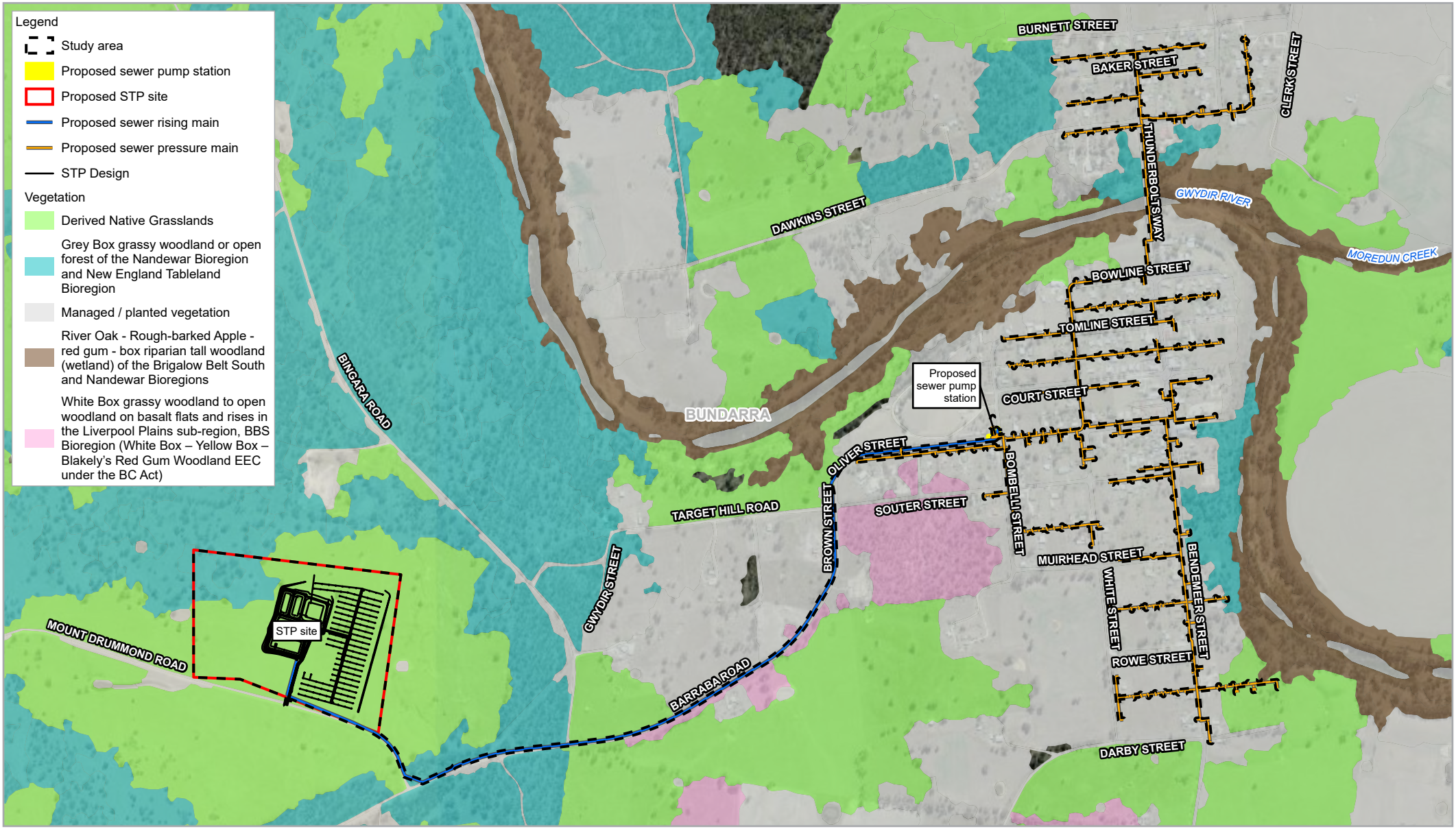
Scientific Name	Common Name	Duty
Senecio madagascariensis	Fireweed	Prohibition on dealings Must not be imported into the State or sold
Opuntia aurantiaca	Tiger pear	Prohibition on dealings Must not be imported into the State or sold
Rubus fruticosus species aggregate	Blackberry	Prohibition on dealings Must not be imported into the State or sold

Vegetation types

Five vegetation types were identified within the study area including four native plant community types and one exotic/managed/planted vegetation type. Vegetation types within the study area include:

- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion (PCT 433) (0.05 ha). This community forms part of White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act and critically endangered under the EPBC Act.
- Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion (PCT 516) (2.99 ha).
- River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84) (0.08 ha).
- Derived Native Grassland, as a result of historical clearing and agricultural practices (17.72 ha).
- Managed/Planted Vegetation, largely within the township of Bundarra (12.36 ha).

Figure 6-4 shows the location and extent of plant community types within the study area



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

GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Vegetation communities within the study area

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Figure 6-4

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\2219174_REF003_Vegetation_0
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Data source: LPI: DTDB / DCDB 2017; public_NSW_Imagery: . Created by: fmackay

Plate 1 **White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub region, BBS Bioregion**

Plate 2 **Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion**

Plate 3 **River Oak – Rough barked Apple – Red Gum- Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion**

Plate 4 **Derived native grassland**

Plate 5 Managed/Planted Vegetation

Threatened ecological communities

White Box – Yellow Box – Blakely's Red Gum grassy woodland is listed as a critically endangered ecological community (CEEC) under the EPBC Act. The patches of White Box Grassy Woodland within the study area meet the criteria for EPBC listing as specified by the EPBC Policy Guidelines (DEH 2006).

Approximately 3.04 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland CEEC occurs within the study area and has potential to be directly impacted. Figure 6-4 shows the greater extent of this CEEC in the wider area, with 0.24 ha being a relatively minimal area.

Threatened fauna species

Two Grey- crowned Babblers (Pomatostomus temporalis temporalis), listed as vulnerable under the BC Act, were observed immediately adjacent to the study area (see Figure 6-5)

Fauna habitat

Habitat in the study area is predominantly in a disturbed condition due to historical agricultural activities, particularly grazing by livestock, and development such as residential housing and roads. There are narrow areas however, particularly along Barraba Road, which provide a moderate level of fauna habitat, due to the presence of an intact midstorey and ground layer, and the presence of fallen logs and tree hollows.

Habitat types

Grassy woodland

The grassy woodland habitats within the study area are likely to provide habitat for a range of bird species, including potentially threatened bird species, and a variety of more common reptiles. Hollows within these communities are typically small and in low numbers, and therefore habitat for hollow- dependent mammals is largely absent. Microchiropteran bat species are likely to be present and can roost under tree bark and in very small hollows and fissures in trees. Five hollow- bearing trees containing five small and two medium hollows were detected within the study area, and two dead stags.

When in flower, the Eucalypt species within the study area are likely to be an important nectar resource for a range of native bird and insect species. Common honeyeater species such as White- plumed Honeyeater (*Lichenostomus penicillatus*), Yellow- faced Honeyeater (*Lichenostomus chrysops*) and White- eared Honeyeater (*Lichenostomus leucotis*), as well as threatened species such as Regent Honeyeater (*Anthochaera Phrygia*) would potentially be found feeding in these trees. Similarly, both common and threatened species of parrot may utilise this nectar resource when available, such as Musk Lorikeet (*Glossopsitta concinna*) and Eastern Rosella (*Platycercus eximius*), and threatened species Little Lorikeet (*Glossopsitta pusilla*) and Swift Parrot (*Lathamus discolor*).

Fallen timber in a variety of sizes from large fallen trees to small hollow logs is fairly common within these communities in the study area (see Plate 6). Groundcover and woody debris such as fallen logs and bark provide suitable foraging and sheltering substrate for a range of native birds, mammals, reptiles and frogs.

Plate 6 A fallen log in the grassy woodland

Derived native grassland

The derived native grassland is typically lacking in habitat features for local fauna, given its disturbed state, and is predominantly subject to either mowing or cattle grazing. However, common ground- foraging bird species such Australian Magpie (*Cracticus tibicen*), Magpie- lark (*Grallina cyanoleuca*) and Masked Lapwing (*Vanellus miles*) are likely to forage within these grasslands. Birds of prey may also hunt over these grasslands as they could be housing prey species such as introduced rabbits and mice. Birds of prey that may potentially utilise these grasslands include Wedge- tailed Eagle (*Aquila audax*), Brown Falcon (*Falco berigora*), Nankeen Kestrel (*Falco cenchroides*) and Black- shouldered Kite (*Elanus axillaris*).

The grasslands are unlikely to provide foraging habitat for many mammal species, though Eastern Grey Kangaroos (*Macropus giganteus*) may feed here and Microchiropteran bat species may forage aerially above these grasslands for insects.

Aquatic habitats

The unnamed creek which crosses under Barraba Road is a third- order stream and is mapped as Key Fish Habitat (see Figure 6-5) under the *Fisheries Management Act* 1994. Within the study area, this creek contains some wetland vegetation that would provide suitable habitat for a range of frog and insect species. It is a relatively small drainage with fringing wetland vegetation and pools of water, rather than continuous flow. No in-stream vegetation was present at the time of survey and there was no obvious riparian corridor along its length. During the survey the water was turbid and rubbish such as tyres were present in the channel. When flowing, it is possible that fish species may be present within this creek, given that it flows into the Gwydir River. At the time of the site inspection, this section of the creek contained pools of water (see Plate 7).

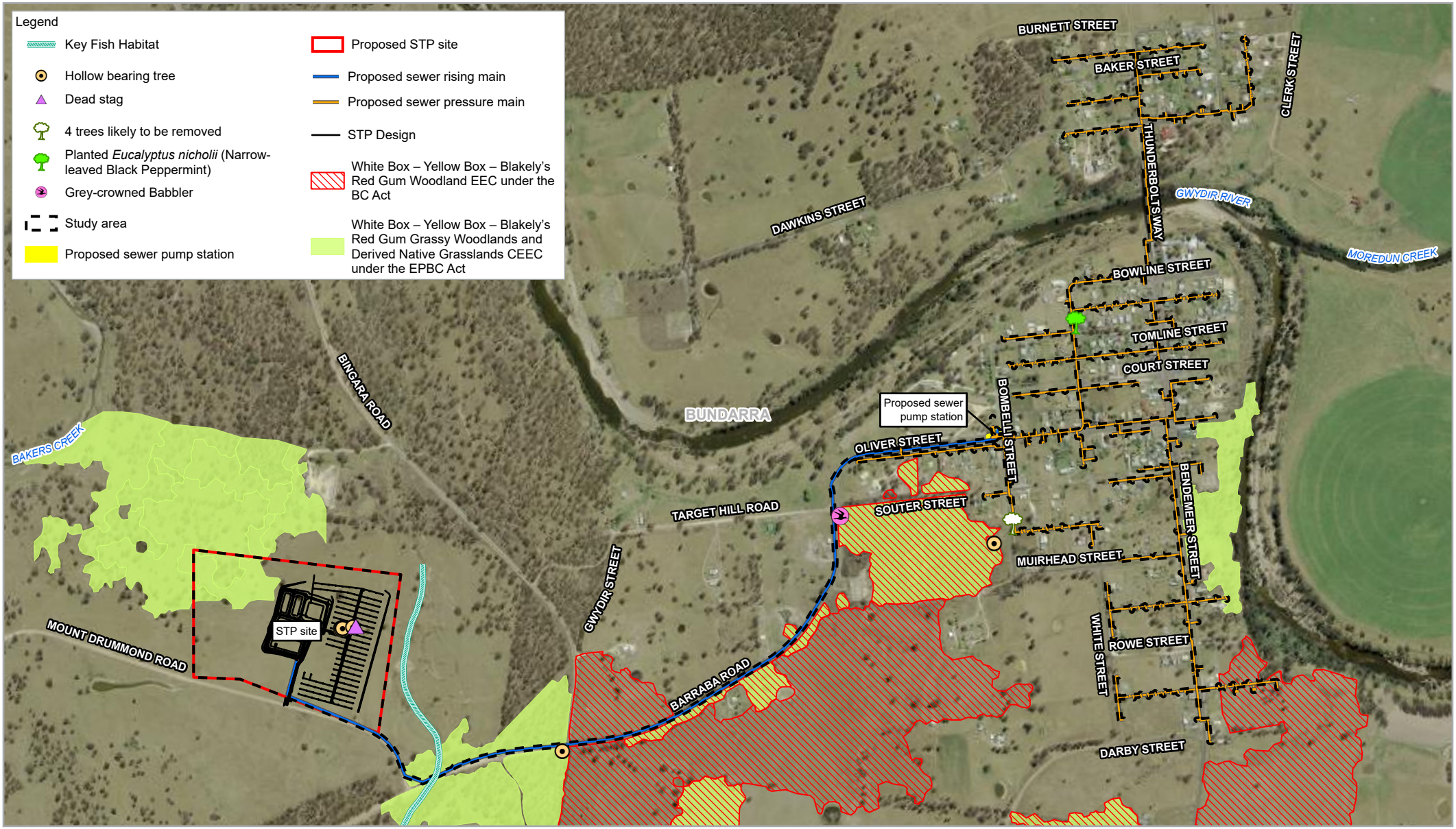
However, once the creek enters the paddock to the east of the proposed STP site, it is extremely degraded and the banks have been eroded away, with no associated woodland vegetation or riparian zone. The land surrounding this section of the creek also lacks tussock grasses or fringing vegetation due to current grazing practices (see Plate 8). The creek was very dry at the time of survey with no noticeable moisture on the ground. It is likely that this section of the creek is largely characterised by very infrequent overland flows, as there is no clearly defined channel (particularly downstream of a farm dam). The dam that is present in the paddock here would also have to fill and overflow in order for water to continue travelling in the direction of the Gwydir River. Therefore, it is unlikely that fish could travel either to or from the Gwydir River. This dam is likely to provide habitat for common species of frog such as *Limnodynastes tasmaniensis* (Spotted Marsh Frog) and waterbird such as *Egretta novaehollandiae* (White- faced Heron) and *Threskiornis spinicollis* (Straw- necked Ibis).

The study area passes over the Gwydir River. This river typically has year- round flow and is likely to provide an important water resource to a variety of native birds, mammals and reptiles and is an important area for fish breeding (MDBA, 2018). The river has potential to be breeding habitat for amphibians and wetland birds and may represent foraging habitat for terrestrial birds and mammals, including threatened species.

The Policy and guidelines for fish habitat conservation and management (DPI 2013) was reviewed with respect to classification of waterways for fish passage. This stream is likely to be moderate key fish habitat (Type 2) at the road crossing. The stream is likely to be minimally sensitive key fish habitat (Type 3) downstream in the paddock where it represents ephemeral aquatic habitat not supporting native aquatic or wetland vegetation.

Plate 7 Key fish habitat within the study area

Plate 8 Section of creek beyond the dam, with no discernible channel



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

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Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Threatened Ecological Communities, Habitat Features, Key Fish Habitat and Threatened Species within the study area

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Figure 6-5

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Data source: LPI: DTDB / DCDB 2017; sixmaps/LPI_Imagery_Best: © Department of Finance, Services & Innovation 2017. Created by: fmackay

6.4.2 Impact assessment

Direct impacts

Vegetation clearing

The project would result in the removal of vegetation from a number of vegetation types within the study area as summarised in Table 6-7. This estimate assumes that all clearing and works associated with the project would be contained within the study area.

The proposed route for the pipeline is predominantly within already cleared or managed areas immediately adjacent to the roadside. It is considered likely that minimal vegetation clearing is required for the proposal. There is a very small area along Bombelli Street in Bundarra where four native trees (three *E. blakelyi* and one *E. melliodora*) occur immediately adjacent to the study area (see Figure 6-5).

Within the proposed STP site, approximately 5 ha of the 20 ha would be utilised for the construction of the STP and for temporary stockpiling of pipes and equipment.

It is expected that a 6 m area will be required to be cleared for the pipeline. The impact areas for all vegetation types in the study area are provided in Table 6-7.

Table 6-7 Vegetation clearing within the study area

Vegetation Type	BC Act Status	EPBC Act Status	Area within study area (ha)	Area to be directly impacted (ha)
White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion	EEC	CEEC	0.05	0.02
Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion	-	Some patches conform to CEEC	2.99	0.23
River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	-	-	0.08	0.05*
Derived Native Grassland	Some patches conform to EEC	-	17.72	11.39
Managed/Planted Vegetation	-	-	12.36	7.58
Total			**33.2**	**19.3**

EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

**Where the project crosses the Gwydir River, the pipeline is proposed to be attached to the existing bridge. Therefore, while the figures portray the disturbance areas as traversing through the River Oak – Rough-barked Apple – Red Gum – Box riparian tall woodland, none of this community will actually require removal as it is situated under the bridge.*

Threatened ecological communities

One TEC was identified within the study area: White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act, and critically endangered under the EPBC Act.

An *Assessment of Significance* in accordance with Section 1.7 of the EP&A Act has been undertaken for potential impacts to this TEC and is presented in Appendix C. The conclusion of the assessment is that the project is unlikely to have a significant impact due to the following:

- Direct impacts to TEC vegetation are minimal within the study area.
- The TEC vegetation to be affected is mainly in a state of low to moderate condition due to its situation adjacent to roadways.
- This TEC exists elsewhere within the locality that would not be impacted by the proposal.
- The project would result in minimal fragmentation as the vegetation is already fragmented by roads.

Threatened flora

One flora species listed under the BC Act and EPBC Act, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint) was recorded within the study area, though these are highly likely to be planted specimens and not naturally occurring. Suitable habitat is present for nine other threatened flora species (refer to Appendix C). Assessments of significance in accordance with Section 1.7 of the EP&A Act have been undertaken for these species and are presented in Appendix C. The general conclusion of these assessments is that the project is unlikely to have a significant impact on these species for the following reasons:

- The habitat that would be removed as a result of the project is already fragmented and predominantly occurs adjacent to roadsides.
- The habitat to be removed comprises a small proportion of better quality habitat in the locality.

Threatened fauna

One threatened fauna species, Grey- crowned Babbler (*Pomatostomus temporalis temporalis*), was recorded immediately adjacent to the study area during field surveys.

The site also contains potential habitat for a large range of fauna species listed under the BC Act and the EPBC Act. Assessments of significance in accordance with Section 1.7 of the EP&A Act have been undertaken for these species and are presented in Appendix C. The general conclusion of these assessments is that the project is unlikely to have a significant impact on these species for the following reasons:

- The habitat that would be removed as a result of the project is already fragmented and predominantly occurs adjacent to roadsides.
- The habitat to be removed comprises a small proportion of better quality habitat in the locality.

Aquatic impacts

It is anticipated that impacts to aquatic habitats are to be minimal. The water quality of the Gwydir River is unlikely to be impacted, given that the pipeline will traverse above the river attached to the existing bridge.

It is proposed to discharge water from the STP into the unnamed creek to the south of the STP site in times of high rainfall. Given that the creek does not appear to have any channel or banks in this area (observed during the field surveys) as a result of cattle grazing, it is unlikely that this discharge would cause significant impacts to any local fauna. It is also considered likely that the discharged water would sit within the paddock, rather than in the creek itself, given that there are no banks to hold it in place. Therefore, the expected impacts to aquatic fauna such as fish are considered to be very low, given the absence of a creek channel.

The introduction of pollutants from the project into the surrounding environment, if uncontrolled, could potentially impact on water quality. However, the potential for water quality impacts are considered to be low to moderate. Potential water quality impacts would be managed through the implementation of mitigation measures, including best practice sediment and erosion controls (Section 6.3.3). There could also be temporary water quality impacts during construction due to runoff from areas stripped of vegetation or runoff from soil stockpiles.

Fragmented and barrier effects

The land in the study area has been previously fragmented due to land use including agricultural grazing. There would be minimal impacts to connectivity as the vegetation to be removed occurs either along the existing roadways, or within already cleared and fragmented areas. The project would increase distances between vegetation by 6 metres, which is not considered a significant barrier to flora and fauna dispersal or movements.

Injury and mortality of native fauna

The project may cause displacement or in some cases possible mortality of fauna that are present at the time of vegetation clearing activities. Less mobile terrestrial fauna, such as common species of frogs and reptiles present within groundcover are most at risk of mortality as a result of vegetation clearing. Other species of fauna are unlikely to remain within the disturbance area during construction activities.

Displaced individuals of nocturnal species including microbats would be vulnerable to predation if they are disturbed in daylight hours and would experience energy costs, increased risk of predation and increased competition for resources. This may result in impacts beyond the study area by favouring aggressive or generalist species.

There is a risk that fauna species that are breeding in the vicinity of the study area may have their breeding disrupted if the construction phase was to coincide with the breeding season. Mitigation measures including pre-clearing surveys and clearing only while in the presence of a qualified ecologist are detailed in 6.4.3.

Loss and / or disturbance of fauna habitat

The vegetation that would be removed for the project is not considered to be important habitat for local populations of native fauna species given that it is already largely disturbed and predominantly occurs along roadsides.

Indirect impacts

Edge effects and weeds

The study area and immediate surroundings are already disturbed due to vegetation clearing that was conducted for agricultural purposes and the existing roads. There is also evidence of weed infestation and exotic perennial grasses throughout the study area and adjoining areas. The project facilitates the introduction or spread of weed species, light and dust into adjacent areas of vegetation.

Introduction of pathogens

The project has the potential to introduce or spread pathogens such as *Phytophthora cinnamomi* (Phytophthora). Rainfall is one key factor influencing the distribution of *Phytophthora cinnamomi*; consequently, disease caused by the pathogen is generally restricted to moister regions (Summerell et al. 2005). Where present, Phytophthora may result in the dieback or modification of native vegetation and damage to fauna habitats.

Spread of *Batrachochytrium dendrobatidis* (Chytrid fungus) is also possible, given the presence of aquatic habitat within the study area. Chytrid fungus affects both tadpoles and adult frogs and can result in the mortality of entire populations once introduced into an area.

Noise and vibration

Noise and vibration impacts are expected during the various stages of construction as a result of vegetation clearing, vehicle movement and operation of plant for construction. Raised levels of noise and vibration may deter native fauna from using the study area during construction. This may potentially interrupt dispersal of fauna within the locality if species are unwilling to travel through the study area while increased levels of noise or vibration are detectable. Species may also abandon the study area in search of quieter areas. It is however likely that fauna species which occur within the vicinity of the study area are somewhat habituated to noises and vibration resulting from the proximity to residential areas and roads, and that species which are sensitive to increased noise levels have already moved away from these areas. In any case, an increase in noise and vibration within the study area will be temporary and short- term.

6.4.3 Mitigation measures

Mitigation measures provided in Table 6-8 would be implemented to minimise potential impacts on biodiversity.

Table 6-8 Proposed mitigation measures – biodiversity

Impact	Mitigation measure	Timing	Responsibility
General	Prepare an CEMP, which will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants along with the mitigation measures detailed below.	Pre-construction	Contractor
	A Flora and Fauna Management Plan (FFMP) should be prepared as a sub-plan to the CEMP for the proposal. The FFMP would identify environmental management measures to protect the natural environment (e.g. weed and pathogen controls) and detail site-specific mitigation measures and management protocols to be implemented before, during and after all construction activities to further avoid or reduce impacts on threatened species or vegetation communities.	Pre-construction	Contractor
	Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the study area and measures to be implemented to protect biodiversity.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Direct impacts to native vegetation	The path of the pipeline should be designed so that removal of trees is avoided, where possible.	Pre-construction	Council/ Consultant
	Delineating a vegetation buffer with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation or aquatic habitat.	Pre-construction	Contractor
	Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas so as to avoid any additional impacts outside the study area.	Pre-construction	Contractor
Clearance of vegetation	Pre-clearing surveys for threatened flora species, particularly Orchid species likely to be present, or sedentary fauna species (i.e. nesting birds, or fauna utilising hollows) should be carried out by a qualified ecologist prior to the commencement of works, or the felling of any hollow-bearing trees. If any species of concern are identified, construction should be delayed until suitable avoidance measures can be implemented. Displaced fauna species may require relocation into suitable adjacent habitat by a fauna-spotter-catcher.	Pre-construction	Contractor
	Clearing of potential habitat trees (hollow bearing trees) should be minimised, and these trees should be searched prior to clearing (i.e. under decorticating bark).	Pre-construction	Contractor
	A suitably qualified fauna-spotter-catcher should be present during vegetation clearing activities. Suitable release methods should be used such as nest boxes for ‘soft release’.	Pre-construction	Contractor
Impact to fauna habitat resources	All hollow logs situated within the project area should be shifted into areas of habitat that are to be retained, so that they can continue to provide fauna habitat in the immediate vicinity of the proposal.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Potential for spread of weeds, pests	Protocols for preventing or minimising the spread of declared and environmental weeds are required to be included in the CEMP, including: • Dispose of weeds correctly by pulling out all of the plant and covering loads when transporting to a disposal facility licensed to accept green waste. • Prior to entering the construction corridor, inspect vehicle exterior and remove all plant propagules (such as seeds) from vehicle tyres, undercarriages, grills, floors and trays. • Ensure that construction plant and equipment that has previously operated in or travelled from areas known to be contaminated with listed priority weeds are washed down prior to entering the site. • In the event of the presence of any declared priority weeds, manage them in accordance with the requirements of the Biosecurity Act 2015. • Remove weeds immediately and dispose of without stockpiling. • Include photos of priority weeds in the CEMP for use by contractors during toolbox talks and site induction.	Construction	Contractor
Pathogens	Implement hygiene measures in accordance with the Department of Environment and Heritage national best practice guidelines for Phytophthora (2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the project should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the study area and when traversing between areas of vegetation within the study area.	Pre-construction	Contractor
	Introduce hygiene measures to prevent the introduction or spread of chytrid fungus during the vegetation clearing, including decontamination of plant equipment working within 40 m of waterways and wetland habitat.	Construction	Contractor
Edge effects	Areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Vehicle strike of fauna	Restricting vehicle movements to operational (daylight) hours	Construction	Contractor
	Implementing and enforcing appropriate speed limits for vehicles traversing the site	Construction	Contractor
	Establishment of 'no-go' areas, which are demarcated with high visibility barrier tape to prevent accidental impacts to vegetation and other biota adjacent to the study area.	Construction	Contractor
Rehabilitation	Soil that is removed for the trenching of the pipeline should be backfilled the same way that it came out i.e. topsoil containing a native seedbank will be placed in last, allowing the area to regenerate naturally	Construction	Contractor
	Following completion of construction works, cleared areas adjacent to the study area should be rehabilitated in an ecologically appropriate manner using soil stabilisation measures and planting of local and endemic species characteristic of the vegetation types identified within the study area.	Post-construction	Contractor

6.5 Aboriginal heritage

An Aboriginal and Non-Aboriginal Cultural Heritage Assessment (ANACHA) was prepared by Everick Heritage Consultants which incorporated an Aboriginal archaeological assessment and an assessment of aboriginal cultural heritage values. The report is included in Appendix B, while a summary of the existing environment, impact assessment and mitigation measures is provided in the following sub-sections.

6.5.1 Existing environment

The proposal is located within close vicinity to the Gwydir River and a broad undulating ridge runs south to north within the STP site location, which are both features conducive to Aboriginal occupancy. However, the site and surrounding area are generally described as disturbed land and have been subject to vegetation clearing, intensive grazing and trampling by cattle, fence construction, construction of drainage channels, roads footpaths, driveways and residential properties, landscaping and installation of underground infrastructure.

A search of Aboriginal Heritage Information Management System (AHIMS) data conducted on 31 July 2018 with a 0 m buffer identified the Bundarra Scar modified tree located in the south eastern corner of the Project Area.

A search of the Aboriginal Place Register (OEH) on 31 July 2018 showed no Aboriginal Place listings in the township of Bundarra.

An archaeological survey was undertaken on 6 August 2018 by Senior Archaeologist Dr Morgan Disspain. Ainawan Local Aboriginal Land Council CEO Mr Greg Livermore was also present during the site inspection.

No additional Aboriginal cultural heritage items or places were identified during the survey.

6.5.1 Impact assessment

The previously recorded Aboriginal site present within the study area, the Bundarra Scar modified tree, would not be impacted by the proposed works.

There is very little topsoil material on the upper slope of the ridge crest within the STP site. It is therefore considered unlikely that the surrounding soils would contain Aboriginal objects, and as such the ridge crest was not identified as a potential archaeological deposit (PAD).

There is extensive disturbance and land surface alteration within the town of Bundarra on the river flats of the Gwydir River. As such, it is considered unlikely that the soils would contain any Aboriginal artefacts, and as such, the river flats within the study area were not identified as a PAD.

It is not considered that additional archaeological research, in the form of test pit excavations, will significantly inform the management response for sites within the study area. This conclusion is based on the following considerations:

- The absence of large scale stone artefact scatters identified during the archaeological survey
- The absence of known ceremonial or intangible sites in the Project Area and surrounds
- The nature and extent of known archaeological sites in the surrounding areas
- The high levels of disturbance within the Project Area
- The absence of deep and undisturbed topsoil deposits

It is considered unlikely that an archaeological excavation program over the PAD areas will identify a stone artefact scatter with either high or moderate conservation value. Stone artefact scatters, should they occur, are likely to be disturbed, have low artefact densities, and are unlikely to contain locally unique artefacts. As such it is reasonable to conclude that these sites, should they exist, will be of low conservation value.

6.5.2 Mitigation measures

The mitigation measures provided in Table 6-9 would be implemented to minimise potential impacts on Aboriginal heritage.

Table 6-9 Proposed mitigation measures – Aboriginal heritage

Impact	Mitigation measure	Timing	Responsibility
Impact to Aboriginal heritage	If suspected Aboriginal material is uncovered during the works: • Work in the surrounding area is to stop immediately. • A temporary fence is to be erected around the site, with a buffer zone of at least 10 m around the known edge of the site. • An appropriately qualified archaeological consultant is to be engaged to identify the material. • If the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manger as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	• Should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.		
Aboriginal human remains	Although unlikely, should human remains be located during the works: • All works must halt in the immediate area to prevent any further impacts on the remains. • The site should be cordoned off and the remains themselves should be left untouched. • The nearest police station (Bundarra), the Anaiwan LALC, and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. • If the remains are found to be of Aboriginal origin and the police to not wish to investigate the site for criminal activities, the RAPs and the OWH should be consulted as to how the remains should be dealt with. • Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties; statutory obligations.	Construction	Contractor

6.6 Non-Aboriginal heritage

An Aboriginal and Non-Aboriginal Cultural Heritage Assessment (ANACHA) was prepared by Everick Heritage Consultants. The report is included in Appendix B, while a summary of the existing environment, impact assessment and mitigation measures is provided in the following sub-sections.

6.6.1 Existing environment

Heritage database searches were conducted on 31 July 2018 to identify any heritage items located within the town of Bundarra. The following database searches were carried out:

- The World Heritage List: Contains no places within proximity to the study area.
- Commonwealth Heritage List (Australian Heritage Council): Contains no places within proximity to the study area.
- The National Heritage Register (Australian Heritage Council): Contains no places within proximity to the study area.
- Register of the National Estate: Contains no places within proximity to the study area.
- State Heritage Register (Heritage Council of NSW): Contains one item within the Project Area. This is the Bundarra Police Station and Courthouse, located on the corner of Oliver Street and Bendemeer Street, Bundarra (see Table 6-10).
- Uralla LEP: Contains three heritage listed places and one heritage precinct within the study area (see Table 6-10).

Table 6-10 State and local heritage listed places within the Project Area

Heritage item	Map reference (Figure 6-6)	Address	Property Description	Significance
Police Station and Courthouse (former)	I05	31 Bendemeer Street	Lot 1, Section 66, DP758181	State
Bridge over Gwydir River	I06	Bendemeer Street		Local
St Mary's Roman Catholic Church	I07	5 Oliver Street	Lot 3, Section 66, DP758181	Local
McDonald's saw, plane mill and house	I08	29 Tomline Street	Lot 3, Section 57, DP758181	Local
Bundarra Commercial Precinct	C01	Bendemeer Street	From Bowline Street to Souter Street (east side) and to Oliver Street (west side)	Local

The state and local heritage items were visited and photographed, with a view to understand if/how the proposed works will impact the items and precinct.

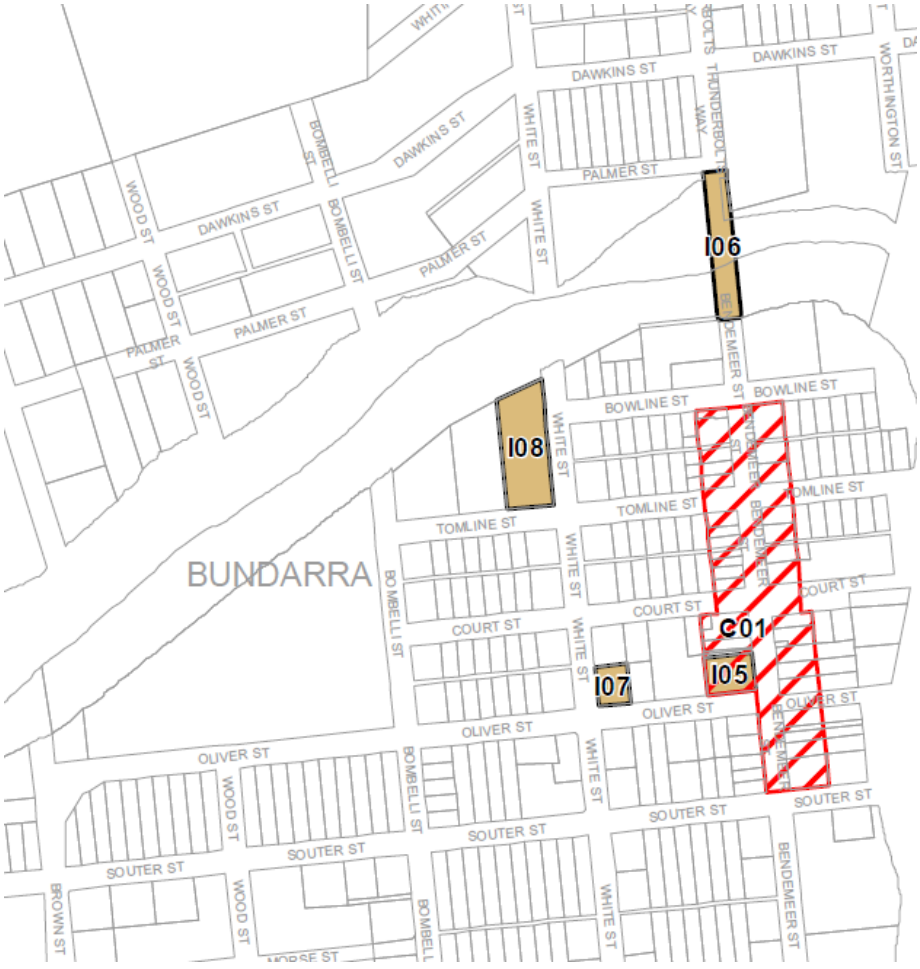


Figure 6-6 Heritage map

6.6.2 Impact assessment

It is considered that the proposal has the potential to impact on items identified as having local or state heritage significance. The works involve the installation of green plastic pods at a number of heritage listed items and the installation of pipework along the heritage listed bridge over the Gwydir River. Most of the pod locations are behind the buildings and will not visually dominate the heritage items. No pipework or services will be attached the buildings themselves. The pipe crossing the bridge will be partly hidden between the footpath and the road of the bridge and will be of a similar colour to the steel structure supporting it. As such, the proposed works will not significantly detrimentally impact on the listed heritage items, although a Conservation Policy is required for the Bundarra Police Station and Courthouse. The Conservation Policy is outlined in Appendix B, with the primary mitigation measures outlined below.

6.6.3 Mitigation measures

The mitigation measures provided in Table 6-11 would be implemented to minimise potential impacts on non-Aboriginal heritage.

Table 6-11 Proposed mitigation measures – non-Aboriginal heritage

Impact	Mitigation measure	Timing	Responsibility
Impacts to the Old Police Station and Courthouse	Temporary fencing should be installed one metre off the wall of the courthouse to ensure that the building is clearly designated as a restricted area.	Pre-construction	Contractor
	The requirements for work adjacent to the building should be clearly identified in operational plans, drawings and works descriptions.	Pre-construction	Contractor
	All staff and contractors should be provided with an induction regarding access and work requirements adjacent to the building, including provisions for a Find Procedure in the event of identification of historic relics.	Pre-construction	Contractor
	High resolution images should be completed of the location of the sewerage pod prior to and on completion of the works.	Pre-construction Post-construction	Contractor

6.7 Noise and vibration

This chapter assesses the potential construction noise and vibration impacts to sensitive receivers due to the proposal in accordance with the DECC *Interim Construction Noise Guideline* (ICNG) (1999) and relevant vibration guidelines and standards.

6.7.1 Existing environment

The proposal runs through a small rural town where the existing ambient noise environment would be subject to rural and agricultural noise, as well as traffic noise from the local road network. As the proposal is located within the village of Bundarra, the proposal alignment will run along the frontage of multiple residential receivers.

The minimum recommended background noise level has been adopted for this assessment as a conservative estimate based on the rural locations that the alignment runs through, as shown in Table 6-12.

Table 6-12 Adopted background levels

RBL (day), dB(A)	RBL (evening), dB(A)	RBL (night), dB(A)
30	30	30

Note: The INP (EPA, 2000) recommends that 30 dB be the minimum background level adopted for the purpose of assessment.

6.7.2 Potential impacts

The following impact assessment is based on the construction information provided in Section 3.

Construction noise and vibration

A quantitative noise assessment has been conducted to assist planning of construction activities by adopting representative sound power data for each identified construction activity and applying a distance loss formula to predict instantaneous sound pressure levels at various distances. Predicted sound pressure levels are compared against construction noise criteria set out in the ICNG.

The recommended standard hours for construction activities are 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

The proposed construction activities are expected to occur during standard construction hours. However, the ICNG acknowledges that the following activities have justification to be undertaken outside the recommended construction hours:

- Emergency work
- The delivery of oversized plant or structures
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours

ICNG noise criteria is summarised in Table 6-13.

Table 6-13 Construction noise management levels at residences

Time of day	Management level (external) $L_{Aeq(15min)}$
Recommended standard 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 holidays	**Noise affected:** Rating background level plus 10 dB(A) **Highly noise affected:** 75 dB(A)
Outside recommended standard hours	**Noise affected:** Rating background level plus 5 dB(A)

Note: The assessment location is 1.5 m above ground, at the most impacted point on a receiver's property that is within 30 m of their dwelling.

A summary of proposal specific construction noise management levels (CNMLs) for residential receivers is presented in Table 6-14.

Table 6-14 ICNG CNMLs for residential receivers, dB(A)

Receiver Type	Rating Background Level (RBL) $L_{A90(period)}$dB(A)			ICNG Management Level $L_{Aeq(15min)}$ dB(A)			
	Day	Evening	Night	During standard construction hours (day) (RBL + 10)	Outside standard construction hours (day) (RBL + 5)	Outside standard construction hours (evening) (RBL + 5)	Outside standard construction hours (night) (RBL + 5)
Residential	30	30	30	40	35	35	35

The noise affected CNML represents the point above which there may be some community reaction to noise. Where the noise affected CNML is exceeded, all feasible and reasonable work practices to minimise noise should be applied and all potentially impacted residences should be informed of the nature of the works, expected noise levels, duration of works and a method of contact. The CNML for residential receivers is the background noise level plus 10 dB during recommended standard hours and the background noise level plus 5 dB outside of recommended standard hours.

The highly noise affected CNML represents the point above which there may be strong community reaction to noise. Where noise is above this level, any feasible and reasonable ways to reduce noise below this level should be carefully considered. If no quieter work method is feasible and/or reasonable, the duration and noise levels of the works and respite periods that would be provided should be clearly explained to the impacted receivers. The ICNG sets the highly affected CNML during standard hours at 75 dB(A) for residential receivers.

All sound power data has been sourced from either the Transport for NSW *Construction Noise Strategy* (CNS) (2012) or from the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) (2016).

Construction of the proposed pipeline largely consists of open trenching, laying the pipe and compacting backfill. Due to the linear nature of this construction, these activities will progress along the alignment relatively quickly. Therefore, the sound pressure levels (SPL) presented in Table 6-15 below will impact individual receivers for a brief period (less than a day).

The STP site would be located at a minimum of 700 m away from the closest resident. Noise impacts would not affect residential receivers from the STP site location.

Table 6-15 Construction sound pressure levels predicted at distance dB(A)

Plant	L_{WA}	Noise affected management level during standard construction hours, dB(A)	Highly noise affected level, dB(A)	SPL (dB) predicted at distance (m)					
				10	20	60	150	300	600
Delivery trucks	103	40	75	75	69	59	51	45	39
Compactor	113			85	79	69	61	55	49
Excavator	107			79	73	63	55	49	43
Trencher	90			62	56	46	38	32	26
Truck and dog	101			73	67	57	49	43	37
Light vehicle	88			60	54	44	36	30	24
Specialist bore equipment	110			82	76	66	58	52	46

Note: Sound pressure levels that exceed the noise affected management level during standard construction hours are shaded orange, while levels exceeding the highly noise affected level are shaded red.

Table 6-15 indicates that the activities anticipated to cause the greatest noise impacts are the compaction of backfill, specialist boring equipment (if required) and excavation. The requirement to use specialist boring equipment has not been confirmed at this point, but their use is anticipated to be limited if required at all.

All other equipment is anticipated to cause noise impacts to residential receivers within 60 m of construction activities but are not anticipated to exceed the highly noise affected level of 75 dB(A). The use of a compactor and excavator have the potential to exceed the highly noise affected level, when the works occur less than 20 m and 10 m respectively from a sensitive receiver. This is possible when installing the pipe work and collection tank in private properties.

The sound pressure levels presented above do not consider the mitigating effects of ground cover or intervening structures and are therefore considered to be conservative. Furthermore, the construction equipment would only be operating in close proximity to individual receivers for a relatively brief period before progressing along the alignment and moving away from the individual receiver.

Construction traffic noise

Construction has the potential to cause traffic noise impacts due to construction vehicles accessing site and the additional traffic on loads roads due to any temporary traffic diversions. The DECCW *NSW Road Noise Policy* (RNP) (2011) provides noise criteria for residential receivers that experience an increase in noise from local roads due to a development. The Application Notes to the RNP states that the objectives of the RNP are met if additional road noise is limited to an increase of 2 dB due to a development.

The Traffic Impact Assessment provided in Section 6.10 concludes that the estimated traffic generation during construction would be insignificant and would fall within typical daily fluctuations encountered within the road network. This would indicate that any increase in road noise would generally be lower than 2 dB and the RNP noise objectives would therefore be met.

Construction vibration

The primary vibration generating construction activities for this proposal include horizontal directional drilling (if required) and the compaction of back fill.

Transport for NSW *Construction Noise Strategy* (CNS) (2016) provides recommended safe working distances to avoid both cosmetic damage to residential structures (based on BS 7385:1993) and human response to vibration (based on DEC *Assessing vibration: A technical guideline* (2006)) for typical vibration generating equipment. Relevant plant and associated working distances provided in the CNS are reproduced below in Table 6-16. Compaction will likely be conducted using a hand held plate compactor. This is expected to be conservatively represented by the < 50 kN vibratory roller.

Table 6-16 Recommended safe working distances from vibration intensive plant

Plant item	Rating/description	Safe working distance	
		Cosmetic damage to residential structures (BS 7385:1993)	Human response (AVTG)
Compactor	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
Pile Boring	≤ 800 mm	2 m	N/A

Table 6-16 indicates that compaction of backfill may potentially cause cosmetic damage when working within 5 m of residential structures and may cause human comfort impacts when working with 15 m of residential structures.

A safe working distance of 2 m is provided for horizontal directional drilling (represented as pile boring in Table 6-16).

Residents will be within the human response safe working distance. Furthermore, some of these residents may be close to or within the safe working distances for cosmetic damage. Mitigation measures outlined in Section 6.1.3 would be implemented in order to minimise construction vibration impacts.

Operational noise and vibration

The STP would generate some noise from the pumps but as the nearest noise sensitive receivers are over 700 m away, no impacts are expected.

The grinder pumps at each property and the pumping station would generate noise but these are either underground or within an enclosure and only run periodically. The pumps are therefore not expected to generate significant noise or cause annoyance to sensitive receivers.

6.7.3 Mitigation measures

Mitigation measures provided in Table 6-17 would be implemented to minimise potential noise and vibration impacts.

Table 6-17 Proposed mitigation measures - noise and vibration

Impact	Mitigation measure	Timing	Responsibility
Noise impacts on sensitive receivers	Inform local residents of the proposed works, including information on expected duration and type of activities, particularly when noisy activities are planned.	Pre-construction	Contractor
	Work and deliveries will only occur during recommended standard construction hours unless approval to conduct work outside these hours is granted.	Construction	Contractor
	An environmental induction will be undertaken by all construction workforce members, and will include the permissible construction hours, identification of high noise and vibration generating activities and site access arrangements.	Construction	Contractor
	Onsite vibration monitoring will be undertaken prior to vibrating compaction activities commencing within 10 m of residential structures or boring commencing within 5 m of residential structures. This monitoring will allow for more accurate vibration predictions based on specific site conditions and plant used.	Construction	Contractor
	Onsite vibration monitoring would be undertaken at the receiver when vibration generating activities are predicted to exceed the cosmetic damage criteria of 15 mm/s ppv. Where exceedances are recorded, the situation should be reviewed in order to identify the measures that can be taken to minimise the impacts. The review may result in a requirement to modify work practices or use alternative, low-vibration methods and equipment. Any vibration measurement would be undertaken by a qualified professional and with consideration to the ICNG guidelines.	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	Dilapidation surveys performed on residential structures identified as being at risk prior to working nearby may assist in mitigating community reaction to high vibration generating activities. Individual properties at risk of cosmetic damage will be determined when the use of specific vibration intensive plant has been identified along the length of the proposal.	Construction	Contractor
	High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.	Construction	Contractor
	Simultaneous operation of noisy plant within discernible range of a residential receiver is to be avoided.	Construction	Contractor
	All vehicles and plant will be turned off when not in use.	Construction	Contractor

6.8 Air quality and energy

6.8.1 Existing environment

Ambient air quality

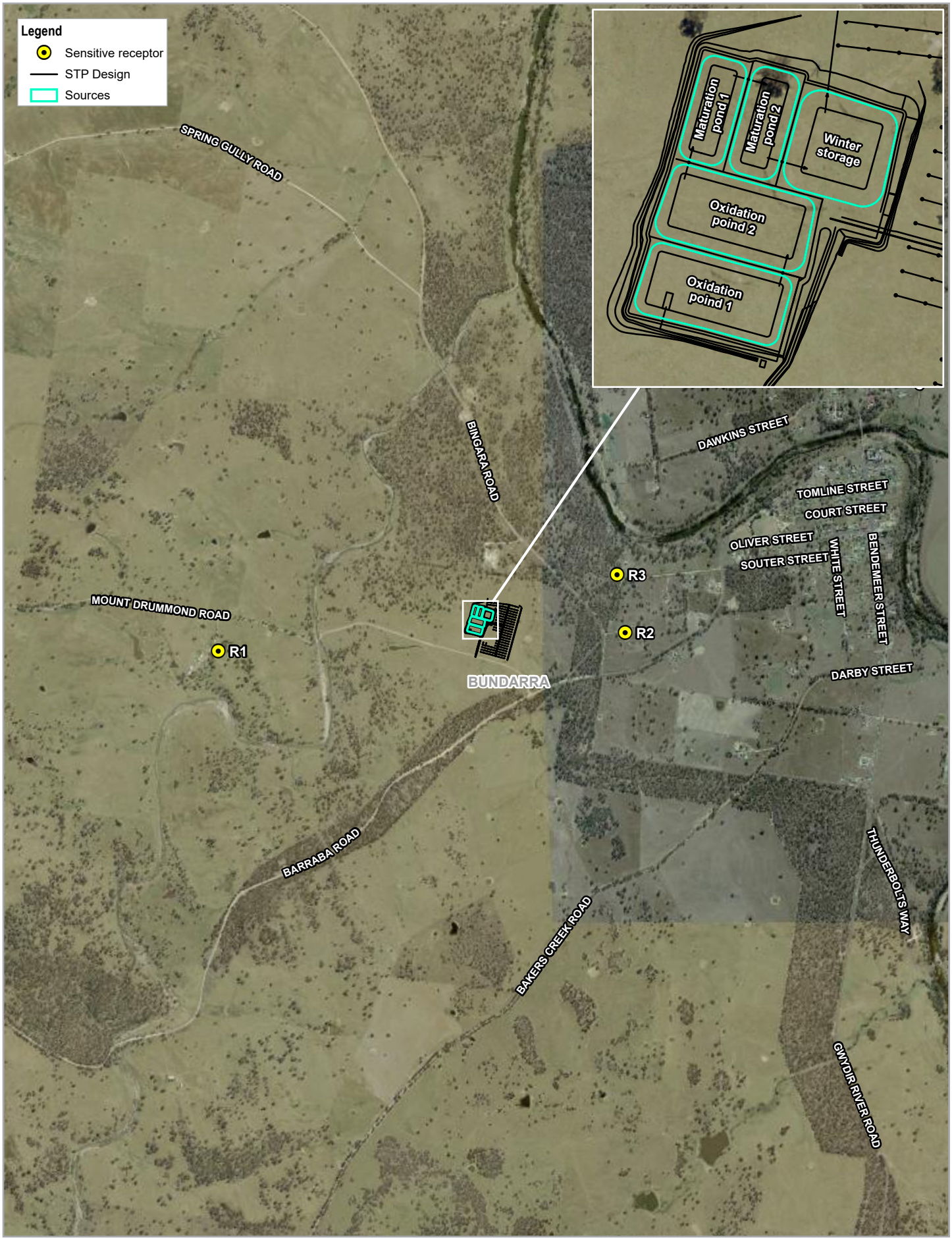
No significant industrial odour sources exist in Bundarra village and the surrounding area. The current system of on-site sewer systems (mainly septic tanks) are sources of odour. Once the proposal has been installed, these local on-site sewer systems will be decommissioned.

Sensitive receivers

The location of the nearest identified sensitive receptors to the site are presented in Table 6-18 along with the nearest road and receptor type. A figure showing the location of the site with surrounding receptors is supplied in Figure 6-7.

Table 6-18 Sensitive receptors locations

ID	X Coordinate (m)	Y Coordinate (m)	Nearest Rd	Description
R1	310792	6659882	Mount Drummond Rd	Residential
R2	313244	6659992	Bingara Rd	Residential
R3	313195	6660342	Target Hill Rd	Residential



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GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Site and sensitive receptor location

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Figure 6-7

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Local meteorology

The local meteorology largely determines the pattern of off-site air quality impact on receptors. The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site. The winds at a site are most readily displayed by means of wind rose and stability distribution plots.

The features of particular interest in this assessment are: (i) the dominant wind directions and (ii) the relative incidence of stable light wind conditions that yield minimal mixing.

Figure 6-8 shows the annual average wind rose for the site for the period 1 January 2016 to 1 January 2017, and the following features can be seen:

- Annual average wind speed of 2.59 m/s
- Winds are most prevalent from the south east
- Winds are least prevalent from the south and the east
- Light winds (< 2 m/s) are more prevalent form the south east
- Calms occur 3.34% of the time

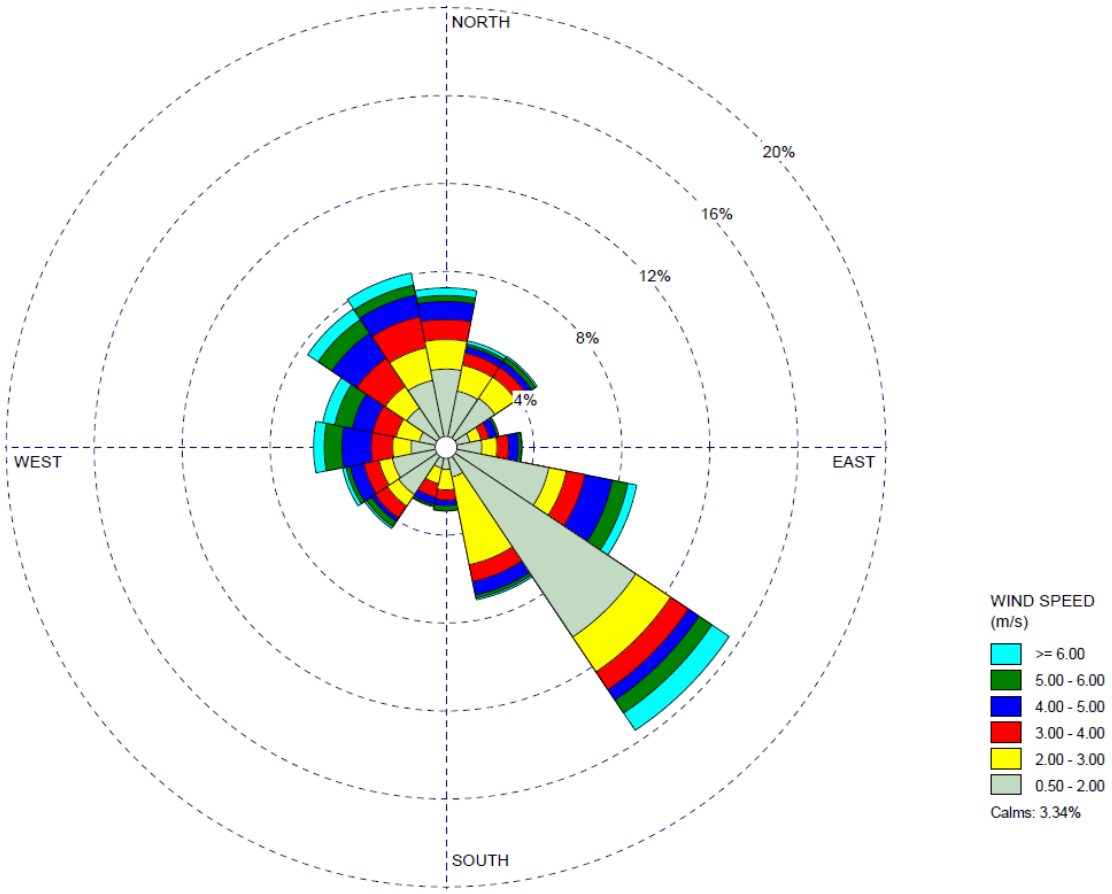


Figure 6-8 CALMET wind rose at the site (average wind speed = 2.59 m/s)

Atmospheric stability substantially affects the capacity of a pollutant such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability, and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and insolation are used to define the stability category as shown in Table 6-19, and as these parameters vary diurnally, there is a corresponding variation in the occurrence of each stability category. Stability is most readily displayed by means of stability rose plots, giving the frequency of winds from different directions for various stability classes A to F.

Table 6-19 Stability category relationship to wind speed, and stability characteristics

Stability category	Wind speed range (m/s) [a]	Stability characteristics
A	0 to 2.8	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.
B	2.9 to 4.8	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.
C	4.9 to 5.9	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.
D	≥6	Neutral atmospheric conditions. Occur during the day or night with stronger winds or during periods of total cloud cover, or during the twilight period.
E	3.4 – 5.4 [b]	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds.
F	0 – 3.3 [b]	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.

a. Data sourced from the Turner's Key to the P-G stability Categories, assuming a Net Radiation Index of +4 for daytime conditions (between 10:00 am and 6:00 pm) and –2 for night-time conditions (between 6:00 pm and 10:00 am)

b. Assumed to only occur at night, during Net Radiation Index categories of –2.

Figure 6-9 shows the frequency distribution of stability classes for the entire data period (one year). The figure shows that stable atmospheres (E and F) occur for 47% of the total time period. Unstable atmospheres (A, B and C) occur 38% of the total time period while neutral conditions (D) occur 15% of the total time period. The dominant state of the atmosphere is stable conditions (E and F).

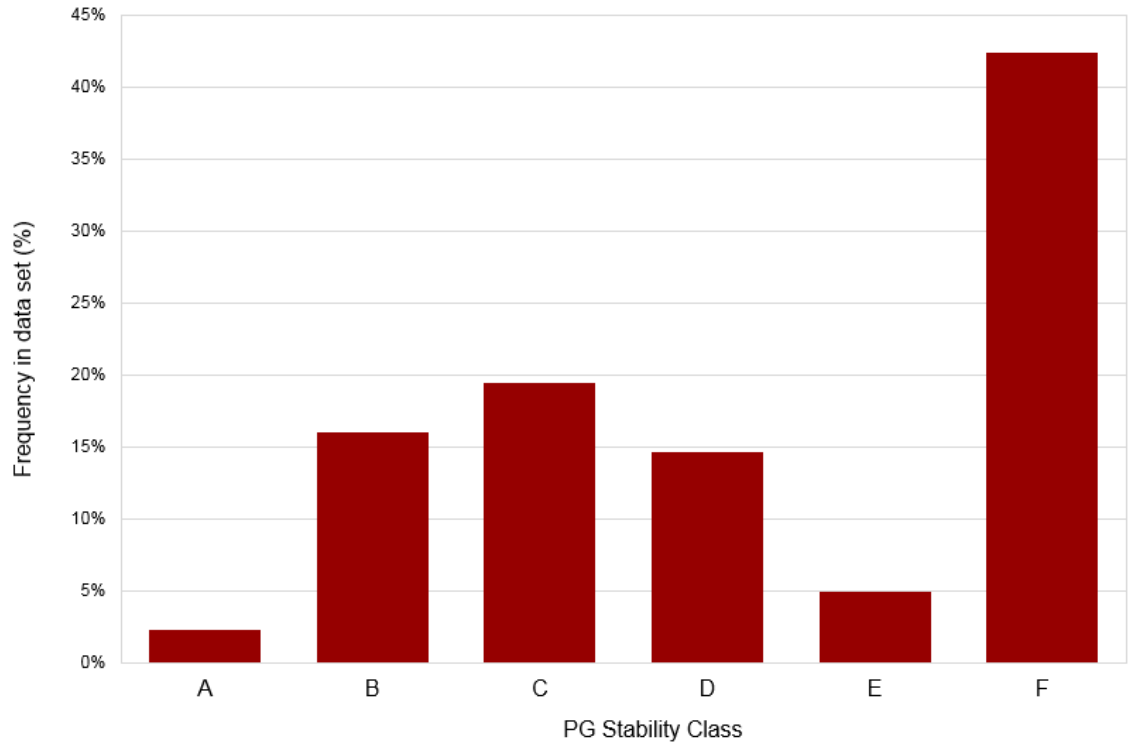


Figure 6-9 CALMET atmospheric stability class distribution at the site

6.8.2 Impact assessment

Construction

Dust generation

Construction of the proposal may have short-term localised impacts on air quality, primarily due to dust generation. Dust (total suspended particulates, including PM_{10}) would be the primary emission to air generated during the construction of the proposal. The individual processes that generate dust are:

- Mechanical disturbance - dust emissions brought about by the operation of construction and maintenance vehicles and equipment.
- Wind erosion - dust emissions from exposed, disturbed soil surfaces under high wind speeds during construction.

The potential for exposure to dust emissions is dependent on the intensity of construction work (i.e. the amount of dust generated and material transfer volumes occurring), soil moisture content, duration and frequency of the operations in any given locality and the relative location of nearby sensitive receptors. The transport and dispersion of air emissions during the construction work would be influenced by the direction and strength of prevailing winds. Sensitive receptors downwind of construction activities have the highest potential for short-term air quality impacts. Dust emission sources to consider are:

- Material handling during earthworks
- Loading and dumping of material
- Levelling, grading and compacting of disturbed soil surfaces
- Wind erosion of exposed unstable soil surfaces and localised stockpiles

Sensitive receptors closest to the construction work area have the highest potential for adverse air quality impacts. However, dust emissions during construction are typically sufficiently managed through the application of mitigation measures. Dust management measures have been outlined in Section 6.8.3 to assist in minimising off-site impacts during the construction phase of the proposal.

Gaseous emissions

Vehicle exhaust emissions and generators utilised during the construction phase have the potential to impact on air quality; however, the impact is likely to be negligible given the limited amount of equipment, distance to receptors and the short duration construction period at any one location, except the STP site. All construction and administrative vehicles are expected to be maintained in a serviceable condition such that exhaust emissions are reduced to manufacturer specified levels.

Energy use

During construction, power will be required for lighting and electric based equipment including pumping during commissioning. It is not expected that large quantities of electricity will be used and what is required will be sourced either from direct connection into mains if available and possible, or from a generator.

Operation

Gaseous and dust emissions

Routine maintenance activities have the potential to generate gaseous emissions and dust from maintenance vehicles. However, the connection of sewer to households is expected to result in a significant reduction in routine maintenance activities compared with the existing on-site sewer systems (primarily septic tanks) at each household, which requires frequent emptying.

Appropriate revegetation of the construction footprint upon completion of construction would limit potential dust emissions from disturbed soils post-construction (refer to Section 6.2.3 and 6.4.3).

Energy use

During operation, power would be required for the pressure sewer pumps, transfer pump station and STP. The pump units to be installed at each lot will be connected to the existing residence switchboard. The preliminary electrical load of the proposed pump units is estimated at a maximum of 1.1 kW. The preliminary electrical load for the transfer pump station is 30 kVA (based on 22 kW duty/standby pump arrangement).

The preferred option for the STP is the installation of solar array and battery system with generator backup.

Based on the above, the electricity use and associated greenhouse gas emissions are considered to be relatively minor.

Odour

As outlined in the Odour Assessment in Appendix E, potential significant odour sources are considered to be:

- Wastewater discharge into first oxidation pond
- Two oxidation ponds
- Two maturation ponds
- Winter storage (treated effluent)
- Irrigation area (treated effluent)

Treated effluent is not anticipated to be odorous and has not been included in odour modelling.

Where an odour release is from an extended liquid surface (such as the oxidation ponds) the source is modelled as an area source, and the odour emission rate (OER) is specified as the specific odour emission rate (SOER, or OER/m^2) multiplied by the source area.

Odour can be elevated at the location wastewater is discharged into the first oxidation pond where turbulence from the discharging waste water causes odour to be released.

The de-sludging data has been calculated using odour measurements down-wind and up-wind of the biosolids holding tank during mixing at the Picton STP, with similar odour levels expected at Bundarra STP. At a site like this, sludge may be removed by long arm excavators into a truck for transfer to a drying area.

Sludge drying has not been assessed as exact details are not known at this stage and would not likely occur for 10 years.

It is possible at times that cool night air temperatures lead to destratification of the ponds. As the surface layer cools down to less than the temperature of the layers beneath, there is the potential for thermal eddies within the water column to promote migration of odorous components from deeper levels to the surface which would increase odour generation rates and offensiveness. The effect is likely to be more pronounced during night time when the top layer is also oxygen depleted due to algal respiration. The steady cool breeze may also exacerbate the odour. The odour levels have been assumed to be double the normal level during a pond inversion.

Treated effluent irrigation is not expected to be a significant source of odour given the level of treatment indicated for the effluent and the size of the buffer. Management measures have been provided for this area however this has not been included as a source in the odour model.

Odour emission rates are presented in Table 6-20.

Table 6-20 Odour emission rate data used for the Bundarra STP

Odour source	Data source	Height (m)	Area (m^2)	SOER OU ($m^3/s/m^2$)	OER OU (m^3/s)
Wastewater discharge location at the oxidation pond	West Camden	1	150	5.00	750
Oxidation pond 1	Leanyer	1	3784	0.12	470
Oxidation pond 2	Leanyer	1	3943	0.09	355
Maturation pond 1	Leanyer	1	1774	0.05	89
Maturation pond 2	Leanyer	1	1886	0.05	88
Desludging of pond	Picton	1	99	46.00	4545

Three operational scenarios were modelled. The configuration of each model is shown in Table 6-21. An ‘x’ denotes that the odour source is active and emitting odour in the scenario.

Table 6-21 Scenario configurations

Odour source	Scenario		
	Normal operations	Normal operations with pond inversion	Normal operations with desludging
Inlet works	x	x	x
Oxidation pond 1	x	x	x
Oxidation pond 2	x	x	x
Maturation pond 1	x	x	x
Maturation pond 2	x	x	x
Pond inversion (odour rates x 2)		x	
Desludging of pond			x

Dispersion modelling was undertaken to predict the maximum ground level odour concentrations resulting from odour emissions as a result of normal operations of the new STP. The objective of the modelling was to generate predicted peak 99th percentile one second averaged ground level odour concentration at nearby sensitive receptors.

The operational model was iterated multiple times to account for the following scenarios:

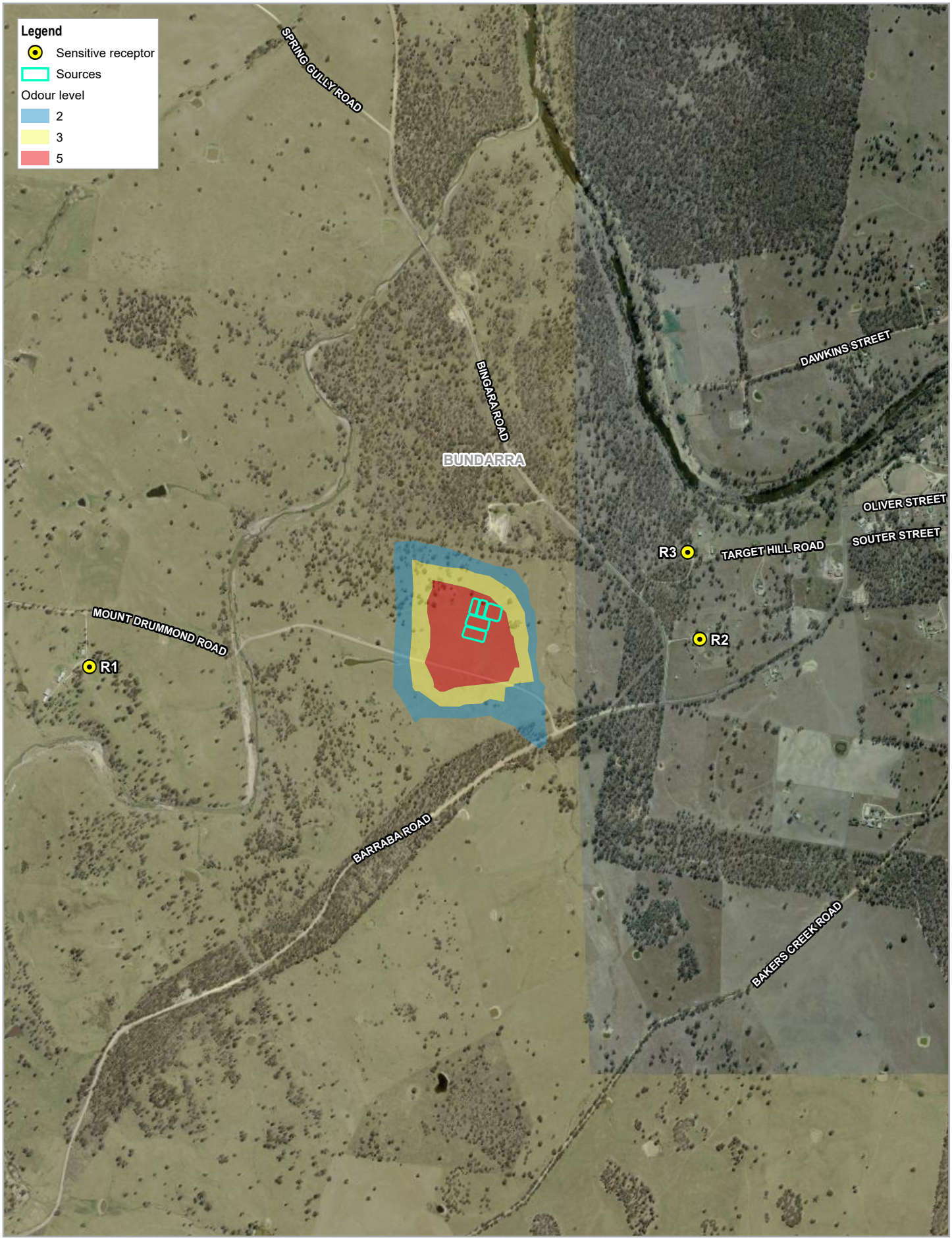
- Normal operations
- Normal operations with pond inversion
- Normal operations with desludging

Predicted 99th percentile odour impact is presented in Table 6-22. Results show that the STP is located sufficiently far away from the village so odour impacts are low. No criteria exceedances are predicted.

Contour plots presenting the predicted 99th percentile odour impacts are supplied for normal operations in Figure 6-10, normal operations with pond inversion in Figure 6-11 and normal operations with desludging in Figure 6-12.

Table 6-22 Predicted odour impact for each scenario

Receptor	Criteria (OU)	Predicted odour impact for each scenario (OU) (99th percentile)		
		Normal Operations	Normal operations with pond inversion	Normal operations with desludging
R1	3	0.1	0.1	0.3
R2	3	0.3	0.4	0.9
R3	3	0.1	0.2	0.5



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Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Predicted odour impact of normal operations scenario

Project No. **22-19174**
Revision No. **0**
Date **08/08/2019**

Figure 6-10

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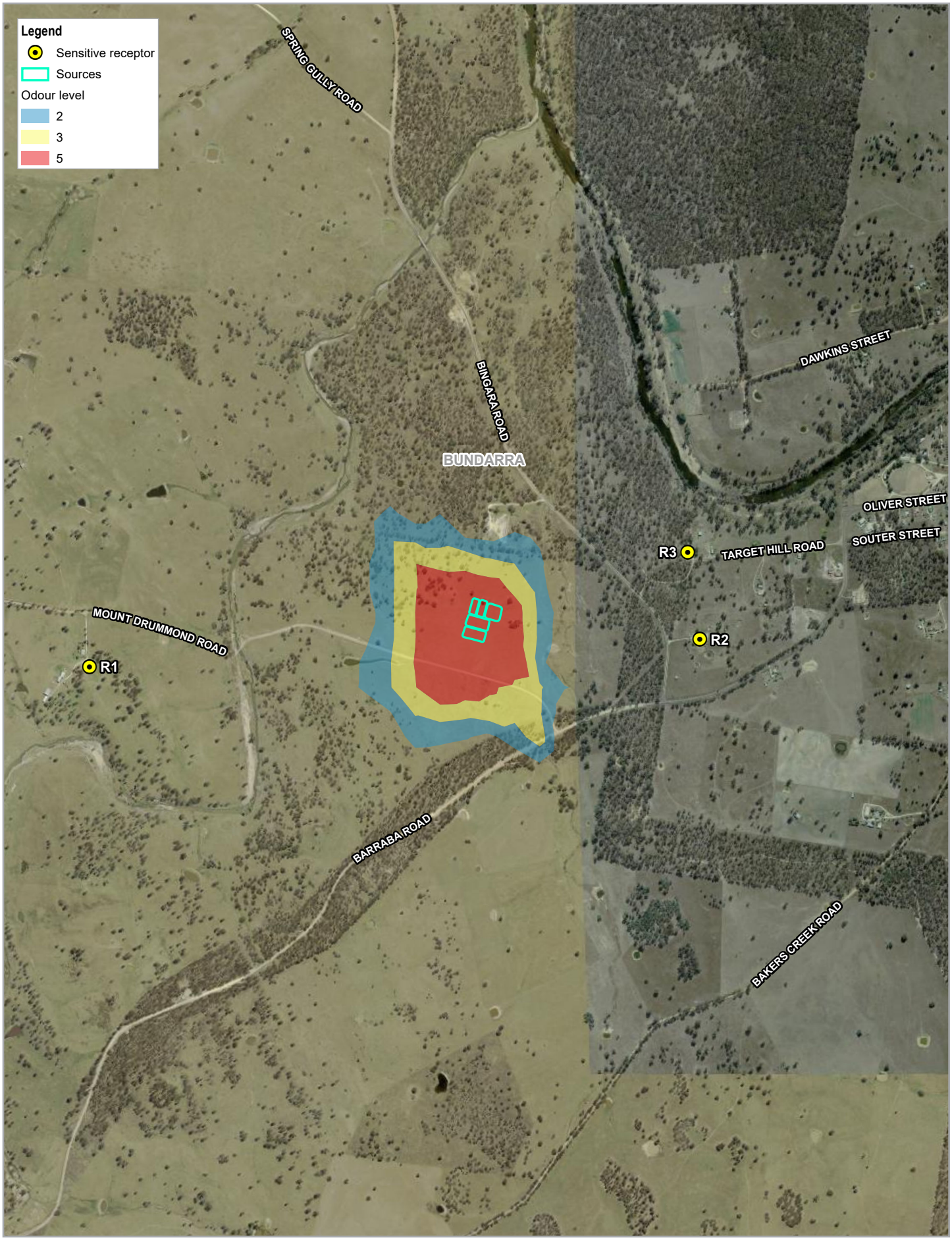

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Metres

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

N

GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Predicted odour impact of normal operations with pond inversion scenario

Project No. **22-19174**
Revision No. **0**
Date **08/08/2019**

Figure 6-11

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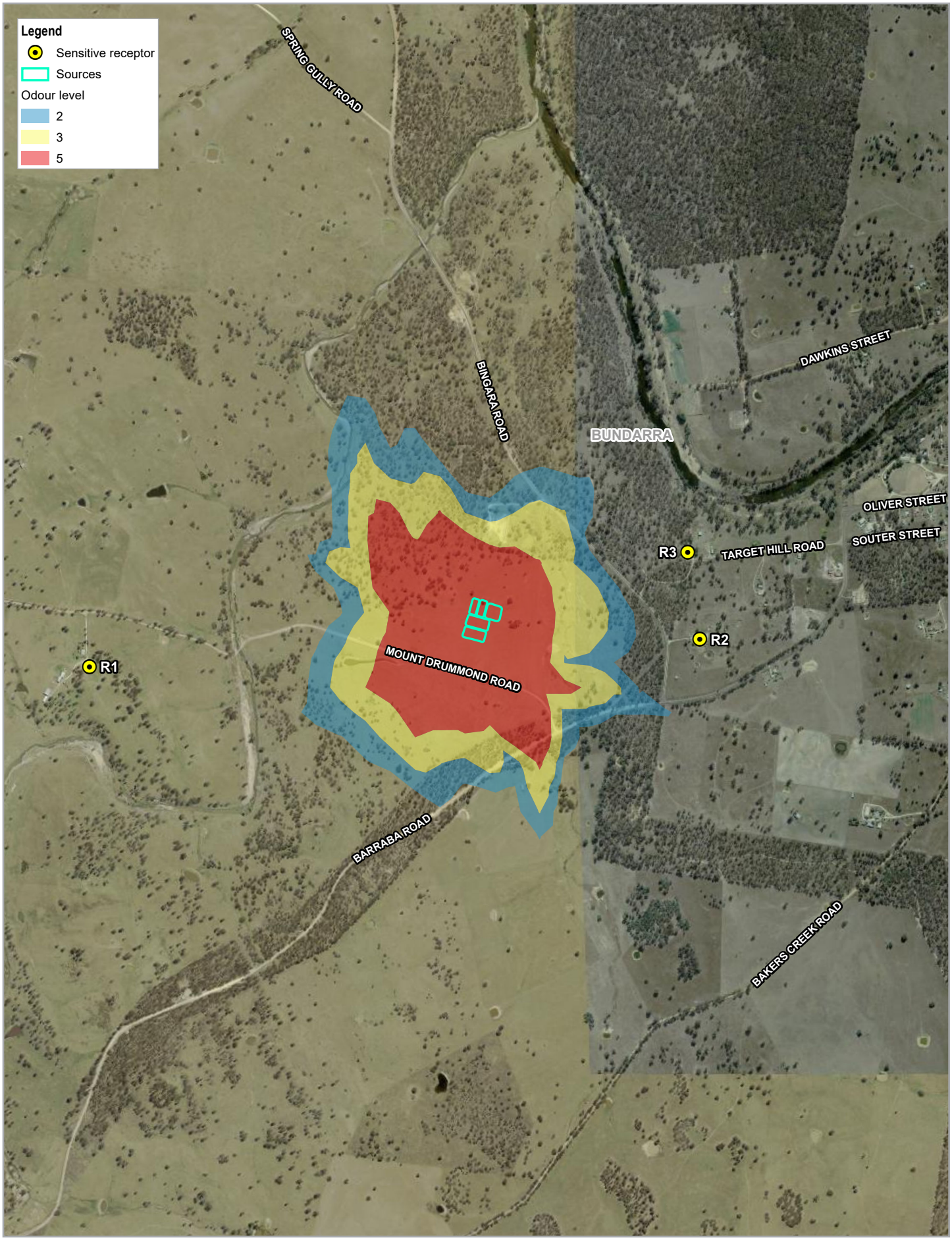
Print date: 08 Aug 2019 - 06:54

Data source: public_NSW_Imagery: LPI: DTDB / DCDB ,2017. Created by: fmackay



Paper Size ISO A4

0 150 300 450 600

Metres

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

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GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Review of Environmental Factors

Predicted odour impact of normal operations with desludging scenario

Project No. 22-19174
Revision No. 0
Date 08/08/2019

Figure 6-12

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Print date: 08 Aug 2019 - 06:54

Data source: public_NSW_Imagery: LPI: DTDB / DCDB ,2017. Created by: fmackay

6.8.3 Mitigation measures

Mitigation measures provided in Table 6-23 would be implemented to minimise potential impacts on air quality and energy.

Table 6-23 Proposed mitigation measures – air quality and energy

Impact	Mitigation measure	Timing	Responsibility
Generation of dust	Include a procedure for effective dust control in the CEMP, including: • Limit earthmoving activities during periods of high winds • Implement dust suppression using water carts or binder sprays • Specify height and cover of stockpiles • Minimise vehicle movements • Cover loads during transport • Set vehicle speed limits	Pre-construction	Contractor
	Limit the areas of clearing and ground disturbance to the minimum required.	Construction	Contractor
	Place gravel on major access tracks to prevent generation of dust.	Construction	Contractor
	Investigate any dust complaints and implement correction as soon as possible. Define the complaint procedure within the CEMP.	Construction	Contractor
	Maintain dust suppression controls on disturbed areas until rehabilitation is completed with appropriate vegetation coverage.	Construction	Contractor
Exhaust emissions	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards.	Construction	Contractor
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired.	Construction	Contractor
Energy Use	Utilise solar power where practicable.	Operation	Council
Odour	Manage odour complaints in accordance with Uralla Shire Council Customer Complaint Procedure	Operation	Council
	Wherever practicable, limit de-sludging to the day time after 7 am, avoid de-sludging during worst case meteorological conditions (winds from the west) and conduct de-sludging in the shortest timeframe possible.	Operation	Council

Impact	Mitigation measure	Timing	Responsibility
	If any odours are noticed offsite during spray irrigation (especially during westerly winds towards receptors), stop irrigation until the weather conditions change.	Operation	Council
	Ensure inlet channels are maintained in a clean state.	Operation	Council
	Avoid stockpiling of sludge and other residuals at the site (from screening or from de-sludging operations).	Operation	Council

6.9 Visual amenity

6.9.1 Existing environment

The study area predominantly comprises agricultural grazing land and the township of Bundarra. There is a drainage line and vegetated area between Bundarra and the proposed STP site. The population of Bundarra was 394 people at the 2016 census. The area in the vicinity of the STP site is rural land, with the closest residence about 700 m to the east which is shielded visually from the proposed STP site by a vegetation buffer. Users of the local road network would be the primary receptor to the proposed STP site. However, there is a vegetation buffer along the road corridor of Barraba Road, so it would only be local traffic on Mount Drummond Road potentially impacted by the STP site.

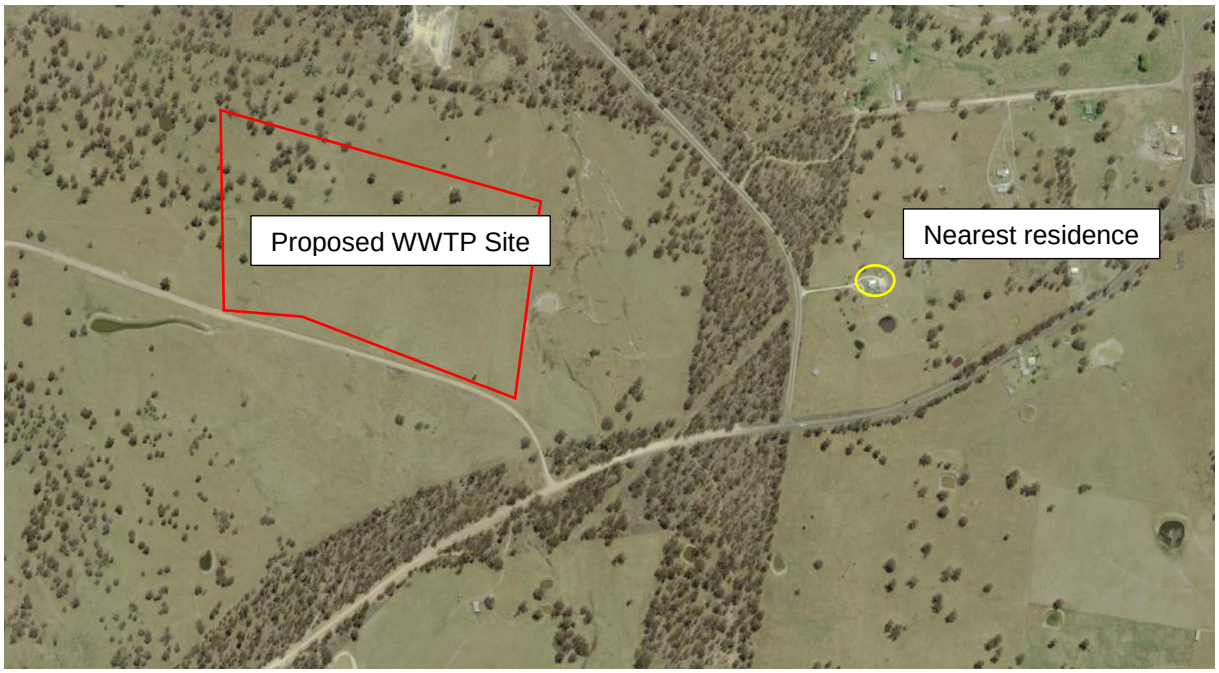

Figure 6-13 Visual receptors to proposed STP site

6.9.2 Impact assessment

Construction

Construction activities would be visible to local residences, farmers and road users in the area. Potential impacts could include negative impact associated with the earthworks and construction machinery, particularly when works are being undertaken within the residential areas of Bundarra. Construction of the STP site would cause significant visual disturbance as clearing of grasses and some trees would be required as would some earthworks and the construction of large infrastructure. However, as outlined in Section 6.9.1, there are few visual receptors to the STP site, except local road users, particularly on Mount Drummond Road. Visual impacts of construction activities, equipment and materials would be short-term, transient and temporary. Where pipework is laid, it is expected that grass will take some time to establish following completion of the construction works.

Overall, the visual impacts associated with the construction of the proposal are considered minor.

Operation

The majority of the proposed works involve installing underground pipework so there would be very little visual impact resulting from operation. However, the proposed STP site would be operating on previously agricultural land, resulting in a significant negative impact to the visual amenity of the area. However, as previously discussed there are very few residences with visual access to the STP site. The primary visual receptors to the STP site would be users of Mount Drummond Road.

The pipeline would be visible on the bridge across the Gwydir River but it would be located between the footpath and road which would obscure its visual impact. The pipe would also be black which would further reduce the visual impact as it would blend with the colour of the bridge.

6.9.3 Mitigation measures

Mitigation measures provided in Table 6-24 would be implemented to minimise potential impacts on visual amenity.

Table 6-24 Proposed mitigation measures – Visual amenity

Impact	Mitigation measure	Timing	Responsibility
Visual impact	Rehabilitate disturbed areas at the STP site as far as reasonably practicable and vegetate along the Mount Drummond Road boundary.	Construction	Contractor
	Maintain construction areas in a tidy manner and inspect daily by the contractor.	Construction	Contractor
	Remove all temporary structures and equipment at the completion of works.	Construction	Contractor
	Maintain and protect existing vegetation wherever possible, as defined in Section 6.4.3.	Construction	Contractor

6.10 Traffic and access

6.10.1 Existing environment

The alignment of the proposed water pipe runs through the village of Bundarra, along Bendemeer Street and travels along numerous streets located perpendicular to Bendemeer Street. The alignment crosses the Gwydir River Bridge and travels along Oliver Street, Wattle Drive and Mount Drummond Road (as displayed in Figure 1-2).

All these roads are owned and maintained by Uralla Shire Council and enable two-way traffic flow. In accordance with their rural nature, all these roads experience relatively low traffic volumes.

Figure 6-14 Bendemeer Street looking north from Bowline Street

Source: Google maps Streetview 2018

Figure 6-15 Oliver Street looking west from Bombelli Street

Source: Google maps Streetview 2018

Figure 6-16 Mount Drummond Road looking West from Wattle Drive

Source: Google maps Streetview 2018

The main existing traffic movements in the vicinity of the proposal area are associated with:

- Bendemeer Street which links Thunderbolts Way in the south and north. Bendemeer Street provides a single travel lane in each direction with a posted speed limit of 50 km/hr.
- Oliver Street which links Bendemeer Street in the east to Wattle Drive in the west. Oliver Street provides a single travel lane in each direction with a posted speed limit of 50 km/hr.

- Wattle Drive which links Bundarra Bingara Road to Bendemeer Road. Wattle Drive provides a single travel lane in each direction.

As specified previously, as the proposal is located within the road reserve, access would be via the roads in which the work is being undertaken on within Bundarra. Access to the compound site would be via Mount Drummond Road.

Construction car parking is proposed to be primarily contained within the proposed ancillary facilities.

6.10.2 Impact assessment

During construction of the proposal, the following key aspects would require vehicle movements and would therefore impact on traffic:

- Pipe delivery and storage – assumed to be stored offsite and delivered incrementally to site
- Material and equipment delivery
- Spoil and waste removal
- Transport of construction labourers to site daily

It is estimated that the construction would involve an average of 5-10 truck movements per day plus about 40 additional traffic movements associated with construction employees during the peak of construction period. Particular operations may require more frequent truck movements, e.g. concreting operations which would require deliveries of large quantities of concrete.

During operation, the main traffic would be associated with employees and the occasional heavy vehicle. It is estimated, on average, there would be 2 light vehicle and 1 heavy vehicle movements per day.

It is anticipated that the contractor worker trips will primarily be inbound in morning periods and outbound in afternoon/evening periods, while the heavy vehicle activity will occur over the course of the day.

Access to the construction site would primarily be via the adjoining arterial road network of Thunderbolts Way and Bundara Bingara Road. Vehicles would traverse the other roads in proximity to the pipeline on a as needs basis to access the construction site.

The main impacts of traffic associated with the proposal are expected to be:

- Relatively minor increases in traffic volumes over a 12 month period for the works
- Short-term lane closures or traffic control for trenchless road crossings
- Short term, localised impact on residents where the pipeline is trenched through driveways

Due to the generally low traffic typically encountered within the study area, the impact on active and public transport is expected to be negligible. Such small increases in traffic movements is expected to fall within typical daily fluctuations encountered within the road network.

Operational traffic is anticipated to be one maintenance vehicle for periodical maintenance and/or inspection in line with maintenance requirements. As such, operational traffic and access impacts are considered negligible.

6.10.3 Mitigation measures

Mitigation measures provided in Table 6-25 would be implemented to minimise potential traffic and access impacts.

Table 6-25 Proposed mitigation measures – traffic and access

Impact	Mitigation measure	Timing	Responsibility
Disruption to traffic from construction vehicle movements	Prepare a detailed construction traffic management plan (TMP) and obtain approval from Uralla Shire Council prior to construction commencing. The TMP would include appropriate Traffic Control Plans and include detail in relation to: • Temporary road diversions (if required) • Traffic control measures in works areas, including use of traffic controllers • Restrictions on the delivery of materials to site during peak traffic periods • Appropriate entry/exit points for the proposed compound areas • Advising motorists of the change in traffic conditions associated with the work.	Pre-construction	Contractor
Traffic control	Provide appropriate exclusion barriers, signage and site supervision at all times to ensure that unauthorised vehicles and pedestrians are excluded from the works area.	Construction	Contractor
	Ensure all traffic control devices are in accordance with • AS 1742.3-2009 – Manual of uniform traffic control Devices: Traffic control for works on roads • Roads and Maritime Services Traffic control at worksites manual.	Construction	Contractor
Road closures	Communicate proposed access changes to the impacted community at least two days prior.	Prior to and during Construction	Contractor
	Diversions with adequate signage and notice would be provided during any road closures.	During any road closures	Contractor
Restricted property access	Maintain access to individual properties during construction, either via vehicle or on foot for short term periods where vehicle access is not possible.	Construction	Contractor

6.11 Waste generation

6.11.1 Existing environment

The construction corridor is not currently subject to any waste generation activities. Minor household rubbish is disposed along the road, likely from passing vehicles. No notable waste items were observed in the study area during investigations.

Currently, on-site waste water systems operate at residential properties within Bundarra. On-site systems discharge treated wastewater to a land application area. There are also generally de-sludged and grease traps checked every three to five years by suitably trained personnel.

6.11.2 Impact assessment

Construction

During STP construction and installation of the associated pipeline throughout Bundarra, the following major wastes would be produced:

- Excess spoil of varying quality
- General construction waste

Excess spoil

It is likely that a proportion of the soils excavated during the construction of the STP site and the laying of the pipeline will not be required for re-use as backfill. While the preferred option would be to re-use all material on-site there may be a requirement to stockpile and characterise the excess material for re-use off-site or off-site disposal. In this instance, all material would be tested and results of any soil analysis compared to either the guidelines in the *Excavated Natural Material Order 2014* (NSW EPA 2014) or the waste classification criteria in the *NSW Waste Classification Guidelines* (NSW EPA 2014).

General construction waste

General construction activities result in the generation of a range of general waste streams, including:

- Material packaging
- Excess construction materials e.g. timber, concrete, metal, plastic
- Packaging and general waste from staff (lunch packaging, portable toilets etc.)
- Cleared vegetation which could include native green waste as well as declared weed material
- Removed structures such as fencing and guide posts
- Wastewater from wash-down and bunded areas
- Redundant erosion and sediment controls

The majority of the waste would by default be sent to landfill, however, re-use of materials where possible would reduce the impact of the proposal considerably. In the event that declared weeds are not disposed of appropriately, this could result in the spread of weeds to new areas (refer to Section 6.4).

Operation

During operation of the STP, biosolids are expected to be produced. It is estimated, sludge would be removed from the ponds every 10 years. Disposal of sludge accumulated in the ponds will be carried out in accordance with the NSW biosolids guidelines (EPA 1997) and in consultation with the EPA. The guidelines set out a number of classes of biosolids, based on the concentrations of metals, organic compounds and nutrients and on the treatment processes used for pathogen, vector and odour control. Following classification of biosolids in accordance with contaminant and stabilisation grading requirements, the beneficial reuse or disposal method may be selected.

Due to the grinders at each house, no other waste is expected to be generated during the proposed STP operation.

6.11.3 Mitigation measures

Mitigation measures provided in Table 6-26 would be implemented to minimise potential impacts on waste generation.

Table 6-26 Proposed mitigation measures – waste generation

Impact	Mitigation measure	Timing	Responsibility
General	Follow the resource management hierarchy principles: • Avoid unnecessary resource consumption as a priority • Re-use materials, reprocess, recycle and recover energy • Dispose as a last resort (in accordance with the Waste Avoidance and Resource Recovery Act 2001)	Construction	Contractor
	Manage all waste material in accordance with the POEO Act and Waste Classification Guidelines (EPA 2014).	Construction	Contractor
Spread of contamination through inappropriate waste management	Include waste classification/ENM characterisation, sampling and analysis within the contingency plan for unexpected finds/contaminated soils.	Construction	Contractor
	If required, dispose of waste to an appropriately licensed facility with supporting waste classification documentation.	Construction	Contractor
Generation of general construction waste	Provide labelled waste receptacles to promote the segregation of waste and recycle materials where appropriate.	Construction	Contractor
	Conduct and record site inductions as specified in the CEMP to ensure staff are aware of waste disposal protocols.	Construction	Contractor
	Preferentially procure materials with no or minimal packaging, or those where packaging is recyclable or able to be returned for re-use to the supplier.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	Maintain all working areas by keeping free of rubbish and cleaning up at the end of each working day.	Construction	Contractor
	Do not accept waste from outside of the construction corridor.	Construction	Contractor
	Follow mitigation measures for weed disposal as defined in Section 6.4.3.	Construction	Contractor
	Chip and re-use cleared weed-free vegetation on-site as part of the proposed landscaping and to stabilise disturbed soils where possible.	Construction	Contractor
	Provide portable toilets for construction workers and manage to ensure the appropriate disposal of sewage (i.e. removed by a licensed supplier).	Construction	Contractor
Biosolids production	Assess options for re-use of biosolids in accordance with the NSW biosolids guidelines (EPA 1997).	Operation	Council

6.12 Social and economic

6.12.1 Existing environment

The proposal is located in Bundarra, which has a population of 394 (Australian Bureau of Statistics, 2016). The median age of residents is 50, while the average number of people per household is 2.3. The predominant occupation for employed people aged 15 years and over comprises labourers, community and personal services workers and technicians and trades workers (Australian Bureau of Statistics, 2016). Income is below the NSW and Australian average with a median weekly personal income of $424 compared with NSW average of $664 and the Australian average of $662. Aged care residential services and sheep-beef cattle farming ranked as the top two industries of employment in Bundarra, with beef cattle farming (specialised), combined primary and secondary education and meat processing also listed (Australian Bureau of Statistics, 2016).

The STP site is proposed on rural land, with the sewer rising main passing through rural, agricultural land into the township of Bundarra.

6.12.2 Impact assessment

Construction

The construction of the proposal would lead to changed traffic conditions. This would have a minor impact on motorists, including local residents, transport providers (such as school buses, community transport), visitors and others.

Properties closest to the proposal are likely to experience temporary amenity impacts resulting from construction activities including:

- Increase in noise and vibration from construction activities and traffic (Section 6.7)
- Visual impacts (Section 6.9)
- Increase in construction traffic (Section 6.10)
- Potential nuisance dust (Section 6.8)

These impacts on local residents are expected to be minor and short term and would be managed through the implementation of mitigation measures for the corresponding environmental component.

In addition, when the sewer is connected to homes it is likely that residents would experience short term disruptions, however this is expected to be outweighed by the positive impact of having reticulated sewer to the home.

A positive impact of the construction work would be the short-term employment of labourers, machinery operators and drivers, which is a key occupation for the area. However, this would vary depending on where the contactor sources personnel, machinery and equipment for the proposal.

Operation

The operation of the proposal is expected to result in a positive socio-economic impact due to:

- Being provided reticulated sewer throughout the town
- A significant reduction in maintenance and costs required for on-site wastewater systems
- Removal/decommissioning of on-site wastewater systems reducing negative odour and visual impacts
- Potential employment of personnel to run the STP

6.12.3 Mitigation measures

Mitigation measures provided in Table 6-27 would be implemented to minimise potential socio-economic impacts.

Table 6-27 Proposed mitigation measures – social and economic

Impact	Mitigation measure	Timing	Responsibility
Temporary amenity impacts (dust, noise, visual, traffic and access)	Refer to mitigation measures provided for air quality, noise and vibration, visual amenity, traffic and access.	Construction	Contractor
Short term disruption to sewer services	Manage timelines and efficiencies of work to minimise impact to residents as much as possible.	Construction	Contractor

6.13 Cumulative impacts

6.13.1 Impact assessment

There are no other known construction proposals planned in the vicinity of the proposal.

The proposal would provide a sewerage system within the township of Bundarra that would be equal to other towns within the Uralla LGA. The proposed development would minimise risks to the environment and public health that are currently in place as a result of the existing on-site sewer systems.

6.13.2 Mitigation measures

No mitigation measures are proposed, however, should other projects be constructed at the same time in the vicinity, Council would manage the potential cumulative impacts as required.

7. Summary of mitigation measures

7.1 Environmental management

A number of safeguards and management measures have been identified in order to minimise potential adverse environmental impacts which could arise as a result of the proposal. Should the proposal proceed, these management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A CEMP would be prepared to describe safeguards and management measures identified in this REF. The CEMP would include a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the proposal and would be reviewed and deemed adequate by Uralla Shire Council prior to the commencement of any on-site works.

All site personnel, contractors and Uralla Shire Council staff would be responsible to ensure that environmental protection measures are implemented and that the environment is protected to the highest standard during works. Constant monitoring and improvement of the protection and mitigation measures would ensure that impacts on the environment are minimised.

The construction site induction would refer to the CEMP. All personnel would be required to attend the environmental site induction. Copies of the CEMP would be kept on-site for ready access by all workers.

7.2 Summary of safeguards and mitigation measures

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1 and are to be included in the CEMP for implementation during the works.

Table 7-1 Summary of mitigation measures

Impact	Mitigation measure	Timing	Responsibility
General			
Inadequate environmental management of the project	The CEMP would be included as a hold point in the contract at the start of the project. Qualifications for preparation of the plan would be included in the specification.	Pre-construction	Council/Consultant
	Environmental inspections would be undertaken by a suitably qualified environment professional either from the proponent or a third party to audit against the requirements of this REF and the CEMP.	During construction	Council
Land use and services			
Resident impacts	Reduce the number and extent of affected properties as much as possible and minimise the construction corridor.	Pre-construction	Council/Consultant
Crown Land	Consult with DoI Crown Lands to transfer the management of the rear lanes to Council and resolve the mechanism to authorise the route of the rising main over Lot 7301 DP 1149103.	Pre-construction	Council
Roads and Maritime	Should the proposed works vary in any way you must advise Roads and Maritime Services.	Pre-construction	Council
	The licence agreement be completed and signed before work commences.	Pre-construction	Council
Service impacts	Consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions during construction.	Pre-construction	Council/Consultant
	Complete dial before you dig and pot holing to confirm location of services and reduce the potential for accidental strike.	Pre-construction	Contractor
	Mark out services to prevent accidental strike. This includes any overhead cables.	Construction	Contractor
Soils and geology			
General	Include provisions in the construction contract for suspension of work until adequate controls are in place to encourage pre-emptive action, not reaction.	Pre-construction	Council/Consultant
Contamination	Preparation of a contingency plan for unexpected finds/contaminated soils within the CEMP. This section would include details of excavation, segregation, stockpiling, remediation, validation and disposal requirements for any contaminated matter.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Exposure of soil to erosion	Prepare an Erosion and Sediment Control Plan (ESCP) in accordance with *Blue Book - Managing Urban Stormwater: Soils and Construction* (4th ed, Landcom, March 2004) and Volume 2A: Installation of Services, which must include the following: • Establish all erosion and sediment control measures before ground disturbance work commences and these are to remain in place until all surfaces have been fully restored and stabilised. • Inspect and maintain controls regularly to ensure effectiveness over the entire duration of the project, and clean out before 30% capacity is remaining. • Provide a clean water diversion around disturbed areas. • Locate controls to protect sensitive receiving environments such as the Gwydir River • Stockpiles would be located outside of drainage lines and the dripline of trees and would have appropriate controls installed to prevent erosion, control runoff and prevent sedimentation. • All excavations are to be progressively backfilled and stabilised within ten working days during the course of construction works to minimise the potential for erosion. • Stabilise stockpiles against erosion and flood management in instances where they would be in place for greater than twenty working days. • Revise the ESCP throughout the proposed works covering all stages.	Pre-construction	Contractor
Accidental contamination from leaks or spills of fuels / chemicals etc.	Prepare an incident emergency spill plan as part of the CEMP to be implemented during construction. Further, procedures for the storage and handling of hazardous materials including fuel and chemicals will be prepared and included within the CEMP and will include: • No refuelling to occur on-site unless appropriate bunded hardstand and spill protection/spill plan is prepared. • Storage of hazardous materials on-site will be kept to a minimum. Any that are stored must be stored in accordance with national guidelines and the Safety Data Sheets relating to bunding, coverage, storage of incompatible materials, etc.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	• A 'spill kit' would be kept on site at all times for potential chemical or fuel spills. Construction contractors will be trained in the correct use of the spill kit.		
Rehabilitation	Minimise disturbance areas during construction and progressively stabilise and rehabilitate disturbed areas following completion of construction activities.	Construction	Contractor
	Monitor and inspect rehabilitated areas on a regular basis.	Construction	Contractor
Irrigation	Prepare and implement a soil monitoring program of the irrigation area, in accordance with *Environmental Guidelines – Use of Effluent by Irrigation* (DEC, 2004)	Operation	Council/Consultant
Hydrology, flooding and groundwater			
General	Prepare a Soil and Water Management Plan (by appropriately qualified specialists as described in Section 6.2.3)	Pre-construction	Contractor
Surface flows	In all open trenched sections of the proposal, the ground level must be reinstated to a similar level to pre-construction to ensure no changes to drainage or flow patterns occurs.	Construction	Contractor
Flooding	Place material stockpiles and ancillary facilities outside of flood conveyance areas and drainage lines.	Construction	Contractor
Biodiversity			
General	Prepare a CEMP, which will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants along with the mitigation measures detailed below.	Pre-construction	Contractor
	A Flora and Fauna Management Plan (FFMP) should be prepared as a sub-plan to the CEMP for the proposal. The FFMP would identify environmental management measures to protect the natural environment (e.g. weed and pathogen controls) and detail site-specific mitigation measures and management protocols to be implemented before, during and after all construction activities to further avoid or reduce impacts on threatened species or vegetation communities.	Pre-construction	Contractor
	Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the study area and measures to be implemented to protect biodiversity.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Direct impacts to native vegetation	The path of the pipeline should be designed so that removal of trees is avoided, where possible.	Pre-construction	Council/Consultant
	Delineating a vegetation buffer with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation or aquatic habitat.	Pre-construction	Contractor
	Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas so as to avoid any additional impacts outside the study area.	Pre-construction	Contractor
Clearance of vegetation	Pre-clearing surveys for threatened flora species, particularly Orchid species likely to be present, or sedentary fauna species (i.e. nesting birds, or fauna utilising hollows) should be carried out by a qualified ecologist prior to the commencement of works, or the felling of any hollow- bearing trees. If any species of concern are identified, construction should be delayed until suitable avoidance measures can be implemented. Displaced fauna species may require relocation into suitable adjacent habitat by a fauna-spotter-catcher.	Pre-construction	Contractor
	Clearing of potential habitat trees (hollow bearing trees) should be minimised, and these trees should be searched prior to clearing (i.e. under decorticating bark).	Pre-construction	Contractor
	A suitably qualified fauna-spotter-catcher should be present during vegetation clearing activities. Suitable release methods should be used such as nest boxes for 'soft release'.	Pre-construction	Contractor
Impact to fauna habitat resources	All hollow logs situated within the project area should be shifted into areas of habitat that are to be retained, so that they can continue to provide fauna habitat in the immediate vicinity of the proposal.	Pre-construction	Contractor
Potential for spread of weeds, pests and pathogens that may be harmful to native biota	Protocols for preventing or minimising the spread of declared and environmental weeds are required to be included in the CEMP, including: • Dispose of weeds correctly by pulling out all of the plant and covering loads when transporting to a disposal facility licensed to accept green waste. • Prior to entering the construction corridor, inspect vehicle exterior and remove all plant propagules (such as seeds) from vehicle tyres, undercarriages, grills, floors and trays. • Ensure that construction plant and equipment that has previously operated in or travelled from areas known to be contaminated with listed priority weeds are washed down prior to entering the site.	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	• In the event of the presence of any declared priority weeds, manage them in accordance with the requirements of the Biosecurity Act 2015. • Remove weeds immediately and dispose of without stockpiling. • Dispose of weed-contaminated soil at an appropriate waste management facility. • Include photos of priority weeds in the CEMP for use by contractors during toolbox talks and site induction.		
	Implement hygiene measures in accordance with the Department of Environment and Heritage national best practice guidelines for Phytophthora (2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the project should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the study area and when traversing between areas of vegetation within the study area.	Pre-construction Construction	Contractor
	Introduce hygiene measures to prevent the introduction or spread of chytrid fungus during the vegetation clearing should be incorporated into the FFMP and include decontamination of plant equipment working within 40m of waterways and wetland habitat.	Construction	Contractor
Rehabilitation	Soil that is removed for the trenching of the pipeline should be infilled the same way that it came out i.e. topsoil containing a native seedbank will be placed in last, allowing the area to regenerate naturally.	Construction	Contractor
	Following completion of construction works, cleared areas adjacent to the study area should be rehabilitated in an ecologically appropriate manner using soil stabilisation measures and planting of local and endemic species characteristic of the vegetation types identified within the study area.	Post-construction	Contractor
Edge effects	Areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Vehicle strike of fauna	Restricting vehicle movements to operational (daylight) hours.	Construction	Contractor
	Implementing and enforcing appropriate speed limits for vehicles traversing the site.	Construction	Contractor
	Establishment of 'no-go' areas, which are demarcated with high visibility barrier tape to prevent accidental impacts to vegetation and other biota adjacent to the study area.	Construction	Contractor
Aboriginal Heritage			
Impact to Aboriginal heritage	If suspected Aboriginal material is uncovered during the works: • Work in the surrounding area is to stop immediately. • A temporary fence is to be erected around the site, with a buffer zone of at least 10 m around the known edge of the site. • An appropriately qualified archaeological consultant is to be engaged to identify the material. • If the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manger as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010). Should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.	Construction	Contractor
	Although unlikely, should human remains be located during the works: • All works must halt in the immediate area to prevent any further impacts on the remains. • The site should be cordoned off and the remains themselves should be left untouched. • The nearest police station (Bundarra), the Anaiwan LALC, and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. • If the remains are found to be of Aboriginal origin and the police to not wish to investigate the site for criminal activities, the RAPs and the OWH should be consulted as to how the remains should be dealt with. • Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties; statutory obligations.	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Non-Aboriginal heritage			
Impacts to the Old Police Station and Courthouse	Temporary fencing should be installed one metre off the wall of the courthouse to ensure that the building is clearly designated as a restricted area.	Pre-construction	Contractor
	The requirements for work adjacent to the building should be clearly identified in operational plans, drawings and works descriptions.	Pre-construction	Contractor
	All staff and contractors should be provided with an induction regarding access and work requirements adjacent to the building, including provisions for a Find Procedure in the event of identification of historic relics.	Pre-construction	Contractor
	High resolution images should be completed of the location of the sewerage pod prior to and on completion of the works.	Pre-construction Post-construction	Contractor
Noise and vibration			
Noise impacts on sensitive receivers	Inform local residents of the proposed works, including information on expected duration and type of activities, particularly when noisy activities are planned.	Pre-construction	Contractor
	Work and deliveries will only occur during recommended standard construction hours unless approval to conduct work outside these hours is granted.	Construction	Contractor
	An environmental induction will be undertaken by all construction workforce members, and will include the permissible construction hours, identification of high noise and vibration generating activities and site access arrangements.	Construction	Contractor
	Onsite vibration monitoring will be undertaken prior to compaction activities commencing within 10 m of residential structures or boring commencing within 5 m of residential structures if vibration equipment are used. This monitoring will allow for more accurate vibration predictions based on specific site conditions and plant used.	Construction	Contractor
	Onsite vibration monitoring would be undertaken at the receiver when vibration generating activities are predicted to exceed the cosmetic damage criteria of 15 mm/s ppv. Where exceedances are recorded, the situation should be reviewed in order to identify the measures that can be taken to minimise the impacts. The review may result in a requirement to modify work practices or use alternative, low-vibration methods and equipment. Any vibration measurement would be undertaken by a qualified professional and with consideration to the ICNG guidelines.	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
	Dilapidation surveys performed on residential structures identified as being at risk prior to working nearby may assist in mitigating community reaction to high vibration generating activities. Individual properties at risk of cosmetic damage will be determined when the use of specific vibration intensive plant has been identified along the length of the proposal.	Construction	Contractor
	High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.	Construction	Contractor
	Simultaneous operation of noisy plant within discernible range of a residential receiver is to be avoided.	Construction	Contractor
	All vehicles and plant will be turned off when not in use.	Construction	Contractor
Air quality and energy			
Generation of dust	Include a procedure for effective dust control in the CEMP, including: • Limit earthmoving activities during periods of high winds • Implement dust suppression using water carts or binder sprays • Specify height and cover of stockpiles • Minimise vehicle movements • Cover loads during transport • Set vehicle speed limits.	Pre-construction	Contractor
	Limit the areas of clearing and ground disturbance to the minimum required	Construction	Contractor
	Place gravel on access tracks to prevent generation of dust	Construction	Contractor
	Investigate any dust complaints and implement correction as soon as possible. Define the complaint procedure within the CEMP.	Construction	Contractor
	Maintain dust suppression controls on disturbed areas until rehabilitation is completed with appropriate vegetation coverage. Rehabilitate within 10 days of completion of the capping layer in an area.	Construction	Contractor
Exhaust emissions	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards.	Construction	Contractor
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired.	Construction	Contractor
Energy use	Utilise solar power where practicable.	Operation	Council

Impact	Mitigation measure	Timing	Responsibility
Odour	Manage odour complaints in accordance with Uralla Shire Council Customer Complaint Procedure.	Operation	Council
	Wherever practicable, limit de-sludging to the day time after 7 am, avoid de-sludging during worst case meteorological conditions (winds from the west) and conduct de-sludging in the shortest timeframe possible.	Operation	Council
	If any odours are noticed offsite during spray irrigation (especially during westerly winds towards receptors), stop irrigation until the weather conditions change.	Operation	Council
	Ensure inlet channels are maintained in a clean state.	Operation	Council
	Avoid stockpiling of sludge and other residuals at the site (from screening or from de-sludging operations).	Operation	Council
Visual amenity			
Visual impact	Rehabilitate disturbed areas at the STP site as far as reasonably practicable and vegetate along the Mount Drummond Road boundary.	Construction	Contractor
	Maintain construction areas in an orderly manner and inspect daily by the contractor	Construction	Contractor
	Remove all temporary structures and equipment at the completion of works	Construction	Contractor
	Maintain and protect existing vegetation wherever possible, as defined in Section 6.4.3.	Construction	Contractor
Traffic and access			
Disruption to traffic from construction vehicle movements	Prepare a detailed construction traffic management plan (TMP) and obtain approval from Uralla Shire Council prior to construction commencing. The TMP would include appropriate Traffic Control Plans and include detail in relation to: • Temporary road diversions (if required) • Traffic control measures in works areas, including use of traffic controllers • Restrictions on the delivery of materials to site during peak traffic periods • Appropriate entry/exit points for the proposed compound areas Advising motorists of the change in traffic conditions associated with the work.	Pre-construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Traffic control	Provide appropriate exclusion barriers, signage and site supervision at all times to ensure that unauthorised vehicles and pedestrians are excluded from the works area.	Construction	Contractor
	Ensure all traffic control devices are in accordance with • AS 1742.3-2009 – Manual of uniform traffic control Devices: Traffic control for works on roads • Roads and Maritime Services Traffic control at worksites manual.	Construction	Contractor
Road closures	Communicate proposed access changes to the impacted community at least two days prior.	Prior to and during Construction	Contractor
	Diversions with adequate signage and notice would be provided during any road closures.	Construction	Contractor
Restricted property access	Maintain access to individual properties during construction, either via vehicle or on foot for short term periods where vehicle access is not possible.	Construction	Contractor
Waste generation			
General	Follow the resource management hierarchy principles: • Avoid unnecessary resource consumption as a priority • Re-use materials, reprocess, recycle and recover energy • Dispose as a last resort (in accordance with the Waste Avoidance and Resource Recovery Act 2001)	Construction	Contractor
	Manage all waste material in accordance with the POEO Act and Waste Classification Guidelines (EPA 2014).	Construction	Contractor
Spread of contamination through inappropriate waste management	Include waste classification/ENM characterisation, sampling and analysis within the contingency plan for unexpected finds/contaminated soils.	Construction	Contractor
	If required, dispose of waste to an appropriately licensed facility with supporting waste classification documentation.	Construction	Contractor

Impact	Mitigation measure	Timing	Responsibility
Generation of general construction waste	Provide labelled waste receptacles to promote the segregation of waste and recycle materials where appropriate.	Construction	Contractor
	Conduct and record site inductions as specified in the CEMP to ensure staff are aware of waste disposal protocols.	Construction	Contractor
	Preferentially procure materials with no or minimal packaging, or those where packaging is recyclable or able to be returned for re-use to the supplier.	Pre-construction	Contractor
	Maintain all working areas by keeping free of rubbish and cleaning up at the end of each working day.	Construction	Contractor
	Do not accept waste from outside of the construction corridor.	Construction	Contractor
	Follow mitigation measures for weed disposal as defined in Section 6.4.3.	Construction	Contractor
	Chip and re-use cleared weed-free vegetation on-site as part of the proposed landscaping and to stabilise disturbed soils where possible.	Construction	Contractor
	Provide portable toilets for construction workers and manage to ensure the appropriate disposal of sewage (i.e. removed by a licensed supplier).	Construction	Contractor
Biosolids production	Assess options for re-use of biosolids in accordance with the NSW biosolids guidelines (EPA 1997).	Operation	Council
Social and economic			
Temporary amenity impacts (dust, noise, visual, traffic and access)	Refer to mitigation measures provided for air quality, noise and vibration, visual amenity, traffic and access.	Construction	Contractor
Short term disruption to sewer services	Manage timelines and efficiencies of work to minimise impact to residents as much as possible.	Construction	Contractor

8. Conclusion

8.1 Justification for the proposal

The proposal is considered justified as it would reduce the risks associated with onsite wastewater systems and upgrade the Bundarra sewerage system to a standard equal to other towns in the local government area. Currently on-site sewage treatment systems are creating pollution issues due to the presence of clay soils which have poor soil permeability, especially during wet weather periods. The proposed STP would address these issues and provide a higher level of service to the Bundarra community.

While there would be some environmental impacts as a consequence of the proposal, these would be avoided or minimised wherever possible through the design development and site-specific safeguards summarised in Table 7-1. The beneficial effects listed in Section 6 are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

8.2 Ecologically sustainable development

The principles of ecologically sustainable development are defined under the EP&A Regulation (Schedule 2) as:

(a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by.

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment.

(ii) An assessment of the risk-weighted consequences of various options.

(b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

(c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.

(d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) Polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.

(iii) Environmental goals, having been established, 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.

These principles are addressed in turn, as they pertain to the proposal, in the following sections.

8.2.1 The precautionary principle

Evaluation and assessment of alternative options has aimed to reduce the risk of serious and irreversible impacts on the environment. The design development has sought to minimise impacts on the amenity of the study area while maintaining engineering feasibility and safety. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high-level of environmental performance. No management measures or mechanisms would be postponed as a result of a lack of information.

8.2.2 Intergenerational equity

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal would benefit future generations by ensuring the impacts from wastewater management are improved, which has a positive benefit for all of the community.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower level of service associated with wastewater treatment.

8.2.3 Conservation of biological diversity and ecological integrity

An assessment of the existing local environment was undertaken to identify and manage any potential impacts of the proposal on local biodiversity. Specific design efforts have been taken to minimise impacts upon locally significant habitats.

The proposal would not have a significant impact on biological diversity and ecological integrity. A biodiversity assessment and appropriate site-specific safeguards are provided in Section 6.4.

8.2.4 Improved valuation, pricing and incentive mechanisms

The REF has examined the environmental consequences of the proposal and identified management measures to manage the potential for adverse impacts. The requirement to implement these management measures would result in an economic cost to Council. The implementation of management measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The proposal design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the proposal is being developed with an environmental objective in mind.

8.3 Summary and recommendations

This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by the proposal. A number of potential environmental impacts from the proposal have been avoided or reduced during the design development and options assessment process. Management measures as detailed in this REF would ameliorate or minimise the remaining potential impacts. The REF has found that:

- Development consent under Division 4.1 of the EP&A Act is not required.
- Environmental assessment under Division 5.1 of the EP&A Act is required.

- An assessment of significance has been undertaken, pursuant to Part 7 of the BC Act and Section 1.7 of the EP&A Act, and the proposed works would not have a significant effect on threatened species, populations, communities or their habitats, as listed under the BC Act or FM Act, therefore a species impact statement is not required.
- The matters listed under Section 5.5 of the EP&A Act and Clause 228 of the EP&A Regulation have been considered and the proposed works would not significantly affect the environment; therefore an EIS is not required under Section 5.7 of the Act.
- The proposed works would not impact on any matters of NES, as listed under the EPBC Act, therefore referral to the Commonwealth Minister for the Environment is not required.

It is recommended that a detailed CEMP with specified sub-plans be prepared before works commence. The CEMP is to include (as a minimum) the measures summarised in Table 7-1. With these measures in place, a significant residual impact is not anticipated.

9. Declaration

This report: has been prepared by GHD for Uralla Shire Council and may only be used and relied on by Uralla Shire Council for the purpose agreed between GHD and the Uralla Shire Council as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Uralla Shire 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. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Uralla Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

This Review of Environmental Factors provides a true and fair review of the activity in relation to its likely impact on the environment. It addresses to the fullest extent possible, all the factors listed in Clause 228 of the *Environmental Planning and Assessment Regulation Act* (as amended) and the *Commonwealth Environmental Protection and Biodiversity Conservation Act* (as amended).

Signed: 

Name: Ben Luffman

Position: Senior Environmental Consultant

Date: 8 August 2019

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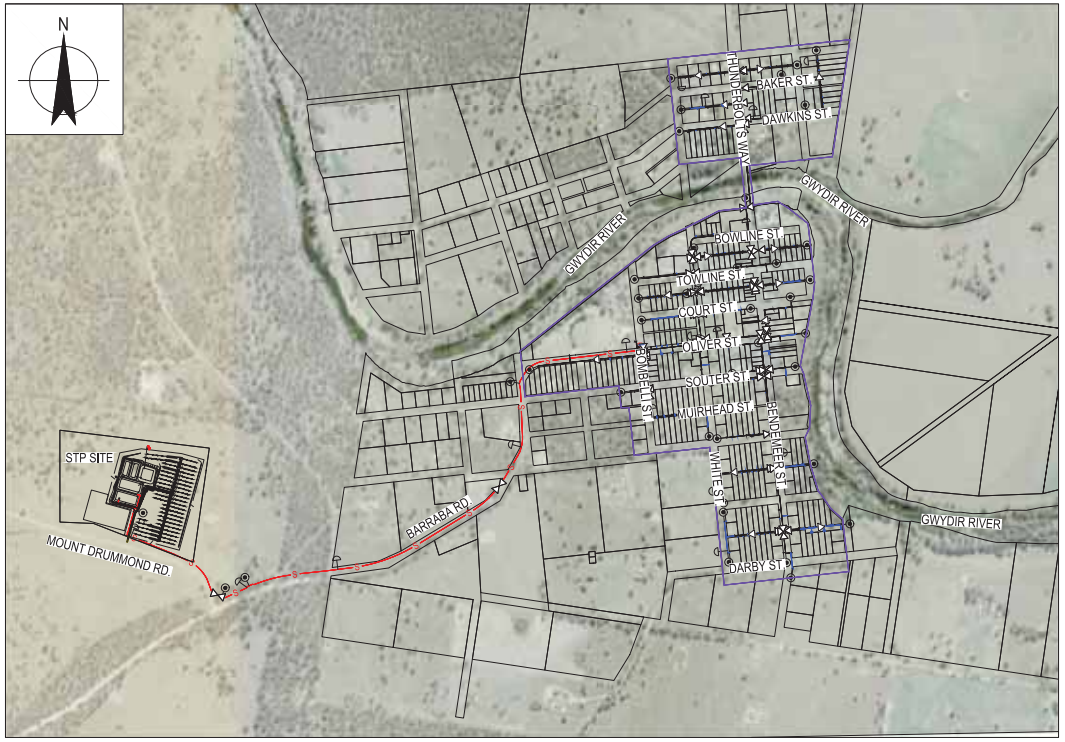
WSA 07-2007 1.1 Pressure Sewerage Code of Australia.

Appendices

Appendix A – Detailed design

URALLA SHIRE COUNCIL
BUNDARRA SEWERAGE SCHEME



REFER 22-19174-G002 FOR LEGEND.

LOCALITY PLAN
SCALE 1:10000

DRAWING LIST	
DRAWING NUMBER	DRAWING TITLE
CIVIL	
22-19174-G001	COVER SHEET, LOCALITY PLAN AND DRAWING LIST
22-19174-G002	PLAN LAYOUT / GENERAL ARRANGEMENT AND LEGEND
22-19174-G003	GENERAL NOTES
22-19174-W001	RETICULATION LAYOUT 1 OF 6
22-19174-W002	RETICULATION LAYOUT 2 OF 6
22-19174-W003	RETICULATION LAYOUT 3 OF 6
22-19174-W004	RETICULATION LAYOUT 4 OF 6
22-19174-W005	RETICULATION LAYOUT 5 OF 6
22-19174-W006	RETICULATION LAYOUT 6 OF 6
22-19174-W010	RETICULATION LINE 1 PLAN AND LONGITUDINAL SECTION 1 OF 3
22-19174-W011	RETICULATION LINE 1 PLAN AND LONGITUDINAL SECTION 2 OF 3
22-19174-W012	RETICULATION LINE 1 PLAN AND LONGITUDINAL SECTION 3 OF 3
22-19174-W020	BENDEMEER ST. BRIDGE CROSSING PLAN AND SECTIONS
22-19174-W021	BENDEMEER ST. BRIDGE CROSSING DETAILS
22-19174-W050	RISING MAIN PLAN AND LONGITUDINAL SECTION 1 OF 5
22-19174-W051	RISING MAIN PLAN AND LONGITUDINAL SECTION 2 OF 5
22-19174-W052	RISING MAIN PLAN AND LONGITUDINAL SECTION 3 OF 5
22-19174-W053	RISING MAIN PLAN AND LONGITUDINAL SECTION 4 OF 5
22-19174-W054	RISING MAIN PLAN AND LONGITUDINAL SECTION 5 OF 5
22-19174-W055	INLET WORKS
22-19174-W100	STP SITE LAYOUT
22-19174-W101	STP SET-OUT PLAN AND PIPEWORK LAYOUT
22-19174-W102	HYDRAULIC PROFILE
22-19174-W103	SECTION AND PIT DETAILS
22-19174-W104	STP EMBANKMENT TYPICAL SECTIONS
22-19174-W105	TYPICAL INLET AND OUTLET DETAILS
22-19174-W106	EARTHWORKS
22-19174-W107	IRRIGATION SITE LAYOUT
22-19174-W108	IRRIGATION SITE DETAILS
22-19174-W109	ACCESS TRACK CROSS SECTIONS AND SUBSURFACE DRAIN DISCHARGE POINT DETAILS
22-19174-W110	WINTER STORAGE POND PUMP STATION PIPEWORK ARRANGEMENT PLAN
22-19174-W111	WINTER STORAGE POND PUMP STATION SECTIONS
22-19174-W112	WINTER STORAGE POND PUMP STATION DETAILS
22-19174-W113	WINTER STORAGE POND INLET WORKS
22-19174-W200	BUNDARRA PUMP STATION SITE LAYOUT PLAN
22-19174-W201	BUNDARRA PUMP STATION PIPEWORK ARRANGEMENT PLAN
22-19174-W202	BUNDARRA PUMP STATION SECTION
22-19174-W203	BUNDARRA PUMP STATION BAROMETRIC LOOP, VENT STACK AND GROUND MOUNT ODOUR FILTER DETAIL
22-19174-W204	BUNDARRA PUMP STATION SWITCHBOARD CONTROL PLATFORM DETAIL
22-19174-W250	PRESSURE SEWER MAINS TYPICAL DETAILS SCOUR CONNECTION AND FLUSHING POINT
22-19174-W251	ODOUR FILTER WITH ABOVE GROUND AIR VALVE TYPICAL DETAILS
ELECTRICAL	
22-19174-E011	INCOMING POWER SUPPLY SINGLE LINE DIAGRAM
22-19174-E012	24V DC POWER SUPPLY UNIT WIRING DIAGRAM
22-19174-E013	SITE RTU DIGITAL INPUTS SCHEMATIC DIAGRAM
22-19174-E014	SITE ACCESS ALARM SCHEMATIC DIAGRAM
22-19174-E016	RTU INTERCONNECTION WIRING DIAGRAM
22-19174-E031	PHOTOVOLTAIC BATTERY PANEL WIRING DIAGRAM
22-19174-E032	PHOTOVOLTAIC AND BATTERY SYSTEM COMMUNICATIONS WIRING DIAGRAM
22-19174-E033	PHOTOVOLTAIC SYSTEM PANEL GENERAL ARRANGEMENT
22-19174-E041	STP SINGLE LINE DIAGRAM
22-19174-E042	STP 24V DC POWER SUPPLY UNIT WIRING DIAGRAM
22-19174-E043	STP RTU IO SCHEMATIC DIAGRAM
22-19174-E044	STP SITE ACCESS ALARM SCHEMATIC DIAGRAM
22-19174-E046	STP RTU INTERCONNECTION WIRING DIAGRAM
STRUCTURAL	
22-19174-S001	BUNDARRA PUMP STATION STRUCTURAL STANDARD GENERAL NOTES SHEET 1 OF 3
22-19174-S002	BUNDARRA PUMP STATION STRUCTURAL STANDARD GENERAL NOTES SHEET 2 OF 3
22-19174-S003	BUNDARRA PUMP STATION STRUCTURAL STANDARD GENERAL NOTES SHEET 3 OF 3
22-19174-S101	BUNDARRA PUMP STATION BAROMETRIC LOOP TALL FOUNDATION PLAN AND PIPE SUPPORT FRAMING
22-19174-S102	BUNDARRA PUMP STATION BAROMETRIC LOOP TALL SECTIONS AND DETAILS
22-19174-S103	BUNDARRA PUMP STATION BAROMETRIC LOOP TALL REINFORCEMENT PLAN AND SECTION DETAILS
22-19174-S104	BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT FOUNDATION PLAN AND PIPE SUPPORT FRAMING
22-19174-S105	BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT SECTIONS AND DETAILS
22-19174-S106	BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT REINFORCEMENT PLAN AND SECTION DETAILS

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 100 200 300 400 500m
SCALE 1:10,000 AT ORIGINAL SIZE

GHD Tower, Level 3
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Drawn	M. PERIDO	Designer	B. REYNOLDS
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:10000		

This Drawing must not be used for Construction unless signed as Approved

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title COVER SHEET, LOCALITY PLAN AND DRAWING LIST

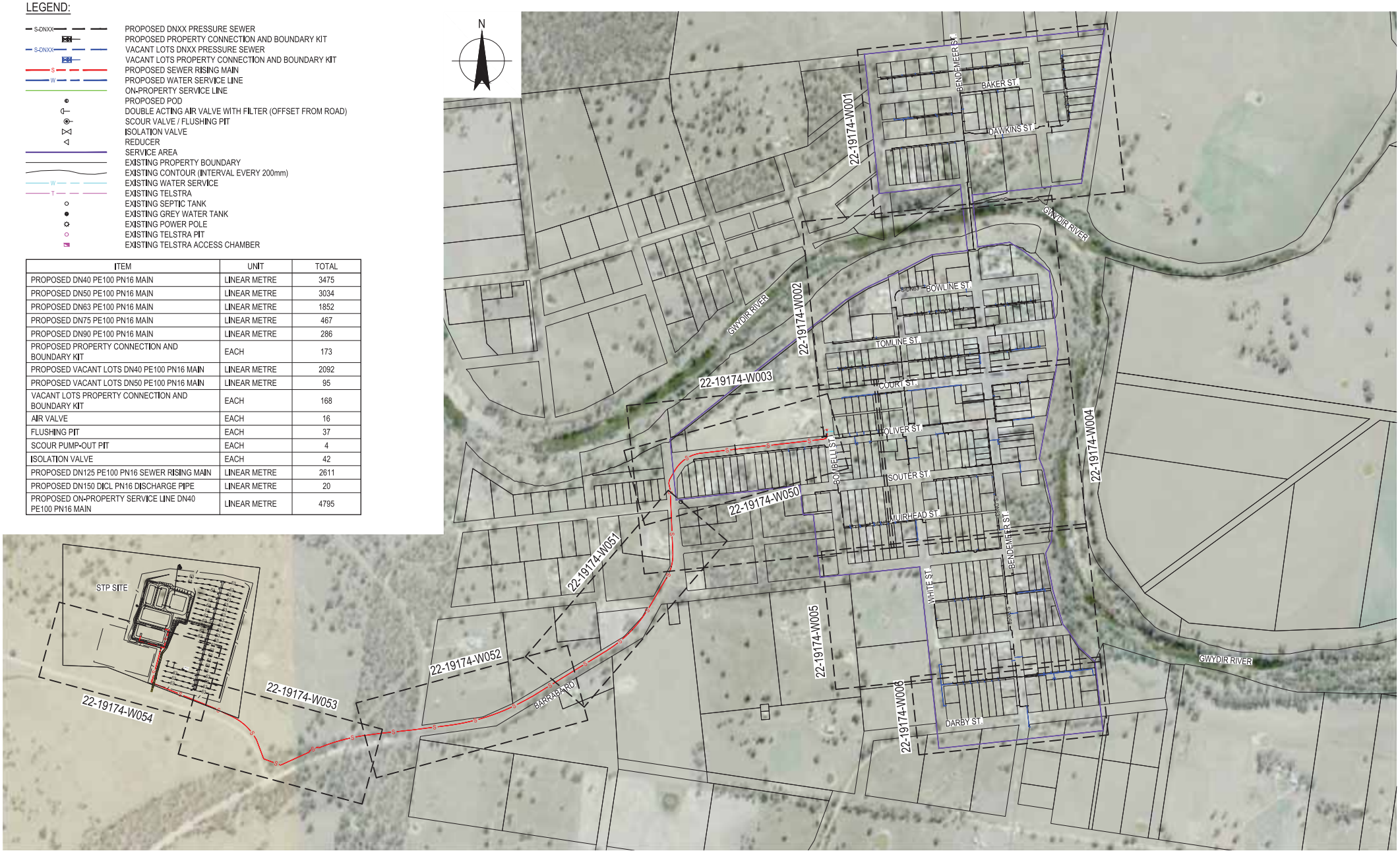
Original Size A1
Drawing No: 22-19174-G001
Rev: 0

Plot Date: 20 June 2019 - 11:26 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-G001.dwg

LEGEND:

- PROPOSED DNXX PRESSURE SEWER
- PROPOSED PROPERTY CONNECTION AND BOUNDARY KIT
- VACANT LOTS DNXX PRESSURE SEWER
- VACANT LOTS PROPERTY CONNECTION AND BOUNDARY KIT
- PROPOSED SEWER RISING MAIN
- PROPOSED WATER SERVICE LINE
- ON-PROPERTY SERVICE LINE
- PROPOSED POD
- DOUBLE ACTING AIR VALVE WITH FILTER (OFFSET FROM ROAD)
- SCOUR VALVE / FLUSHING PIT
- ISOLATION VALVE
- REDUCER
- SERVICE AREA
- EXISTING PROPERTY BOUNDARY
- EXISTING CONTOUR (INTERVAL EVERY 200mm)
- EXISTING WATER SERVICE
- EXISTING TELSTRA
- EXISTING SEPTIC TANK
- EXISTING GREY WATER TANK
- EXISTING POWER POLE
- EXISTING TELSTRA PIT
- EXISTING TELSTRA ACCESS CHAMBER

ITEM	UNIT	TOTAL
PROPOSED DN40 PE100 PN16 MAIN	LINEAR METRE	3475
PROPOSED DN50 PE100 PN16 MAIN	LINEAR METRE	3034
PROPOSED DN63 PE100 PN16 MAIN	LINEAR METRE	1852
PROPOSED DN75 PE100 PN16 MAIN	LINEAR METRE	467
PROPOSED DN90 PE100 PN16 MAIN	LINEAR METRE	286
PROPOSED PROPERTY CONNECTION AND BOUNDARY KIT	EACH	173
PROPOSED VACANT LOTS DN40 PE100 PN16 MAIN	LINEAR METRE	2092
PROPOSED VACANT LOTS DN50 PE100 PN16 MAIN	LINEAR METRE	95
VACANT LOTS PROPERTY CONNECTION AND BOUNDARY KIT	EACH	168
AIR VALVE	EACH	16
FLUSHING PIT	EACH	37
SCOUR PUMP-OUT PIT	EACH	4
ISOLATION VALVE	EACH	42
PROPOSED DN125 PE100 PN16 SEWER RISING MAIN	LINEAR METRE	2611
PROPOSED DN150 DICL PN16 DISCHARGE PIPE	LINEAR METRE	20
PROPOSED ON-PROPERTY SERVICE LINE DN40 PE100 PN16 MAIN	LINEAR METRE	4795



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0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: PLAN LAYOUT / GENERAL ARRANGEMENT AND LEGEND

Original Size: A1
Drawing No: 22-19174-G002
Rev: 0

Plot Date: 20 June 2019 - 11:27 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-G002.dwg

GENERAL NOTES:

1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH WSA 07-2007 1.1 PRESSURE SEWERAGE CODE OF AUSTRALIA AND WSA 04-2005 2.1 SEWAGE PUMPING STATION CODE OF AUSTRALIA UNLESS SPECIFIED OTHERWISE.
2. TRENCH DETAILS FOR INSTALLATION OF NEW PRESSURE SEWER MAINS IN OTHER THAN POOR GROUND CONDITIONS OR UNDER EXISTING ROAD CARRIAGEWAYS MUST BE IN ACCORDANCE WITH THE STANDARD DRAWINGS PSS-1000.
3. BURIED CROSSING DETAILS UNDER OBSTRUCTIONS MUST BE IN ACCORDANCE WITH THE STANDARD DRAWINGS PSS-1002 AND PSS-1003.
4. TRENCH BACKFILL OUTSIDE OF PAVEMENT AREAS:
   a. BACKFILL MATERIALS SHALL COMPRISE GRANULAR NATURAL MATERIAL (VENM OR ENM FREE FROM TOPSOIL, ORGANICS, FINE SAND OR SILT, OVERSIZE PARTICLES (>100mm) OR OTHER DELETERIOUS MATERIAL.
   b. CLEAN SAND AND/OR GRAVEL MATERIAL WON FROM THE TRENCH EXCAVATION IS EXPECTED TO BE SUIT ABLE FOR REUSE AS BACKFILL
   c. BACKFILLING OPERATIONS SHALL BE CONDUCTED UNDER A LEVEL 1 EARTHWORKS TESTING AND INSPECTION SERVICE, AS DEFINED IN AS3798-2007, PROVIDED BY A NATA REGISTERED GEOTECHNICAL INSPECTION AND TESTING AUTHORITY (GITA).
   d. BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 250mm AND COMPACTED USING A VIBRATING PLATE COMPACTOR (OR OTHER APPROVED METHODS) TO AT LEAST 95% OF STANDARD MAXIMUM DRY DENSITY RATIO (SMDDR) OR A MINIMUM 65% DENSITY INDEX.
   e. GEOTECHNICAL ADVICE SHOULD BE SOUGHT IF RECOMMENDED COMPACTION CRITERIA ARE NOT CONSIDERED ACHIEVABLE DUE TO SITE CONDITIONS.
   f. TOPSOIL AND GRASSED AREAS TO BE RESTORED AS PER SECTION 14 OF THE TECHNICAL SPECIFICATION.
5. INSTALLATION OF ISOLATION VALVES TO BE IN ACCORDANCE WITH PSS-1005. ALL ISOLATION VALVES TO INCLUDE MARKER POST.
6. INSTALLATION OF FLUSHING POINTS IN PRESSURISED SEWER RETICULATION TO BE IN ACCORDANCE WITH PSS-1007.
7. INSTALLATION OF SCOUR CONNECTION WITH PUMP OUT SUMP FOR SEWER RISING MAIN TO BE IN ACCORDANCE WITH WAT-1307.
8. INSTALLATION OF HOUSE SERVICE TO BE IN ACCORDANCE WITH PSS-1101.
9. INSTALLATION OF PROPERTY BOUNDARY KITS TO BE IN ACCORDANCE WITH PSS-1102.
10. SURFACE RESTORATION AND PAVEMENT RESTORATION MUST BE IN ACCORDANCE WITH THE DRAWINGS AND REQUIREMENTS OF COUNCIL'S SPECIFICATION.
11. ACCEPTANCE TESTING OF SEWER MAINS MUST BE ARRANGED BY THE CONTRACTOR. ACCEPTANCE TESTING MUST BE IN ACCORDANCE WITH WSA 07-2007 1.1.
12. ALL DICL FITTINGS TO BE PN16 TO AS 2280.
13. AIR VALVES AND CONNECTED ODOUR FILTERS BOTH TO BE INSTALLED BELOW GROUND AND OFFSET FROM ROAD AND DRIVEWAYS AS SHOWN IN DRAWING 22-19174-W251. ODOUR FILTERS TO BE CONNECTED TO ABOVE GROUND COWLS. COWLS TO BE INSTALLED OFFSET FROM ROAD AND DRIVEWAYS WITH BOLLARDS TO BE INSTALLED SURROUNDING COWLS.
14. SCOUR POINTS TO BE OFFSET FROM ROADS AND DRIVEWAYS.
15. HYDROSTATIC TEST PRESSURE FOR THE RISING MAIN IS 1000 kPa.
16. PRESSURE MAINS TO BE LAID AT MINIMUM COVER OF 450 U.N.O.
17. 2% EXTRA LENGTH OF RISING MAIN TO BE MEASURED FROM CHAINAGES TO BE LAID AND SNAKED IN THE TRENCH.
18. CONTRACTOR MAY USE CURVE RADIUS INSTEAD OF BENDS IF FEASIBLE.
19. TRENCHSTOPS TO BE PROVIDED ON PIPES GRADED TO 5% TO 14% AS PER WAT-1209.
20. LONG HANDLE HEAVY-DUTY GATIC LID LIFTER TO BE PROVIDED TO COUNCIL UPON COMPLETION OF THE PROJECT.

SERVICES NOTES:

1. SERVICE LOCATIONS ARE FOR INFORMATION ONLY AND HAVE BEEN OBTAINED FROM 'DIAL BEFORE YOU DIG', HISTORICAL RECORDS AND NON-INVASIVE INVESTIGATION METHODS.
2. THE CONTRACTOR MUST LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS. ALL EXISTING SERVICES AND UTILITIES MUST BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR MUST BE RESPONSIBLE FOR THE RELOCATION AND REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION AND ANY CHARGES THAT MAY APPLY DUE TO THE DAMAGE OF THE SERVICE.
3. THE DEPTH OF EXISTING SERVICES HAVE BEEN ASSUMED TO BE AT STANDARD DEPTH OR OBTAINED FROM SITE INVESTIGATIONS, WHERE AVAILABLE. THE CONTRACTOR MUST POT-HOLE ALL EXISTING SERVICES TO CONFIRM THE DESIGN AND WHERE REQUIRED, THE DESIGN MUST BE MODIFIED TO SUIT BY THE CONTRACTOR AND APPROVED BY COUNCIL AND THE PRINCIPAL.
4. OVERHEAD ELECTRICAL LINES ARE NOT SHOWN ON DRAWINGS FOR CLARITY.
5. A MINIMUM CLEARANCE OF 500MM MUST BE MAINTAINED BETWEEN THE NEW SEWER MAINS AND ALL EXISTING POWER POLES. ENSURE STABILITY OF POLES AND AVOID DISRUPTIONS.
6. CLEARANCES:

CLEARANCES BETWEEN PIPELINES AND UNDERGROUND SERVICES			
UTILITY (EXISTING SERVICE)	MINIMUM HORIZONTAL CLEARANCE (mm)		MINIMUM VERTICAL CLEARANCE (mm)
	PIPELINE SIZE		
	≤DN200	>DN200	
WATER MAINS	1000[b]	1000[b]	500[e]
GAS MAINS	300[c]	600	150
TELECOMMUNICATION CONDUITS AND CABLES	300[c]	600	150
ELECTRICITY CONDUITS AND CABLES	500	1000	225
DRAINS	300[c]	600	150[d]
SEWERS	300[c]	600	500[d,e]
KERBS	150	600[d]	150 (WHERE PRACTICABLE)

NOTES:

a. VERTICAL CLEARANCES APPLY WHEN PIPELINES CROSS OTHER UTILITY SERVICES, EXCEPT IN THE CASE OF WATER MAINS WHEN A VERTICAL SEPARATION SHALL ALWAYS BE MAINTAINED, EVEN WHEN THE PRESSURE SEWER AND WATER MAIN ARE PARALLEL. THE PRESSURE SEWER SHOULD ALWAYS BE LOCATED BELOW THE WATER MAIN TO MINIMISE THE POSSIBILITY OF BACKFLOW CONTAMINATION IN THE EVENT OF A PRESSURE MAIN BREAK.

b. FOR AREAS WITH EXISTING WATER RETICULATION CLEARANCES CAN BE FURTHER REDUCED TO 600 MM WITH THE APPROVAL OF THE WATER MAIN OWNER.

c. CLEARANCES CAN BE FURTHER REDUCED TO 150 MM FOR DISTANCES UP TO 2 M WHEN PASSING INSTALLATIONS SUCH AS POLES, PITS AND SMALL STRUCTURES, PROVIDING THE STRUCTURE IS NOT DESTABILISED IN THE PROCESS.

d. CLEARANCE FROM KERBS SHALL BE MEASURED FROM THE NEAREST POINT OF THE KERB. FOR PRESSURE SEWERS ≤DN 375 CLEARANCES FROM KERBS CAN BE PROGRESSIVELY REDUCED UNTIL THE MINIMUM OF 150 MM IS REACHED FOR SEWERS ≤DN 200.

e. FOR PRESSURE SEWER LATERALS, MINIMUM VERTICAL CLEARANCES MAY BE REDUCED TO 150 MM PROVIDED THERE IS NO JOINT IN THE LATERAL WITHIN 500 MM OF EITHER SIDE OF THE SERVICE BEING CROSSED.

SURVEY NOTES:

1. SURVEY IS ON GDA94 / MGA ZONE 56 GRID COORDINATES AND AHD.
2. ORIGIN OF SURVEY IS SSM57042 FROM SCIMS SURVEY MARKS ACCESSED 19/06/2018. SSM57042 HAS A CLASS C-3 AHD HEIGHT VALUE.

ON PROPERTY WORK NOTES:

1. REFER TO ON PROPERTY WORKS AGREEMENT.
2. CONTRACTOR TO INSTALL POLE FILLERS WITHIN THE EXISTING SWITCHBOARDS AS REQUIRED. INSTALLATION IN ACCORDANCE WITH AUSTRALIAN STANDARDS.

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Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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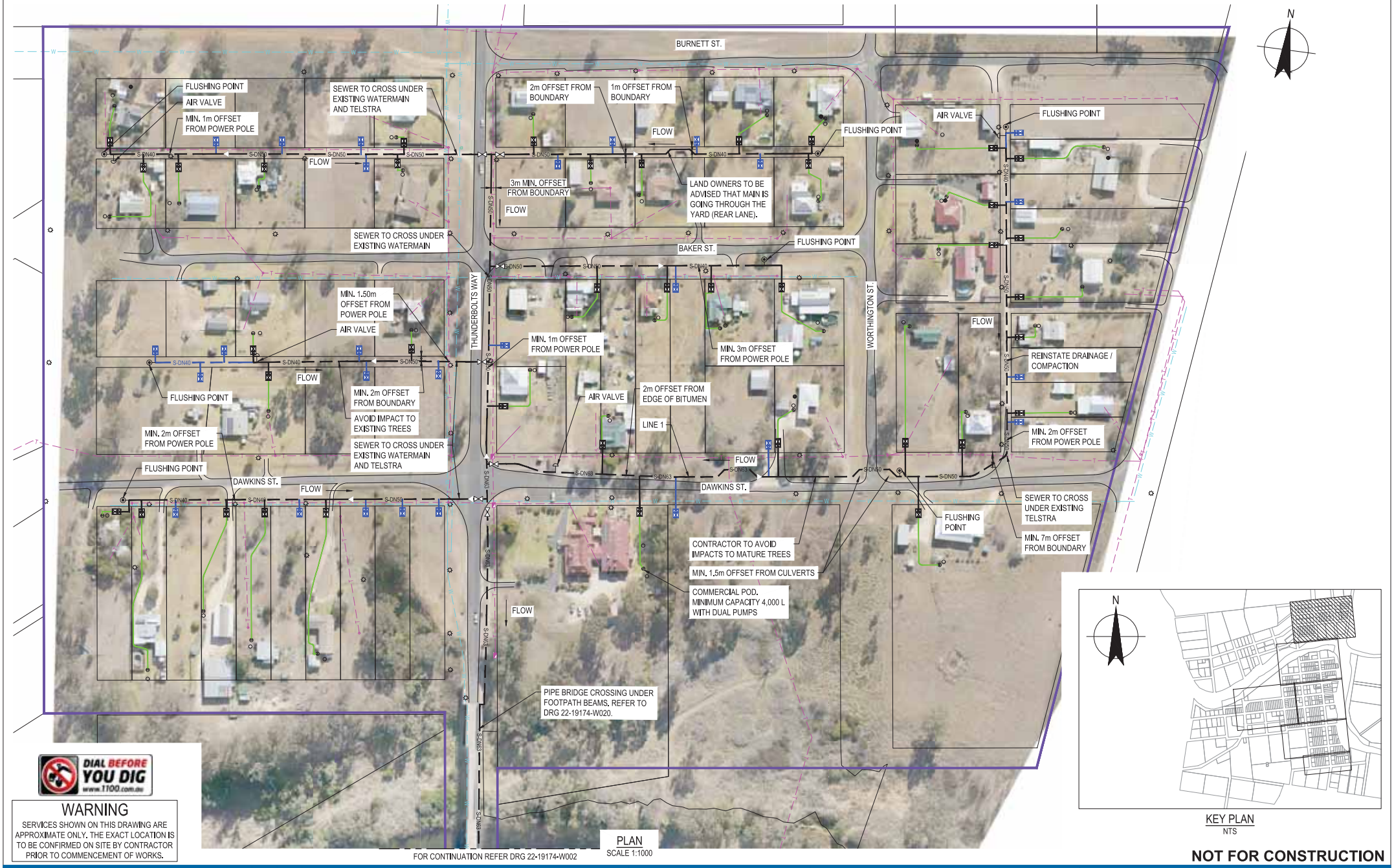
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title GENERAL NOTES

Original Size A1 Drawing No: 22-19174-G003 Rev: 0

Plot Date: 20 June 2019 - 11:28 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-G003.dwg



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KEY PLAN
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 1 OF 6

Original Size A1
Drawing No: 22-19174-W001
Rev: 0

Plot Date: 20 June 2019 - 11:29 AM
Plotted by: Rj Geronimo
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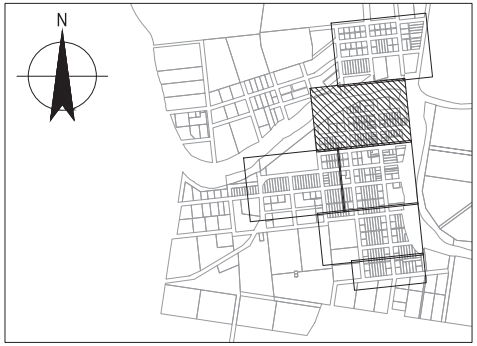

KEY PLAN
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FOR CONTINUATION REFER DRG 22-19174-W001

PIPE BRIDGE CROSSING UNDER FOOTPATH BEAMS. REFER TO DRG 22-19174-W020.

REFER TO DRG 2219174-W021

SEWER TO CROSS UNDER EXISTING WATERMAIN

FLUSHING POINT

1m OFFSET FROM EXISTING BOUNDARY

LINE 1

AIR VALVE

1.50m OFFSET FROM POWER POLE

SEWER TO CROSS UNDER EXISTING TELSTRA

1.50m OFFSET FROM POWER POLE

2.50m OFFSET FROM FENCE

BUNDARRA CENTRAL SCHOOL

EXISTING BOUNDARY KIT INSTALLED BY OTHERS UNDER A SEPARATE CONTRACT TO BE ABANDONED. NEW PROPERTY BOUNDARY KIT PROVIDED IN THE NORTHERN SIDE OF THE SCHOOL.

SEWER TO CROSS UNDER EXISTING STORMWATER

FLOW

BOWLINE ST.

MIN. 2.0m OFFSET FROM FENCE

FLUSHING POINT

CONTRACTOR TO CONFIRM WATERMAIN ALIGNMENT

1.50m OFFSET FROM ROAD EDGE

1m OFFSET FROM POWER POLE

TRENCHLESS CROSSING

FLUSHING POINT

BENDEMEER ST.

MIN. 2.50m OFFSET FROM BOUNDARY

MIN. 1.0m OFFSET FROM POWER POLE IN FOOTPATH

FLUSHING POINT

TOMLINE ST.

FLUSHING POINT

TRENCHLESS CROSSING

1m OFFSET FROM POWER POLE

WHITE ST.

BOMBELLI ST.

MIN. 2.0m OFFSET FROM FENCE

FLUSHING POINT

FLUSHING POINT

TRENCHLESS CROSSING

MIN. 2.50m OFFSET FROM BOUNDARY

FLUSHING POINT

1.50m OFFSET FROM ROAD EDGE

SEWER TO CROSS UNDER EXISTING STORMWATER

MIN. 2.0m OFFSET FROM FENCE

VALVES 1.0m OFF EACH BRANCH

CONCRETE ENCASE SEWER LINE CROSSING ON TOP OF DRAINAGE

MIN. 1.2m OFFSET FROM KERB IN FOOTPATH

COMMERCIAL POD. MINIMUM CAPACITY 2,000 L WITH DUAL PUMPS.

COMMERCIAL POD. MINIMUM CAPACITY 6,000 L WITH DUAL PUMPS.

FOR CONTINUATION REFER DRG 22-19174-W003

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FOR CONTINUATION REFER DRG 22-19174-W004

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Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 2 OF 6

Original Size A1
Drawing No: 22-19174-W002
Rev: 0

Plot Date: 20 June 2019 - 11:30 AM
Plotted by: Rj Geronimo
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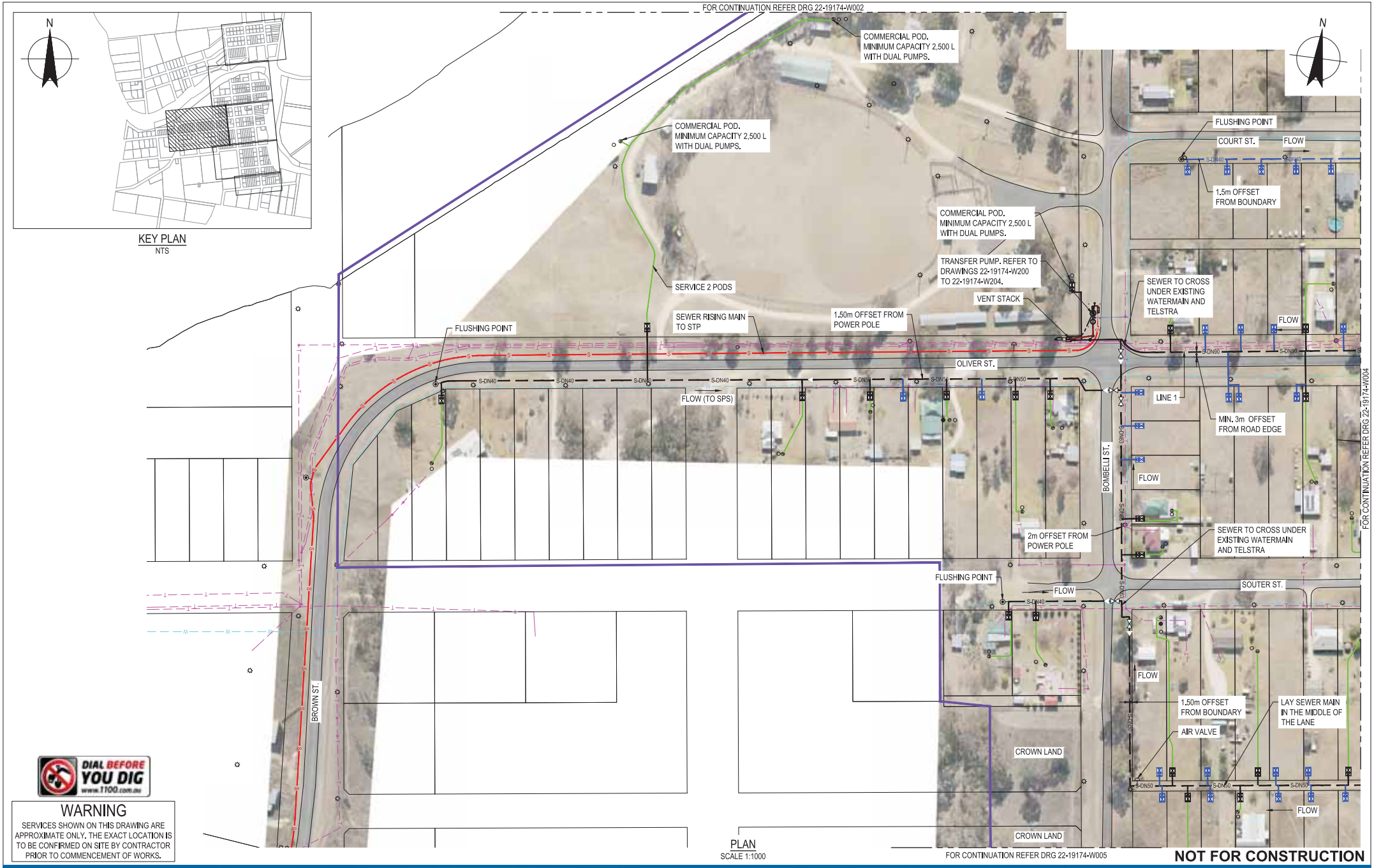

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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 3 OF 6

Original Size A1
Drawing No: 22-19174-W003
Rev: 0

Plot Date: 20 June 2019 - 11:30 AM
Plotted by: Rj Geronimo
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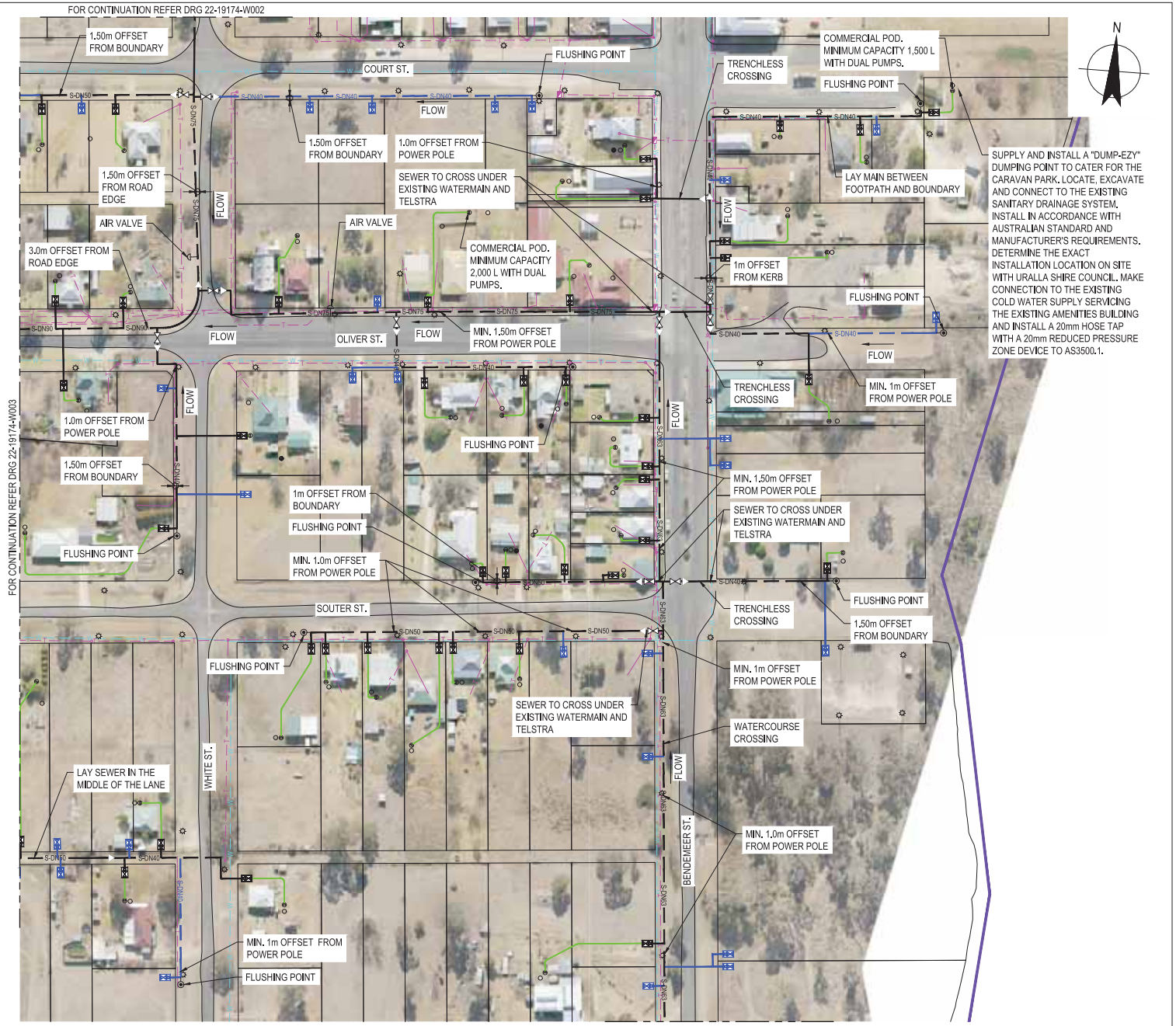

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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 4 OF 6

Original Size A1
Drawing No: 22-19174-W004
Rev: 0

Plot Date: 20 June 2019 - 11:30 AM Plotted by: Rj Geronimo
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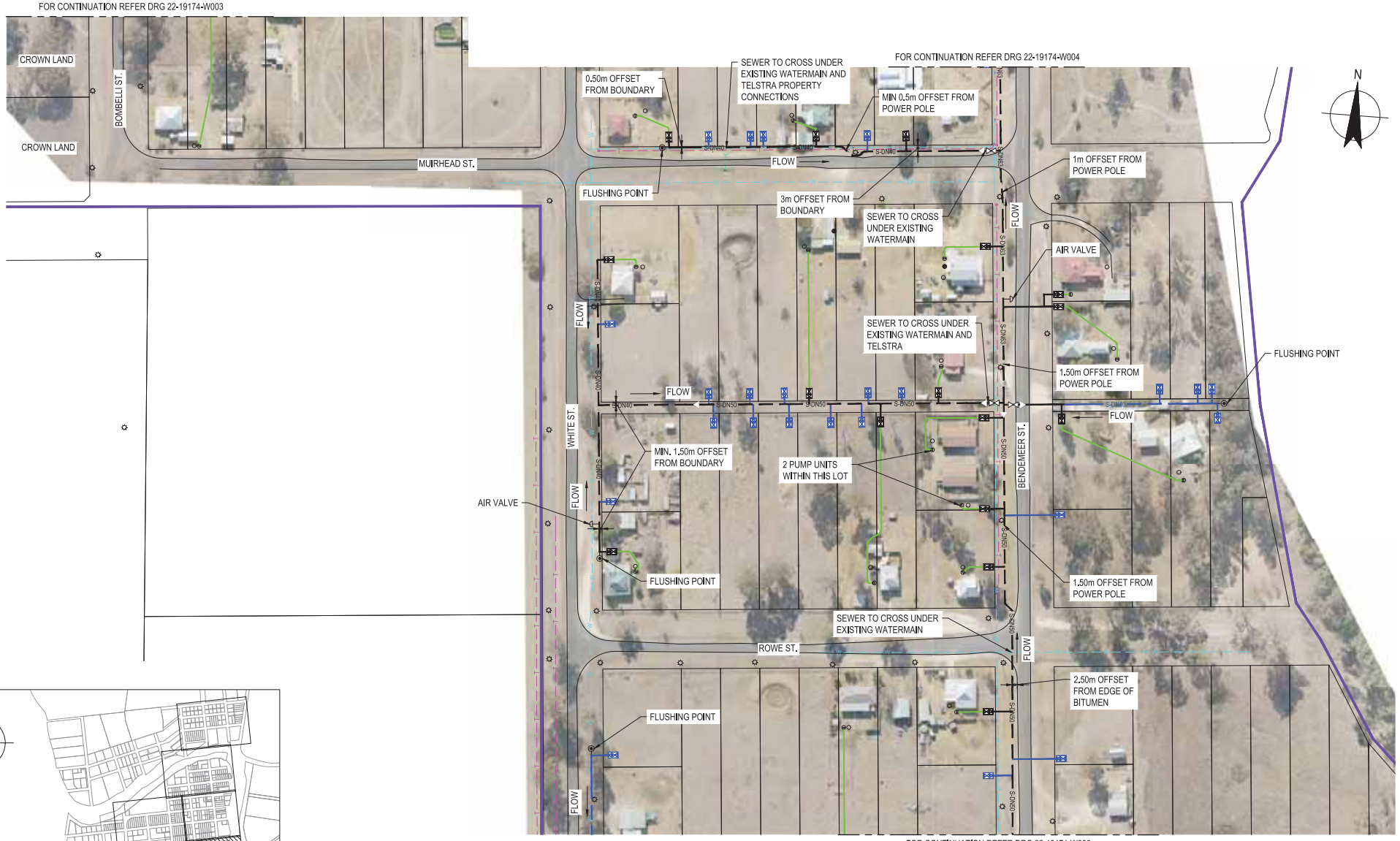

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KEY PLAN
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 5 OF 6

Original Size A1
Drawing No: 22-19174-W005
Rev: 0

Plot Date: 20 June 2019 - 11:30 AM Plotted by: Rj Geronimo
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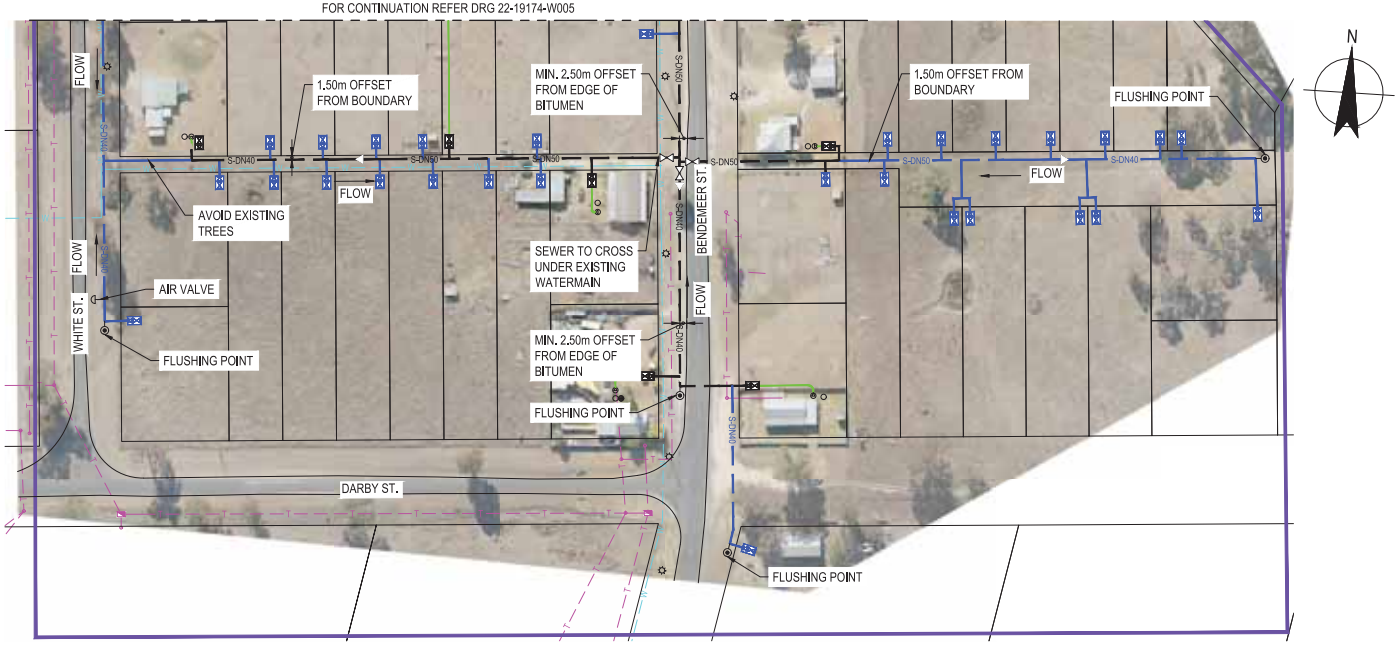

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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LAYOUT 6 OF 6

Original Size A1
Drawing No: 22-19174-W006
Rev: 0

Plot Date: 20 June 2019 - 11:30 AM Plotted by: Rj Geronimo
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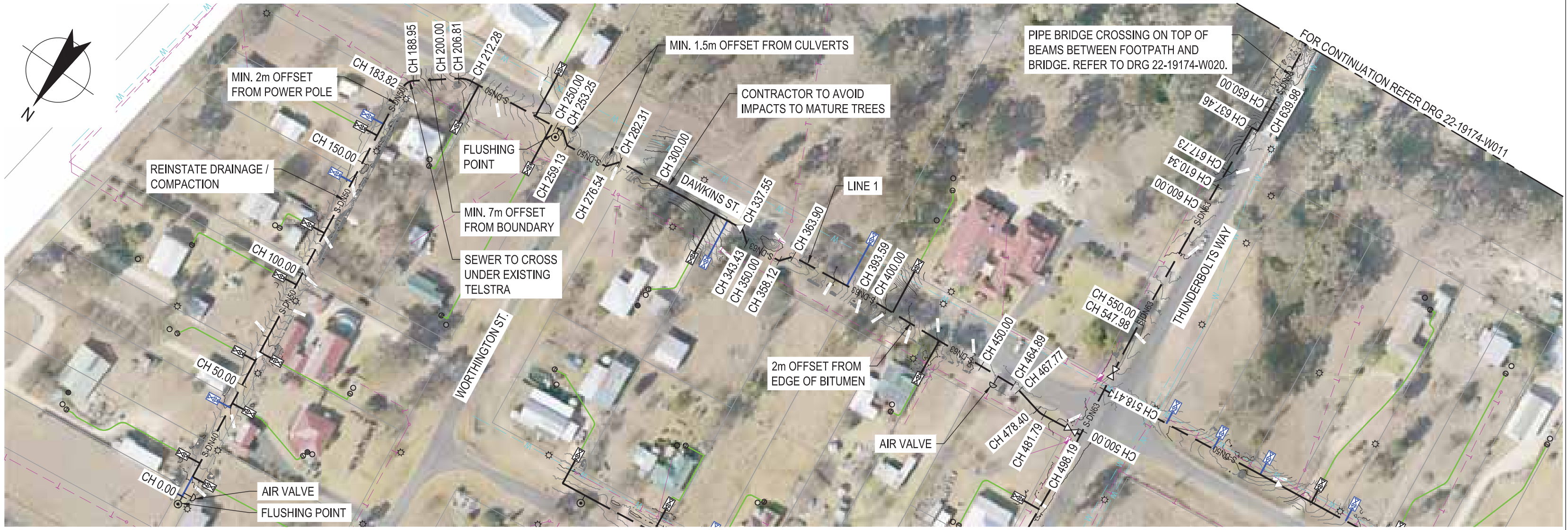
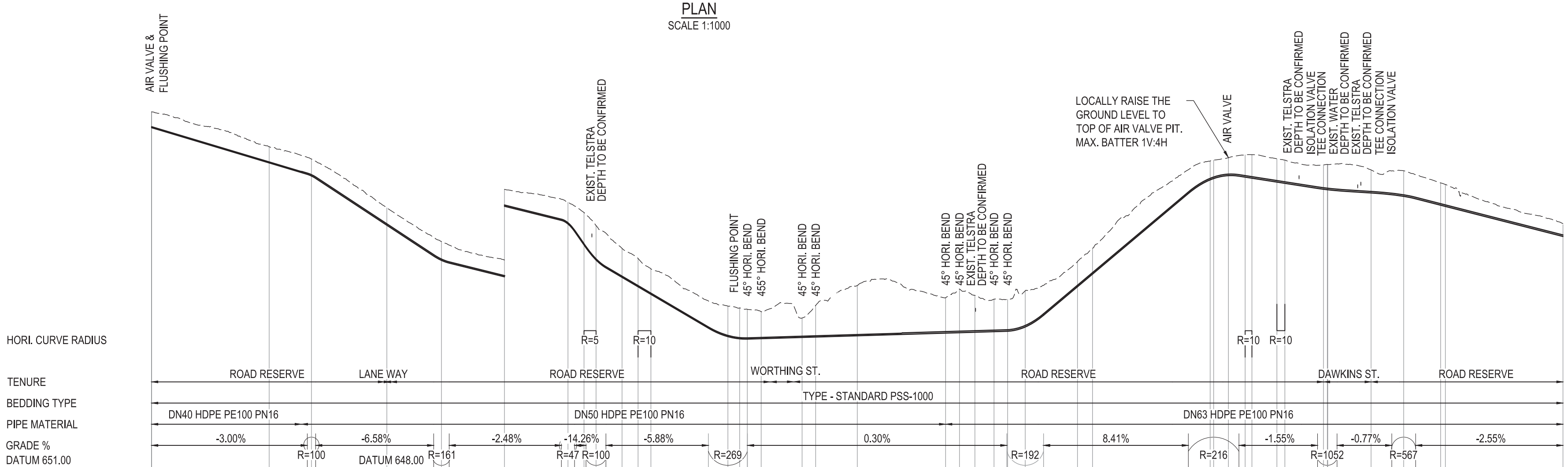


PLAN
SCALE 1:1000

NOTE:

1. TRENCHSTOPS TO BE INSTALLED ON PIPES WITH GRADES GREATER THAN 5% IN ACCORDANCE WITH WAT-1209.



CHAINAGE	DEPTH TO INVERT	PIPE INVERT LEVEL	EXISTING SURFACE LEVEL
0.00	0.67	665.51	666.18
50.00	0.69	664.01	664.69
67.97	0.72	663.45	664.17
100.00	0.74	661.36	662.10
123.22	0.80	659.87	660.67
150.00	0.72	659.17	659.88
177.01	0.92	658.41	659.33
183.82	1.38	657.52	658.90
188.95	1.46	656.88	658.34
200.00	1.23	656.14	657.37
206.81	1.21	655.74	656.95
212.28	1.08	655.42	656.50
245.00	1.30	653.62	654.92
250.00	1.31	653.53	654.84
253.25	1.26	653.52	654.78
259.13	1.15	653.54	654.69
276.54	0.83	653.59	654.42
282.31	1.34	653.61	654.95
300.00	2.14	653.66	655.80
337.55	1.50	653.77	655.27
343.43	1.85	653.79	655.65
350.00	1.56	653.81	655.38
358.12	1.38	653.84	655.22
363.90	1.35	653.85	655.21
371.39	1.54	654.03	655.57
393.59	1.07	655.74	656.82
400.00	1.10	656.28	657.38
450.00	0.80	660.29	661.09
451.49	0.78	660.34	661.13
457.78	0.77	660.47	661.23
464.89	0.95	660.40	661.35
467.77	1.00	660.36	661.36
478.40	0.99	660.19	661.18
481.79	0.99	660.14	661.13
498.19	1.04	659.89	660.93
499.82	1.07	659.87	660.94
500.00	1.08	659.87	660.94
518.41	0.99	659.72	660.71
532.29	1.08	659.59	660.67
547.98	0.95	659.21	660.16
550.00	0.94	659.16	660.10
600.00	0.55	657.88	658.43

LONGITUDINAL SECTION - LINE 1
SCALE HOR 1:1000 VER 1:100

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No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

VERTICAL 1:100 AT ORIGINAL SIZE 0 1 2 3 4 5m
HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m

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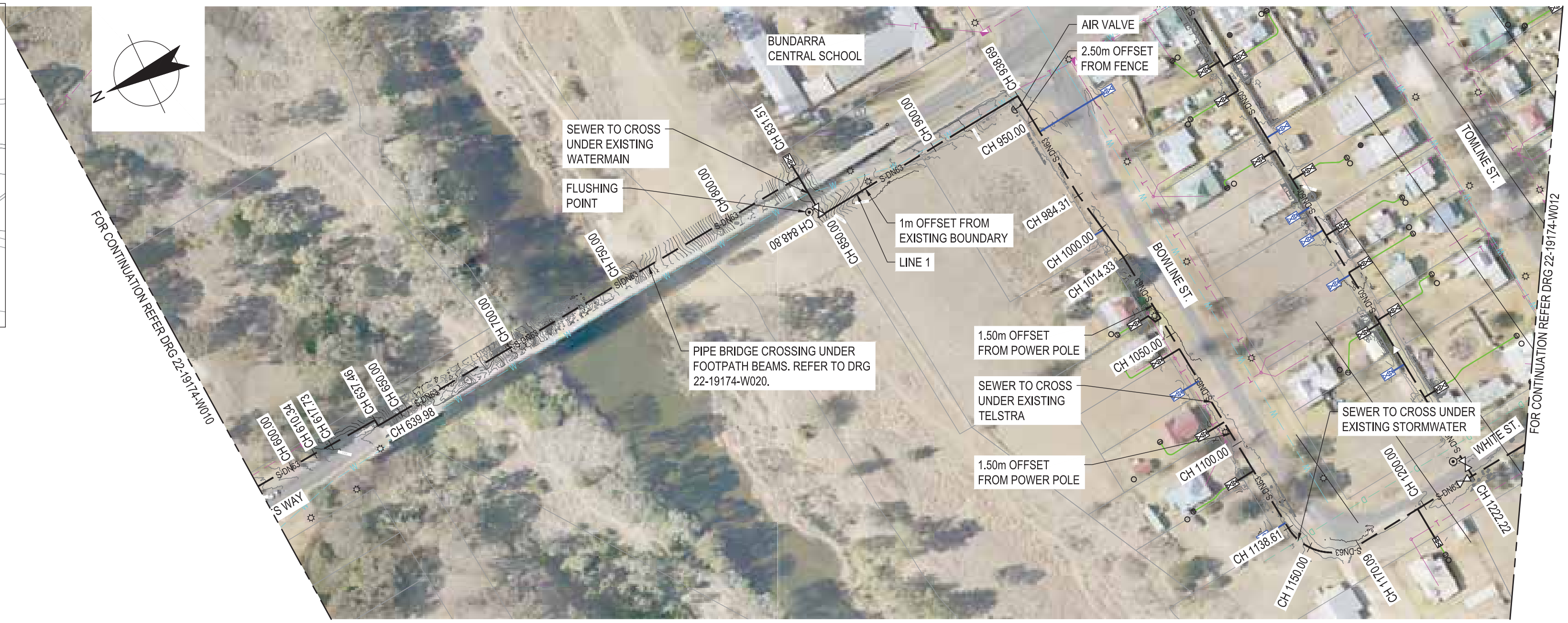
Drawn	L.CEDILLA	Designer	B. REYNOLDS
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client **URALLA SHIRE COUNCIL**
Project **BUNDARRA SEWERAGE SCHEME**
Title **RETICULATION LINE 1**
PLAN AND LONGITUDINAL SECTION 1 OF 3

Original Size A1 Drawing No: **22-19174-W010** Rev: 0

Plot Date: 20 June 2019 - 11:31 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W010-W012.dwg

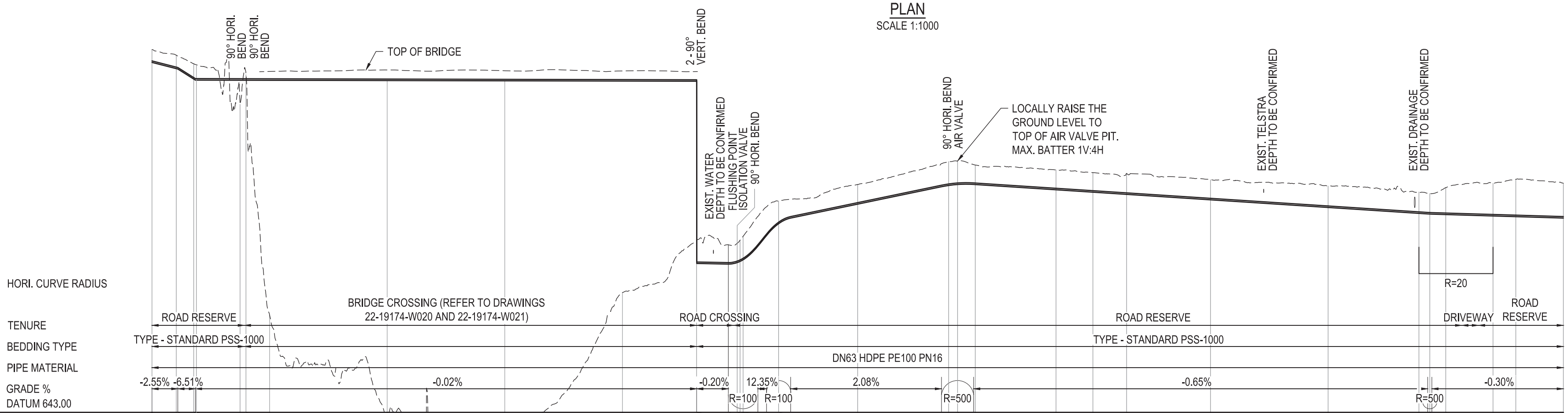
KEY PLAN
NTS



PLAN
SCALE 1:1000

NOTES:

1. TRENCHSTOPS TO BE INSTALLED ON PIPES WITH GRADES GREATER THAN 5% IN ACCORDANCE WITH WAT-1209.
2. CONTRACTOR TO ENSURE INVERT LEVEL OF PIPE AT CHAINAGE 618.47 TO BE 50mm HIGHER THAN PIPE INVERT AT CHAINAGE AT 831.51.



DEPTH TO INVERT	0.55	0.57	0.55	0.65	0.66	-1.03	0.24	-9.98	-14.15	-16.36	-8.99	-6.79	-6.78	0.97	0.82	0.82
PIPE INVERT LEVEL	657.88	657.62	657.60	657.18	657.13	657.13	657.13	657.12	657.11	657.09	657.09	657.08	657.08	649.33	649.30	649.37
EXISTING SURFACE LEVEL	658.43	658.19	658.16	657.83	657.79	656.10	657.36	647.14	642.96	640.74	648.10	650.30	650.30	650.30	650.12	650.19
CHAINAGE	600.00	610.34	611.00	617.73	618.47	637.46	639.98	650.00	700.00	750.00	800.00	831.51	831.56	831.60	845.22	848.80

DEPTH TO INVERT	0.90	1.00	0.96	0.84	1.02	1.00	0.83	0.85	0.83	0.89	0.85	0.91	0.91	0.87	1.15	1.39	1.48
PIPE INVERT LEVEL	649.42	649.49	651.02	651.85	652.65	652.69	652.69	652.47	652.36	652.27	652.04	651.71	651.46	651.43	651.41	651.35	651.26
EXISTING SURFACE LEVEL	650.32	650.49	651.99	652.69	653.67	653.69	653.52	653.31	653.20	653.16	652.89	652.62	652.37	652.31	652.56	652.74	652.74
CHAINAGE	850.00	851.30	866.39	900.00	938.69	942.47	950.00	984.31	1000.00	1014.33	1050.00	1100.00	1138.61	1143.23	1150.00	1170.09	1200.00

LONGITUDINAL SECTION - LINE 1
SCALE HOR 1:1000 VER 1:100

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Drawn L.CEDILLA | Designer B. REYNOLDS
Drafting Check M. BUMOTAD | Design Check A. MUNOZ
Approved (Project Director) L. SYLVA
Date 17.06.19
Scale AS SHOWN
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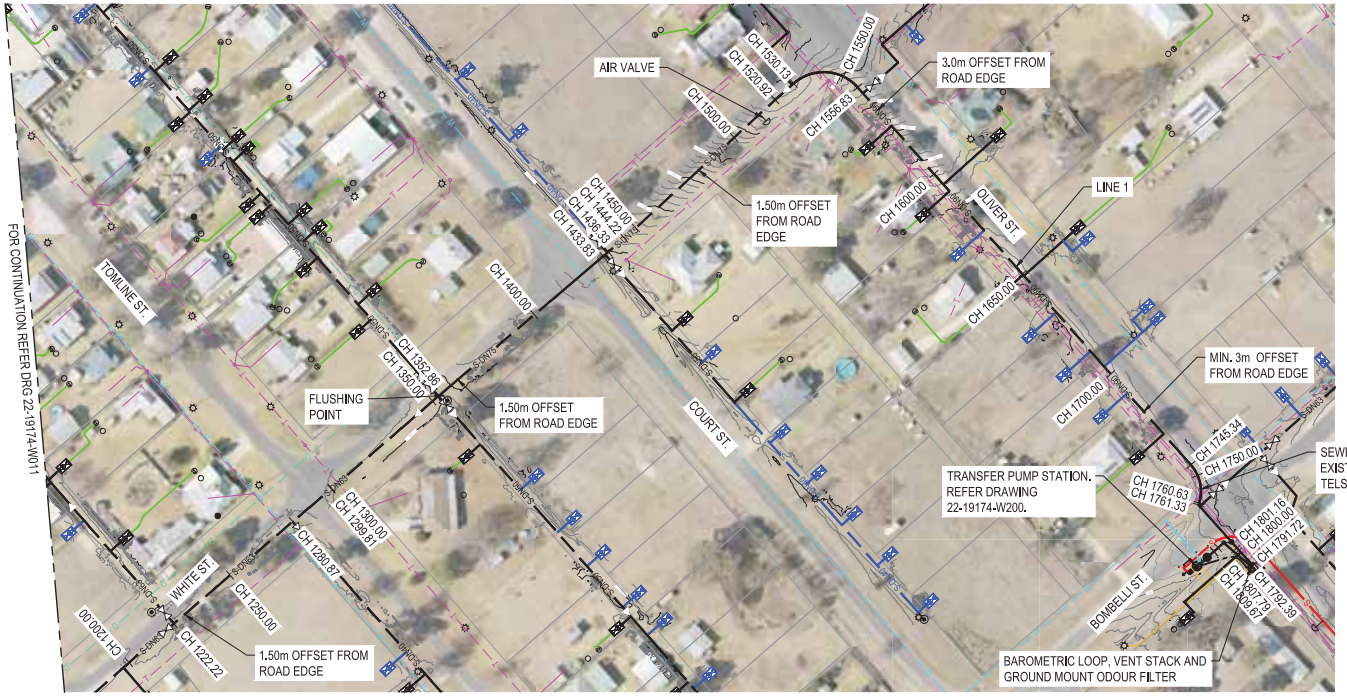
Client **URALLA SHIRE COUNCIL**
Project **BUNDARRA SEWERAGE SCHEME**
Title **RETICULATION LINE 1 PLAN AND LONGITUDINAL SECTION 2 OF 3**

Original Size A1 | Drawing No: **22-19174-W011** | Rev: 0

Plot Date: 20 June 2019 - 11:31 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W010-W012.dwg

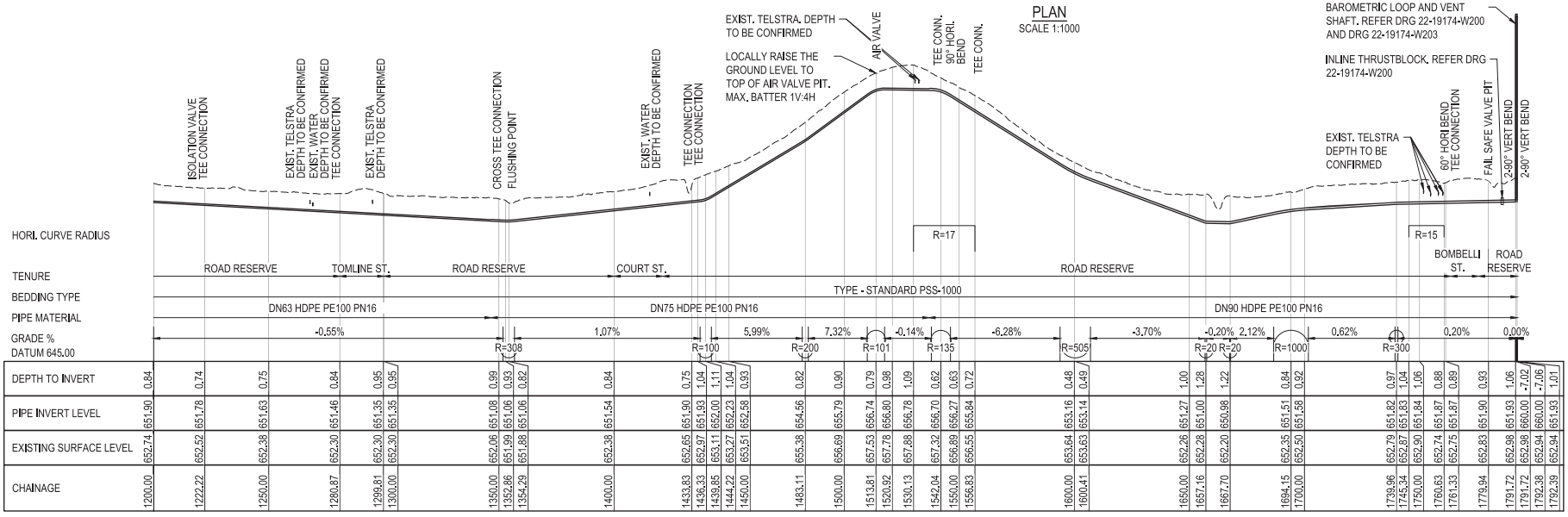
KEY PLAN
NTS



NOTE:

1. TRENCHSTOPS TO BE INSTALLED ON PIPES WITH GRADES GREATER THAN 5% IN ACCORDANCE WITH WAT-1209.

PLAN
SCALE 1:1000



CHAINAGE	1200.00	1222.22	1250.00	1280.87	1299.81	1300.00	1350.00	1352.86	1354.29	1400.00	1433.83	1436.33	1439.85	1444.22	1450.00	1483.11	1500.00	1513.81	1520.92	1530.13	1542.04	1550.00	1556.83	1600.00	1600.41	1650.00	1657.16	1667.70	1694.15	1700.00	1739.96	1745.34	1750.00	1760.63	1761.33	1779.94	1791.72	1791.72	1792.38	1792.39
EXISTING SURFACE LEVEL	652.74	652.52	652.38	652.30	652.30	652.30	652.06	651.99	651.88	652.38	652.65	652.97	653.11	653.27	653.51	655.38	656.89	657.53	657.78	657.88	657.32	656.89	656.55	653.64	653.63	652.26	652.28	652.20	652.35	652.50	652.79	652.87	652.90	652.74	652.75	652.83	651.90	652.98	652.94	652.94
PIPE INVERT LEVEL	651.90	651.78	651.63	651.46	651.35	651.35	651.08	651.06	651.06	651.54	651.90	651.93	652.00	652.23	652.58	654.56	655.79	656.74	656.80	656.78	656.70	656.27	655.84	653.16	653.14	651.27	651.00	650.98	651.51	651.58	651.82	651.83	651.84	651.87	651.87	651.90	651.93	660.00	660.00	651.93
DEPTH TO INVERT	0.84	0.74	0.75	0.84	0.95	0.95	0.99	0.93	0.82	0.84	0.75	1.04	1.11	1.04	0.93	0.82	0.90	0.79	0.98	1.09	0.62	0.63	0.72	0.48	0.49	1.00	1.28	1.22	0.84	0.92	0.97	1.04	1.06	1.06	0.88	0.89	0.93	1.06	-7.02	-7.06	1.01

LONGITUDINAL SECTION - LINE 1
SCALE HOR 1:1000 VER 1:100

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VERTICAL 1:100 AT ORIGINAL SIZE
HORIZONTAL 1:1000 AT ORIGINAL SIZE
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0 10 20 30 40 50m

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Drawn	L.CEDILLA	Designer	B. REYNOLDS
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RETICULATION LINE 1
PLAN AND LONGITUDINAL SECTION 3 OF 3

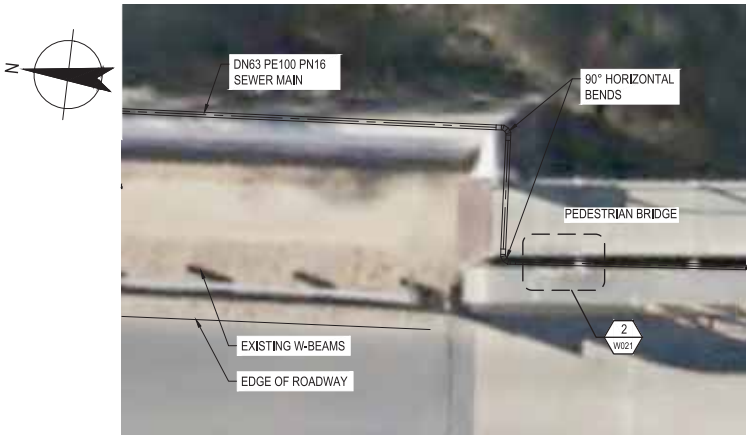
Original Size A1
Drawing No: 22-19174-W012
Rev: 0

Plot Date: 20 June 2019 - 11:32 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W010-W012.dwg

PLAN
SCALE 1:500

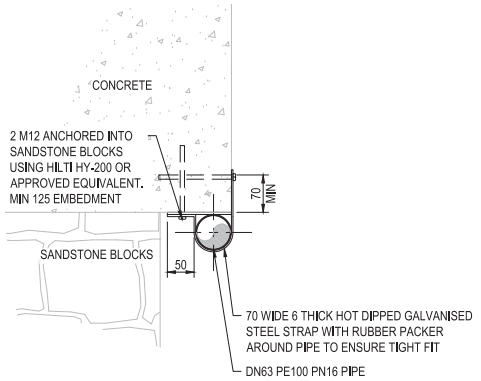
NOTES:

1. SADDLE CLAMPS ARE TO BE INSTALLED ON THE SECOND FOOTPATH BEAM FROM NORTHERN ABUTMENT, THEN EVERY SECOND FOOTPATH BEAM THEREAFTER. PROVIDE PTFE STRIP ATTACHED TO ALL FOOTPATH BEAMS.
2. PIPES INSTALLED ABOVE GROUND ARE TO BE BLACK PE, NOT STRIPED OR COLOURED PE PIPE.
3. MAXIMUM DESIGN PRESSURE 1000 kPa.
4. WEIGHT OF FULL PE DN63 PIPE IS 8.0 kg/lm.
5. ABOVE GROUND PIPES TO BE INSTALLED WITH AN AMBIENT TEMPERATURE BETWEEN 20°C AND 25°C AND WITH AN ADDITIONAL 1% LENGTH, USING A SNAKED ALIGNMENT, TO ALLOW FOR EXPANSION AND CONTRACTION.



1 - DETAIL
SCALE 1:50

PERSPECTIVE VIEW
SCALE NTS



A - SECTION
SCALE 1:5

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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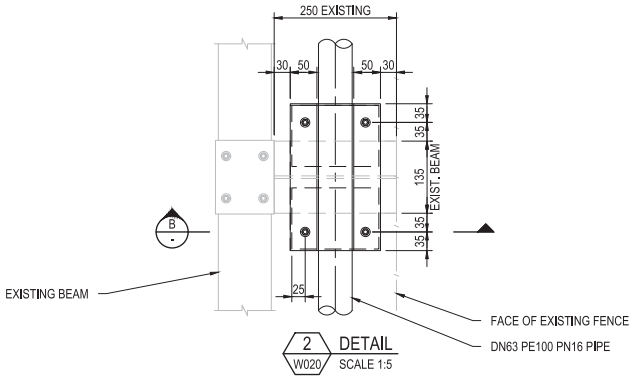
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

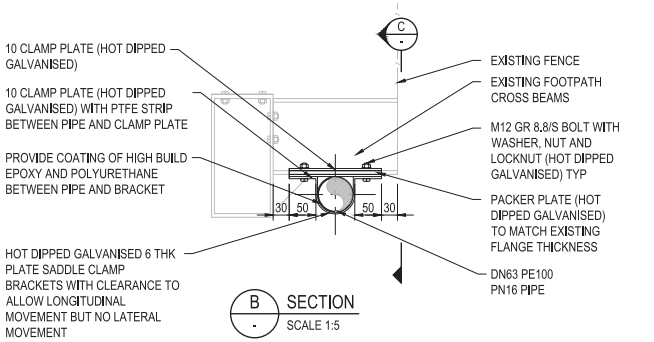
Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: BENDEMEER ST. BRIDGE CROSSING PLAN AND SECTIONS

Original Size A1
Drawing No: 22-19174-W020
Rev: 0

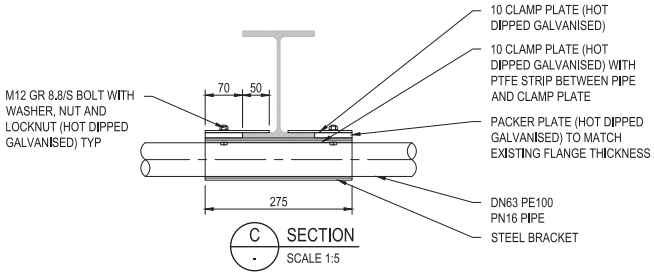
Plot Date: 20 June 2019 - 11:34 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W020-W021.dwg



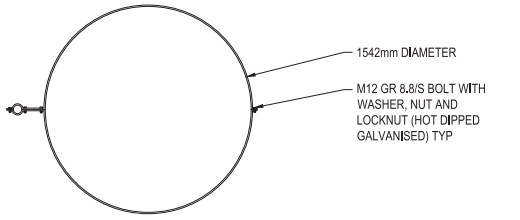
2 W020 DETAIL SCALE 1:5



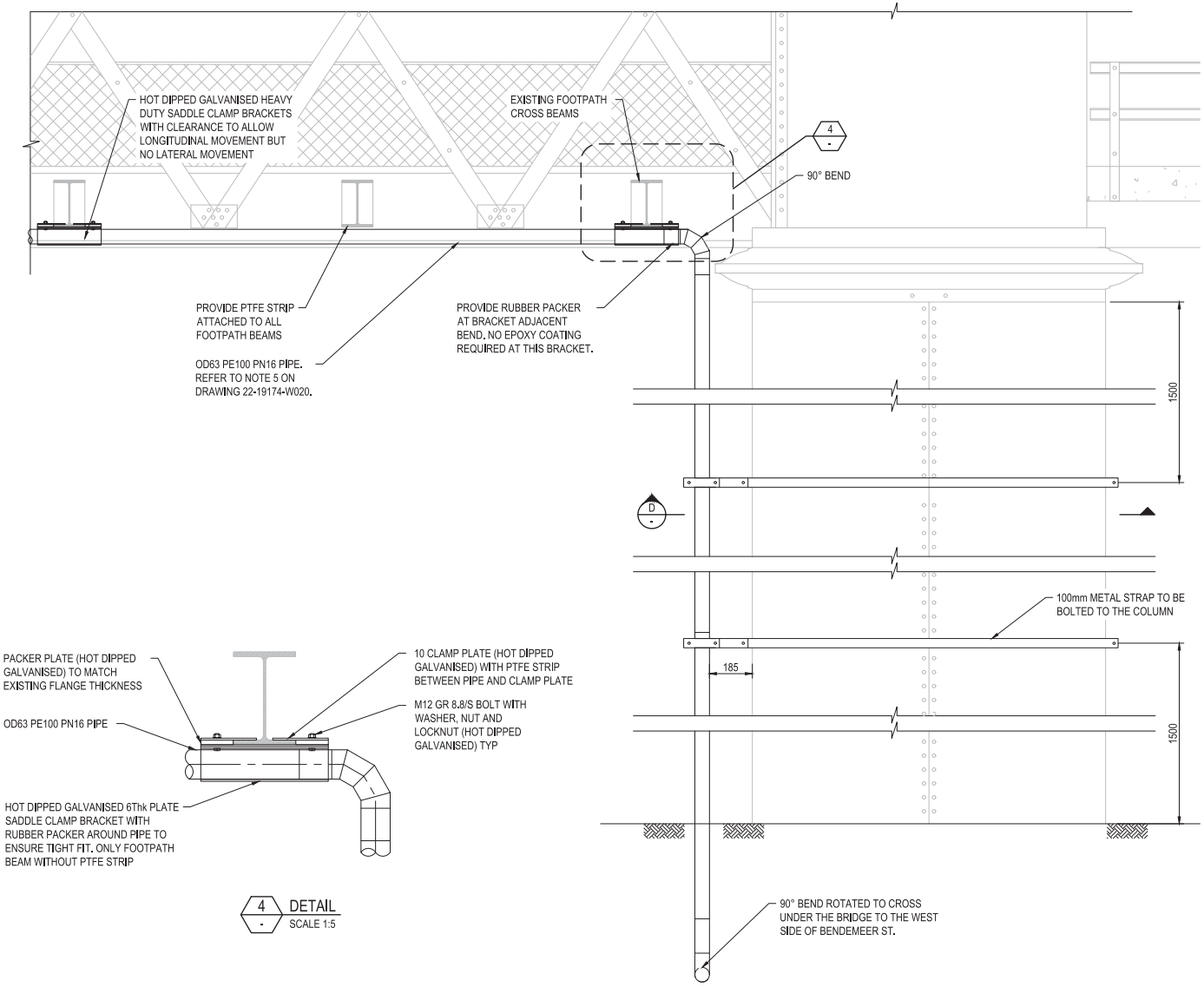
B SECTION SCALE 1:5



C SECTION SCALE 1:5



D SECTION SCALE 1:20



3 W020 DETAIL SCALE 1:10

4 DETAIL SCALE 1:5

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No	Revision	Drawn	Job Manager	Project Director	Date
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Note: * indicates signatures on original issue of drawing or last revision of drawing

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BENDEMEER ST. BRIDGE CROSSING DETAILS

Original Size A1
Drawing No: 22-19174-W021
Rev: 0

Plot Date: 20 June 2019 - 11:34 AM Plotted by: Rj Geronimo
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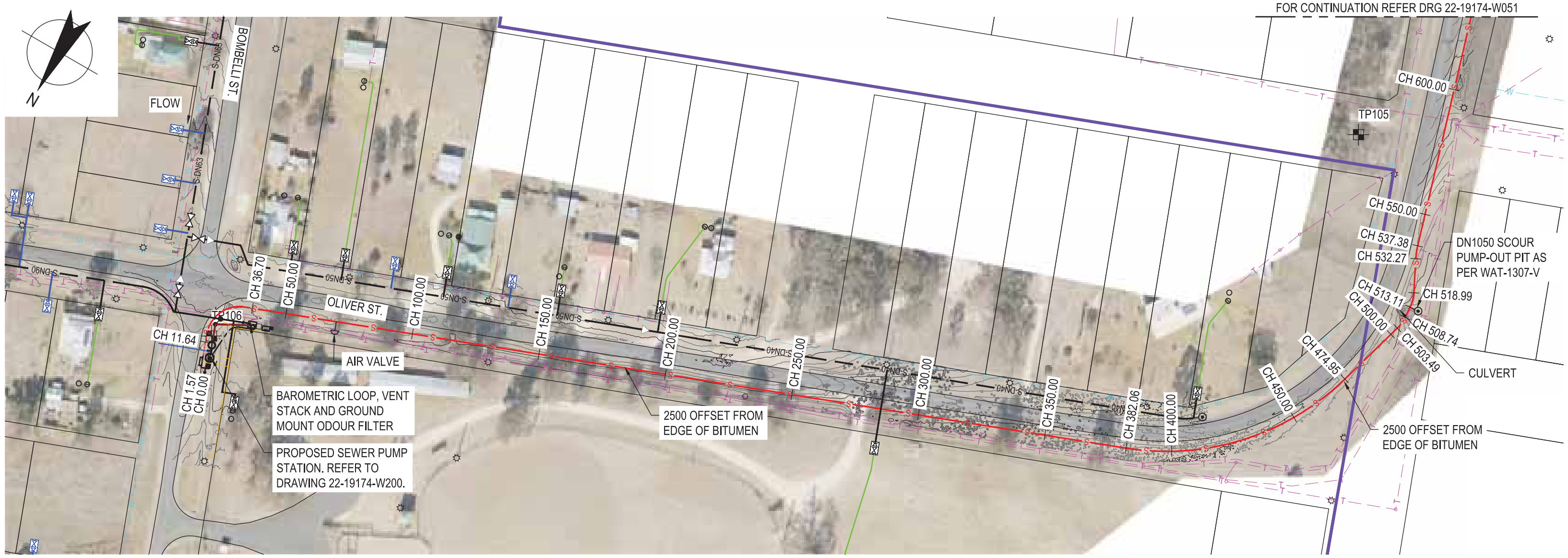
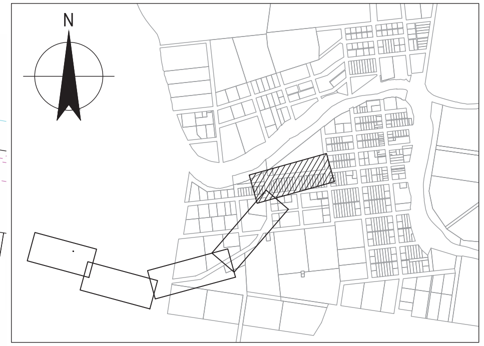


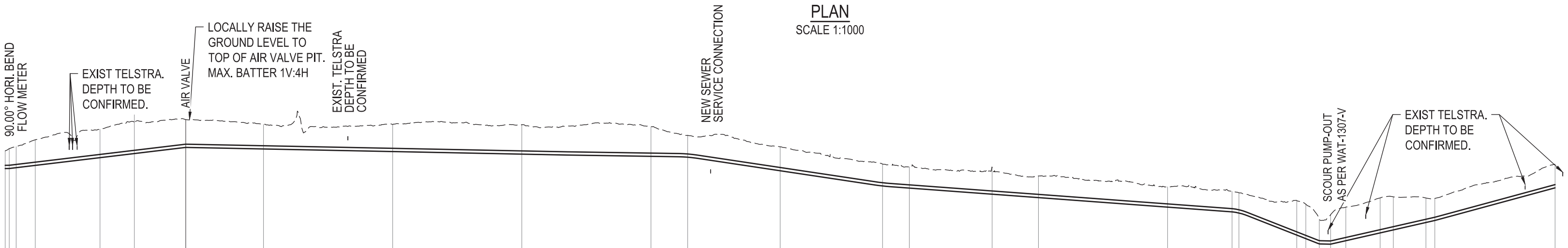


KEY PLAN
NTS

PLAN
SCALE 1:1000

NOTE:

1. REFER DRG 22-19174-G002 FOR LEGEND.



HORI. CURVE RADIUS: R=16; R=100; R=15; R=15; R=30

TENURE: ROAD RESERVE; ACCESS TRACK; ROAD RESERVE; DRIVEWAY

BEDDING TYPE: TYPE - STANDARD PSS-1000

PIPE MATERIAL: DN90 HDPE PE100 PN16; DN125 HDPE PE100 PN16

GRADE %: 0.20%; 1.20%; -0.20%; R=500; -1.47%; R=800; -0.74%; R=200; -3.93%; -0.20%; R=20; R=20; 2.28%; R=500; 2.72%

DATUM 641.00

DEPTH TO INVERT	0.69	0.77	0.82	0.99	1.10	1.50	1.08	0.95	1.04	1.14	1.16
PIPE INVERT LEVEL	651.49	651.49	651.53	651.61	651.91	652.07	652.31	652.25	652.15	652.05	651.95
EXISTING SURFACE LEVEL	652.18	652.27	652.34	652.61	653.01	653.57	653.39	653.20	653.19	653.19	653.11
CHAINAGE	0.00	1.57	4.23	11.64	36.70	50.00	69.90	100.00	150.00	200.00	250.00

DEPTH TO INVERT	0.87	0.94	0.85	0.82	1.04	0.84	0.79	0.79	0.78	1.34
PIPE INVERT LEVEL	651.91	651.39	650.82	650.73	650.50	650.37	650.00	649.81	649.77	648.91
EXISTING SURFACE LEVEL	652.78	652.33	651.66	651.55	651.54	651.20	650.78	650.61	650.55	650.25
CHAINAGE	264.21	300.00	339.66	350.00	382.06	400.00	450.00	474.95	477.61	500.00

DEPTH TO INVERT	1.33	0.96	1.12	1.14	1.30	1.36	1.28	0.95	0.85	0.91
PIPE INVERT LEVEL	648.78	648.57	648.56	648.56	648.70	649.00	649.11	649.40	649.48	650.74
EXISTING SURFACE LEVEL	650.11	649.53	649.68	649.70	650.00	650.36	650.39	650.35	650.33	651.65
CHAINAGE	503.49	508.74	512.90	513.11	518.99	532.27	537.38	550.00	553.46	600.00

LONGITUDINAL SECTION
SCALE HOR 1:1000 VER 1:100

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HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m

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Drawn L. CEDILLA | Designer M. BLANDFORD
Drafting Check M. BUMOTAD | Design Check A. MUNOZ
Approved (Project Director) L. SYLVA
Date 17.06.19
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Client **URALLA SHIRE COUNCIL**
Project **BUNDARRA SEWERAGE SCHEME**
Title **RISING MAIN PLAN AND LONGITUDINAL SECTION 1 OF 5**

Original Size A1 Drawing No: **22-19174-W050** Rev: 0

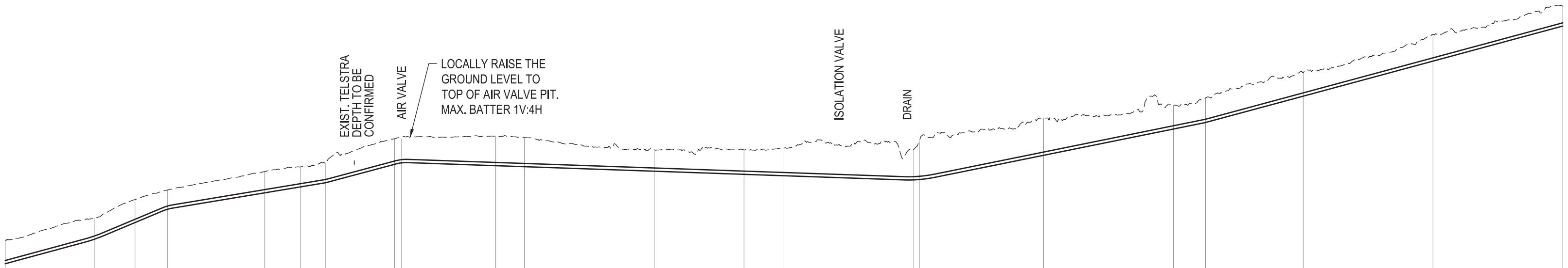
Plot Date: 20 June 2019 - 11:36 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg

KEY PLAN
NTS

PLAN
SCALE 1:1000

NOTE:

1. REFER DRG 22-19174-G002 FOR LEGEND.



HORI. CURVE RADIUS: R=130; R=367

TENURE: ROAD RESERVE; DRIVEWAY; ROAD RESERVE

BEDDING TYPE: TYPE - STANDARD PSS-1000

PIPE MATERIAL: DN125 HDPE PE100 PN16

GRADE %: 2.72% R=500 4.20% R=150 1.66% R=200 2.69% R=150 -0.35% R=500 2.03% R=200 2.71%

DATUM 645.00

DEPTH TO INVERT	0.91	0.81	0.89	0.75	0.82	0.77	0.76	0.99	1.00	1.14	1.12
PIPE INVERT LEVEL	650.74	651.69	652.34	652.85	653.48	653.71	653.88	654.59	654.64	654.53	654.49
EXISTING SURFACE LEVEL	651.65	652.50	653.23	653.59	654.30	654.48	654.64	655.57	655.64	655.67	655.62
CHAINAGE	600.00	634.28	650.00	662.45	700.00	713.66	723.47	750.00	752.69	788.95	800.00

DEPTH TO INVERT	0.83	0.95	1.08	1.18	1.50	1.44	0.92	0.95	0.91	1.03	0.77
PIPE INVERT LEVEL	654.32	654.20	654.14	653.98	654.00	654.93	655.95	656.20	657.22	658.58	659.93
EXISTING SURFACE LEVEL	655.15	655.15	655.23	655.17	655.49	656.37	656.87	657.15	658.14	659.60	660.70
CHAINAGE	850.00	884.60	900.00	950.00	952.14	1000.00	1050.00	1062.36	1100.00	1150.00	1200.00

LONGITUDINAL SECTION
SCALE HOR 1:1000 VER 1:100

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No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

VERTICAL 1:100 AT ORIGINAL SIZE 0 1 2 3 4 5m
HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m

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Approved (Project Director) L. SYLVA
Date 17.06.19
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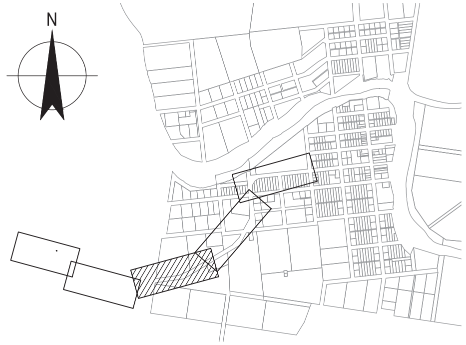
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RISING MAIN PLAN AND LONGITUDINAL SECTION 2 OF 5

Original Size A1 | Drawing No: 22-19174-W051 | Rev: 0

Plot Date: 20 June 2019 - 11:36 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg

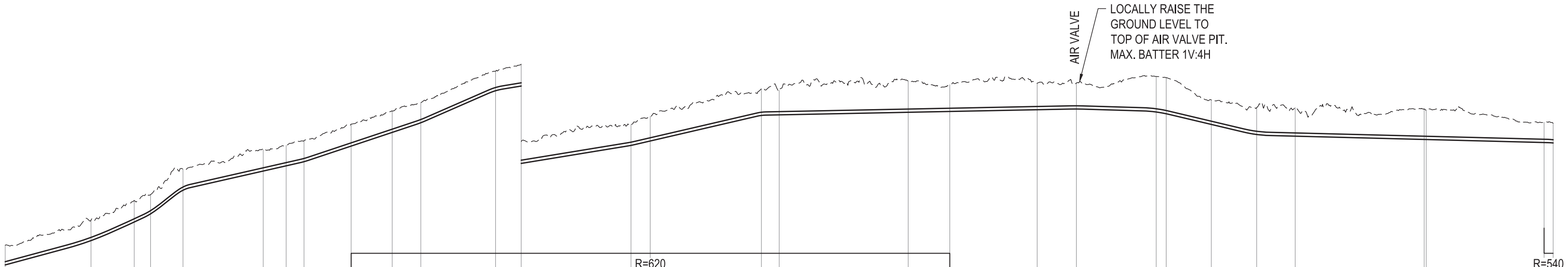
PLAN
SCALE 1:1000



KEY PLAN
NTS

NOTES:

1. REFER DRG 22-19174-G002 FOR LEGEND.
2. TRENCHSTOPS TO BE INSTALLED ON PIPES WITH GRADES GREATER THAN 5% IN ACCORDANCE WITH WAT-1209.



HORI. CURVE RADIUS: R=620; R=540

TENURE: ROAD RESERVE; ROAD CROSSING; ROAD RESERVE

BEDDING TYPE: TYPE - STANDARD PSS-1000

PIPE MATERIAL: DN125 HDPE PE100 PN16

GRADE %: 2.71%; R=1000; 4.57%; R=200; 7.80%; R=100; 2.27%; R=300; 3.34%; R=300; 4.36%; R=200; 1.64%; R=500; 2.32%; R=150; 0.20%; R=1000; -0.30%; R=500; -2.38%; R=500; -0.25%; R=220

DATUM 655.00; DATUM 658.00

CHAINAGE	DEPTH TO INVERT	PIPE INVERT LEVEL	EXISTING SURFACE LEVEL
1200.00	0.77	659.93	660.70
1233.25	0.79	660.87	661.66
1250.00	0.84	661.59	662.43
1256.34	0.75	661.91	662.66
1268.90	0.83	662.83	663.65
1300.00	0.83	663.57	664.40
1308.90	0.79	663.77	664.57
1315.82	0.81	663.93	664.75
1334.08	0.85	664.54	665.39
1350.00	0.83	665.07	665.90
1361.09	0.78	665.44	666.23
1390.06	0.76	666.69	667.45
1400.00	0.85	666.87	667.71
1442.56	0.81	667.57	668.37
1450.00	0.96	667.74	668.70
1493.11	1.04	668.73	669.77
1500.00	0.96	668.75	669.71
1550.00	1.21	668.85	670.05
1566.12	1.04	668.88	669.92
1600.00	1.03	668.95	669.98
1615.18	1.01	668.98	669.98
1646.13	1.38	668.86	670.24
1650.00	1.40	668.79	670.19
1667.50	0.95	668.38	669.33
1685.08	1.04	667.99	669.03
1700.00	1.11	667.92	669.03
1750.00	1.18	667.80	668.97
1750.78	1.15	667.79	668.94
1796.48	0.78	667.68	668.46
1799.46	0.79	667.67	668.45
1800.00	0.76	667.66	668.42

LONGITUDINAL SECTION
SCALE HOR 1:1000 VER 1:100

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0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

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HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m

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Designer M. BLANDFORD
Drafting Check M. BUMOTAD
Design Check A. MUNOZ
Approved (Project Director) L. SYLVA
Date 17.06.19
Scale AS SHOWN
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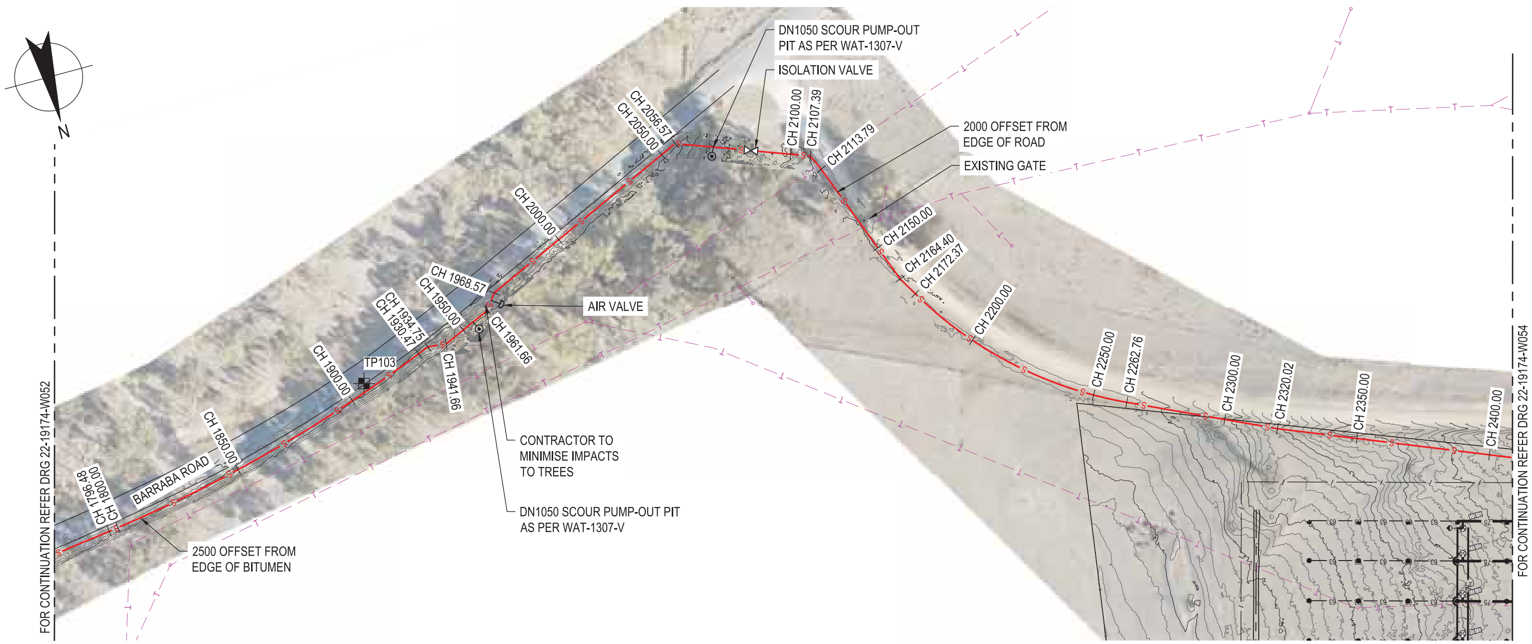
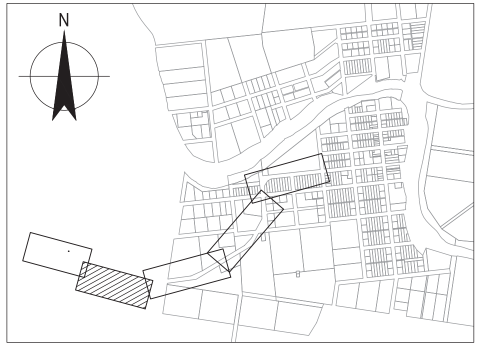
Client **URALLA SHIRE COUNCIL**
Project **BUNDARRA SEWERAGE SCHEME**
Title **RISING MAIN PLAN AND LONGITUDINAL SECTION 3 OF 5**

Original Size A1
Drawing No: **22-19174-W052**
Rev: 0

Plot Date: 20 June 2019 - 11:36 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg



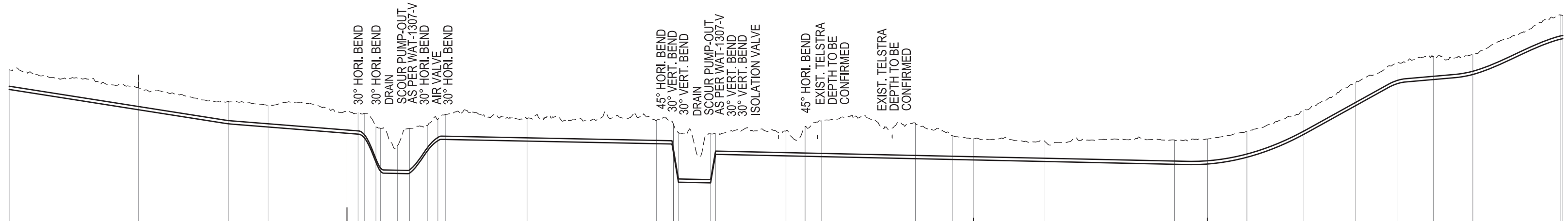


KEY PLAN
NTS

PLAN
SCALE 1:1000

NOTES:

1. REFER DRG 22-19174-G002 FOR LEGEND.
2. TRENCHSTOPS TO BE INSTALLED ON PIPES WITH GRADES GREATER THAN 5% IN ACCORDANCE WITH WAT-1209.



HORI. CURVE RADIUS: R=540; R=150

TENURE: ROAD RESERVE; CREEK CROSSING; CREEK CROSSING; ROAD RESERVE

BEDDING TYPE: TYPE - STANDARD PSS-1000; CONCRETE ENCASED PSS-1003 & PSS-1001; TYPE - STANDARD PSS-1000; CONCRETE ENCASED PSS-1003 & PSS-1001; TYPE - STANDARD PSS-1000

PIPE MATERIAL: DN125 HDPE PE100 PN16

GRADE %: -1.57%; -0.79%; -24.20%; -0.20%; 12.15%; -0.20%; -58.78%; -0.20%; 58.40%; -0.22%; 5.54%; 0.87%; 4.42%

DATUM 657.00: R=220; R=300; R=20; R=10; R=10; R=23; R=800; R=150; R=400; R=300

CHAINAGE	DEPTH TO INVERT	PIPE INVERT LEVEL	EXISTING SURFACE LEVEL
1800.00	0.76	667.66	668.42
1850.00	0.84	666.88	667.72
1884.66	0.86	666.33	667.20
1900.00	0.83	666.21	667.04
1930.47	0.83	665.97	666.79
1934.75	0.84	665.93	666.78
1937.28	0.96	665.78	666.73
1941.66	1.37	664.85	666.22
1943.42	1.66	664.50	666.16
1950.00	1.08	664.42	665.49
1954.64	1.73	664.42	666.15
1961.66	1.02	665.26	666.28
1965.57	0.82	665.69	666.51
1968.57	0.97	665.73	666.70
2000.00	0.87	665.67	666.54
2050.00	0.90	665.57	666.47
2055.96	0.89	665.55	666.44
2056.57	1.12	665.20	666.32
2058.48	1.92	664.08	665.99
2070.90	1.90	664.05	665.95
2072.79	0.82	665.15	665.97
2100.00	0.97	665.10	666.06
2107.39	1.14	665.08	666.22
2113.79	1.39	665.07	666.46
2150.00	1.37	664.99	666.36
2164.40	0.91	664.96	665.87
2172.37	0.83	664.94	665.77
2200.00	0.77	664.88	665.65
2250.00	0.94	664.77	665.71
2262.76	0.96	664.78	665.74
2278.01	1.01	665.04	666.05
2300.00	0.93	665.93	666.86
2320.02	0.89	667.04	667.92
2335.99	0.81	667.88	668.69
2350.00	0.89	668.04	668.93
2365.26	0.78	668.24	669.02
2398.98	0.95	669.60	670.55
2400.00	0.90	669.62	670.52

LONGITUDINAL SECTION
SCALE HOR 1:1000 VER 1:100

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Drafting Check M. BUMOTAD | Design Check A. MUNOZ
Approved (Project Director) L. SYLVA
Date 17.06.19
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title RISING MAIN PLAN AND LONGITUDINAL SECTION 4 OF 5

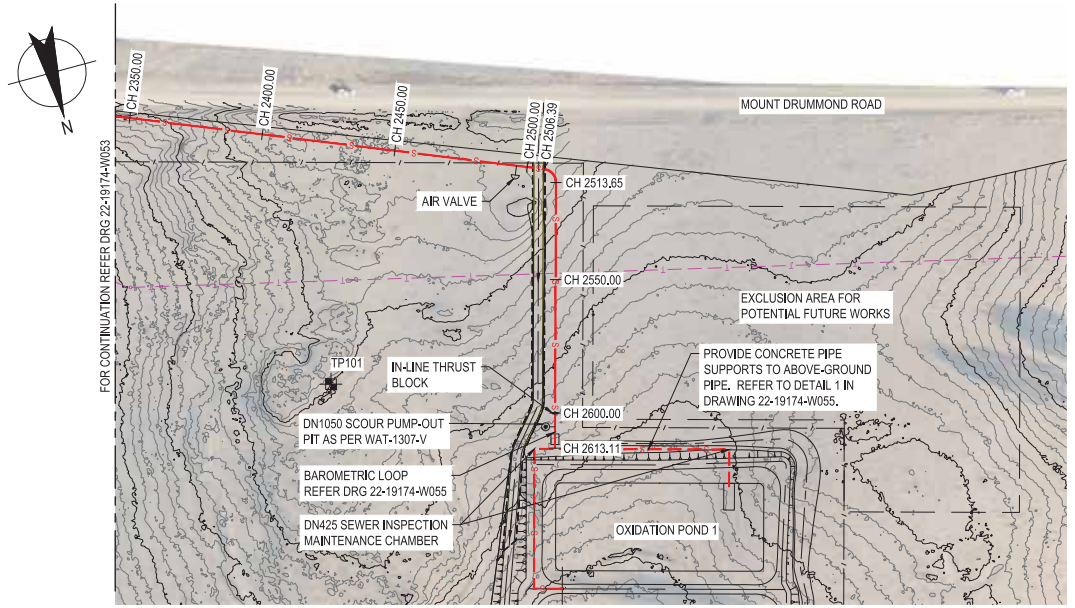
Original Size A1 Drawing No: 22-19174-W053 Rev: 0

Plot Date: 20 June 2019 - 11:37 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg

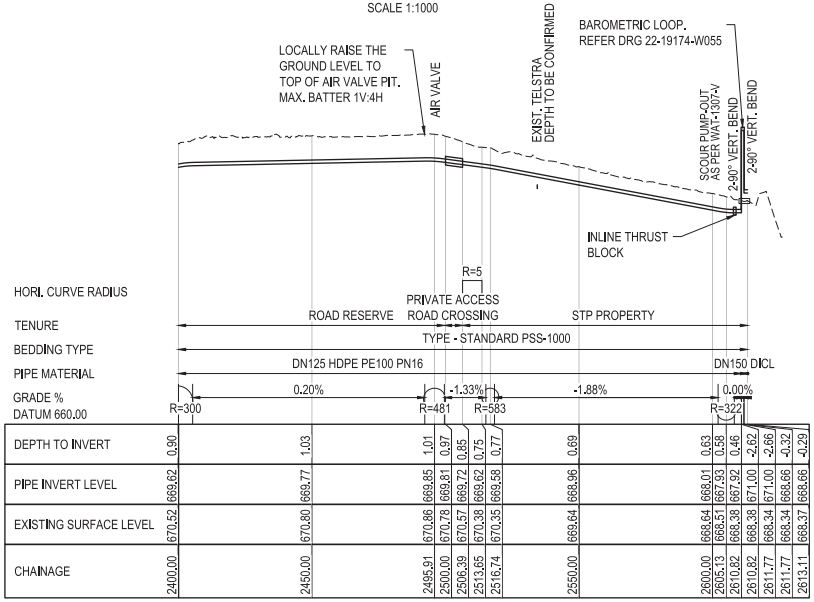
NOTE:

1. REFER DRG 22-19174-G002 FOR LEGEND.

SEWER RISING MAIN SETOUT TABLE			
CHAINAGE	EASTING	NORTHING	REMARK
0.00	314256.499	6660592.207	START OF ALIGNMENT
1.57	314258.062	6660592.378	90° HORI. BEND
11.64	314259.153	6660582.369	BEG. OF HORI. CURVE
36.70	314245.057	6660564.738	END OF HORI. CURVE
69.90	314212.073	6660560.984	AIR VALVE
382.06	313901.910	6660525.685	BEG. OF HORI. CURVE
474.95	313826.864	6660476.755	END OF HORI. CURVE
503.49	313812.470	6660452.107	BEG. OF HORI. CURVE
508.74	313810.663	6660447.216	END OF HORI. CURVE
513.11	313809.884	6660442.912	BEG. OF HORI. CURVE / SCOUR VALVE
518.99	313809.983	6660437.070	END OF HORI. CURVE
532.27	313812.790	6660424.086	BEG. OF HORI. CURVE
537.38	313813.440	6660419.028	END OF HORI. CURVE
713.66	313820.975	6660242.911	BEG. OF HORI. CURVE
752.69	313816.815	6660204.248	AIR VALVE
788.95	313802.834	6660170.915	END OF HORI. CURVE
884.60	313753.949	6660088.699	BEG. OF HORI. CURVE
920.58	313734.014	6660058.773	ISOLATION VALVE
1062.36	313630.364	6659963.353	END OF HORI. CURVE
1334.08	313398.114	6659822.364	BEG. OF HORI. CURVE
1566.12	313178.400	6659752.069	END OF HORI. CURVE
1615.18	313129.705	6659746.073	AIR VALVE
1796.48	312949.665	6659724.897	BEG. OF HORI. CURVE
1930.47	312820.385	6659691.003	END OF HORI. CURVE
1934.75	312816.412	6659689.414	30° HORI. BEND
1941.66	312809.537	6659690.142	30° HORI. BEND
1954.61	312797.676	6659684.874	SCOUR VALVE
1961.66	312791.260	6659682.023	30° HORI. BEND
1965.57	312788.957	6659678.860	AIR VALVE
1968.58	312787.191	6659676.434	30° HORI. BEND
2056.57	312707.045	6659640.103	45° HORI. BEND
2070.90	312693.624	6659645.122	SCOUR VALVE
2085.14	312680.362	6659650.054	ISOLATION VALVE
2107.39	312659.447	6659657.902	30° HORI. BEND
2172.38	312635.023	6659718.008	BEG. OF HORI. CURVE
2262.76	312569.254	6659778.000	END OF HORI. CURVE
2495.91	312354.574	6659868.802	AIR VALVE
2506.39	312344.864	6659872.768	BEG. OF HORI. CURVE
2513.65	312341.935	6659878.725	END OF HORI. CURVE
2605.13	312366.244	6659966.914	SCOUR VALVE
2613.11	312368.365	6659974.608	BAROMETRIC LOOP - END OF ALIGNMENT

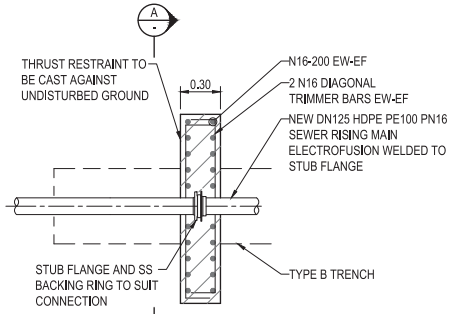


PLAN
SCALE 1:1000

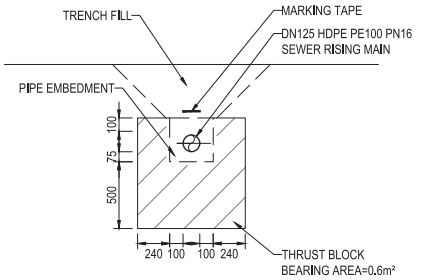


LONGITUDINAL SECTION
SCALE HOR 1:1000 VER 1:100

KEY PLAN
NTS



CONNECTION/THRUST RESTRAINT PLAN
THRUST BLOCK TYPE 1
SCALE 1:20



THRUST RESTRAINT SECTION
THRUST BLOCK TYPE 1

A - SECTION
SCALE 1 : 20

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VERTICAL 1:100 AT ORIGINAL SIZE 0 1 2 3 4 5m
HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m
0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

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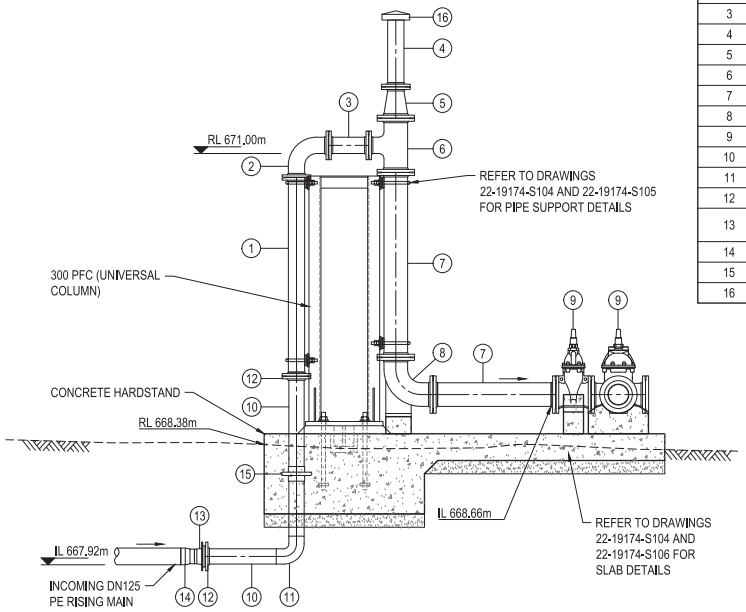
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

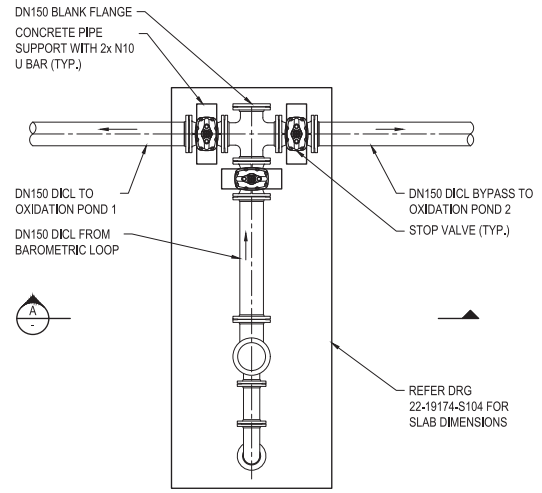
Client	URALLA SHIRE COUNCIL
Project	BUNDARRA SEWERAGE SCHEME
Title	RISING MAIN PLAN AND LONGITUDINAL SECTION 5 OF 5
Original Size	A1
Drawing No:	22-19174-W054
Rev:	0

Plot Date: 20 June 2019 - 11:37 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg

SCHEDULE OF PIPES AND FITTINGS	
ITEM NO.	DESCRIPTION
1	DN100 FL-FL DICL PN16 PIPE (LTS)
2	DN100 FL-FL DICL 90° BEND
3	DN100 FL-FL DICL PN16 PIPE (0.30m)
4	DN100 FL-SP DICL PN16 PIPE (0.50m)
5	DN150 x DN100 FL-FL DICL TAPER
6	DN150 x DN150 x DN100 FL-FL-FL DICL TEE
7	DN150 FL-FL DICL PN16 PIPE (LTS)
8	DN150 FL-FL DICL 90° DUCKFOOT BEND
9	DN150 STOP VALVE
10	DN100 SS316 PIPE (LTS)
11	DN100 SS316 90° BEND WITH WELDED JOINTS
12	DN100 SS316 FLANGE TO TABLE D AS2129
13	DN110 STUB FLANGE WITH BACKING RING WITH PCD 178mm
14	DN125 x DN110 PE TAPER
15	DN100 PUDDLE FLANGE
16	DN100 VENT COWL



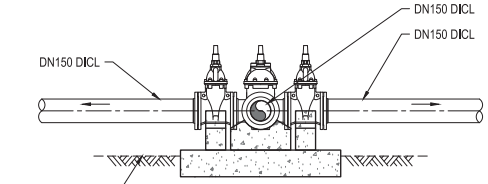
BAROMETRIC LOOP DETAIL
SCALE 1:20



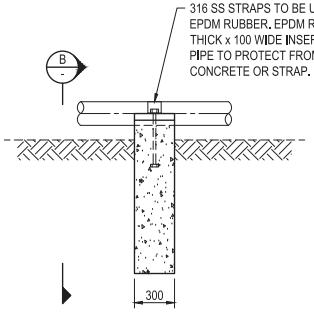
BAROMETRIC LOOP AND FLOW DIVIDER PLAN VIEW
SCALE 1:20

NOTES:

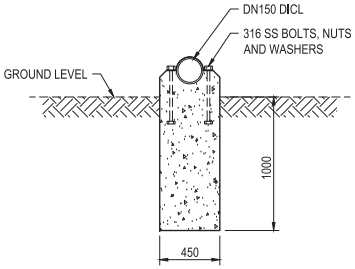
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. PIPE SUPPORT IN ACCORDANCE WITH WAT-1310.



A - SECTION
SCALE 1:20



1 / W054 DETAIL
SCALE 1:20



B - SECTION
SCALE 1:20

PIPE SUPPORT DETAIL

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

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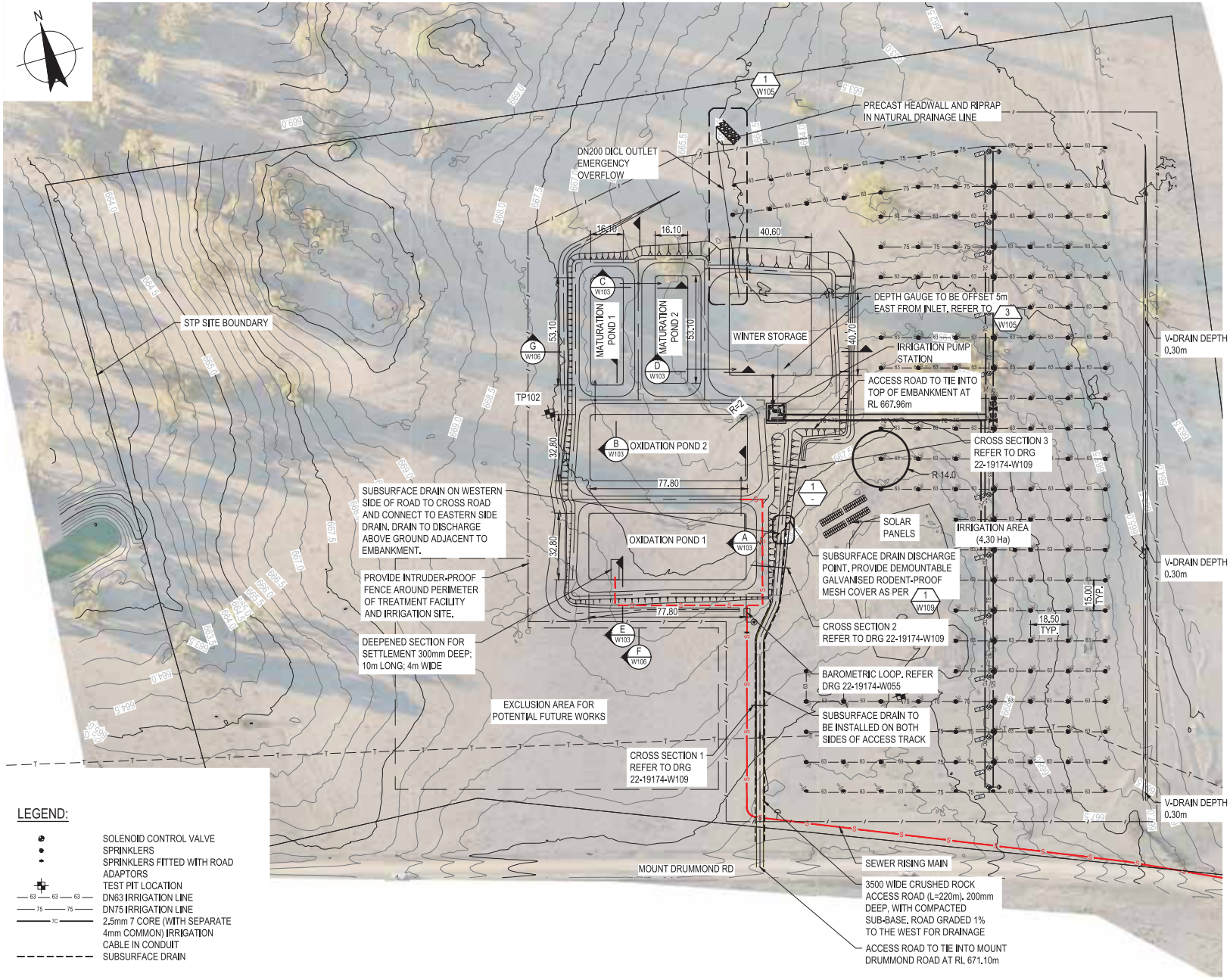
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:20	This Drawing must not be used for Construction unless signed as Approved	

Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: INLET WORKS

Original Size: A1
Drawing No: 22-19174-W055
Rev: 0

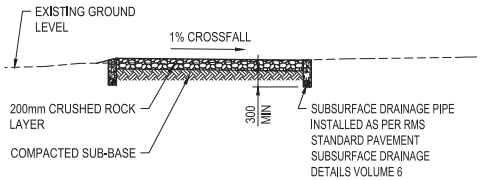
Plot Date: 20 June 2019 - 11:37 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W050-W055.dwg



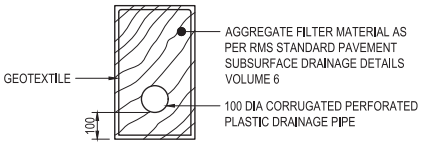
LEGEND:

- SOLENOID CONTROL VALVE
- SPRINKLERS
- SPRINKLERS FITTED WITH ROAD ADAPTORS
- TEST PIT LOCATION
- DN63 IRRIGATION LINE
- DN75 IRRIGATION LINE
- 2.5mm 7 CORE (WITH SEPARATE 4mm COMMON) IRRIGATION CABLE IN CONDUIT
- SUBSURFACE DRAIN

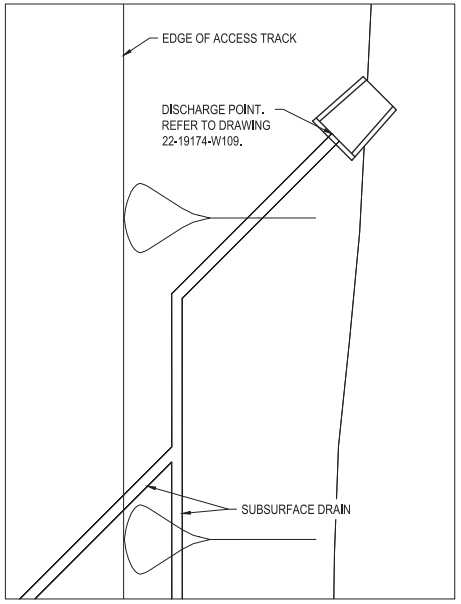
PLAN
SCALE 1:1000



ACCESS ROAD TYPICAL ROAD SECTION
SCALE 1:50



SUBSURFACE DRAIN DETAIL
SCALE 1:10



1 DETAIL
SCALE 1 : 25

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

SCALE 1:1000 AT ORIGINAL SIZE
SCALE 1:25 AT ORIGINAL SIZE
SCALE 1:50 AT ORIGINAL SIZE
SCALE 1:10 AT ORIGINAL SIZE

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Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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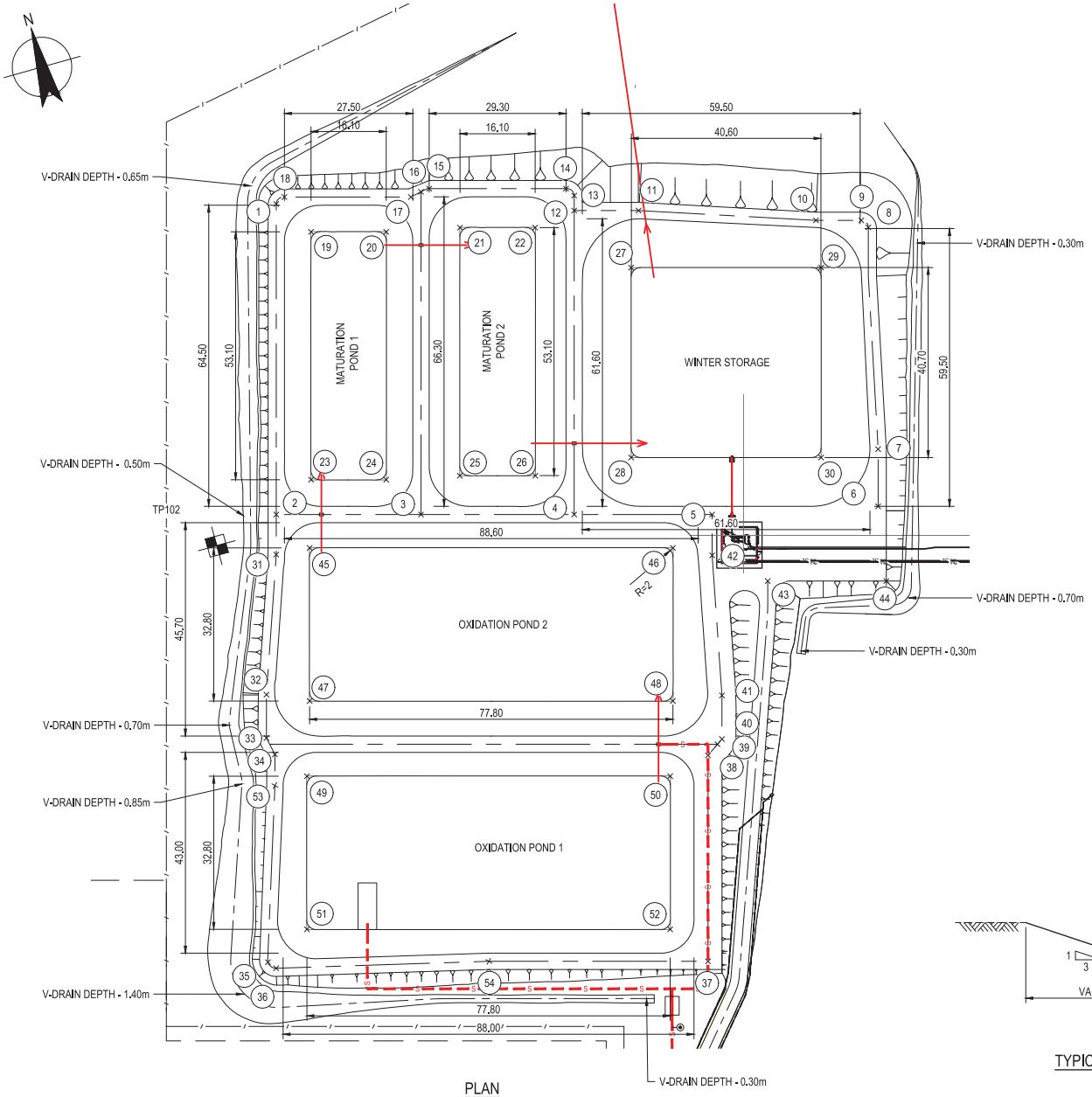
Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: STP SITE LAYOUT

Original Size: A1
Drawing No: 22-19174-W100
Rev: 0

Plot Date: 20 June 2019 - 11:39 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W100-W103.dwg



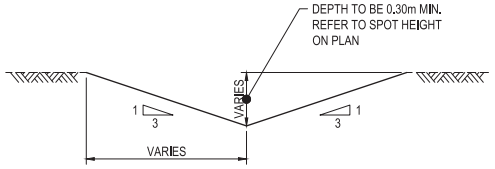
PLAN
SCALE 1:500

LAGOON SETOUT POINTS			
POINT	EASTING	NORTHING	ELEVATION
1	312331.194	6660159.429	667.885
2	312313.581	6660095.303	667.930
3	312343.476	6660087.094	667.990
4	312375.105	6660078.407	667.990
5	312403.600	6660070.582	667.940
6	312438.344	6660062.854	667.935
7	312441.588	6660074.667	667.870
8	312452.143	6660121.027	667.185
9	312451.094	6660122.871	667.185
10	312441.738	6660125.440	667.220
11	312405.651	6660137.529	667.900
12	312392.350	6660141.183	667.889
13	312393.195	6660144.270	667.885
14	312391.903	6660146.179	667.885
15	312363.649	6660153.938	667.885
16	312361.780	6660153.744	667.885
17	312359.388	6660153.242	667.904
18	312333.279	6660160.412	667.885
19	312336.802	6660151.719	666.020
20	312352.327	6660147.455	666.020
21	312367.802	6660144.138	665.720
22	312383.327	6660139.875	665.720
23	312322.740	6660100.515	666.020
24	312338.265	6660096.251	666.020
25	312353.679	6660092.900	665.720
26	312369.299	6660088.610	665.720
27	312400.875	6660126.170	664.420

LAGOON SETOUT POINTS			
POINT	EASTING	NORTHING	ELEVATION
28	312390.101	6660086.941	664.420
29	312440.120	6660115.392	664.420
30	312429.349	6660076.172	664.420
31	312311.308	6660087.021	667.985
32	312301.338	6660058.649	668.670
33	312298.878	6660049.692	668.680
34	312299.701	6660045.837	668.710
35	312286.477	6660003.305	669.090
36	312287.819	6660001.595	669.090
37	312377.401	6659978.533	668.685
38	312389.082	6660021.063	668.660
39	312391.686	6660022.832	668.675
40	312392.888	6660023.648	668.648
41	312395.364	6660032.664	668.630
42	312401.284	6660062.149	667.980
43	312411.309	6660053.687	667.960
44	312435.794	6660046.962	668.960
45	312318.584	6660086.515	666.220
46	312393.606	6660065.911	666.220
47	312309.897	6660054.886	666.220
48	312384.919	6660034.283	666.220
49	312305.069	6660039.516	667.020
50	312380.091	6660018.912	667.020
51	312296.383	6660007.887	667.020
52	312371.405	6659987.283	667.020
53	312297.935	6660039.399	668.71
54	312332.135	6659990.966	668.71

NOTE:

1. INSTALL V-DRAIN TO LANDCOM'S SOIL AND CONSTRUCTION MANUAL 2004 (BLUE BOOK). DEPTH OF V-DRAIN IS VARIABLE. REFER TO SPOT HEIGHTS ON PLAN. CONTRACTOR TO LINEARLY GRADE V-DRAIN DEPTHS BETWEEN SPOT HEIGHT LOCATIONS. REFER TO TYPICAL V-DRAIN SECTION VIEW FOR DETAILS.



TYPICAL V-DRAIN SECTION VIEW
NTS

NOT FOR CONSTRUCTION

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN		LAC	AMS	LMS	20.06.19

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

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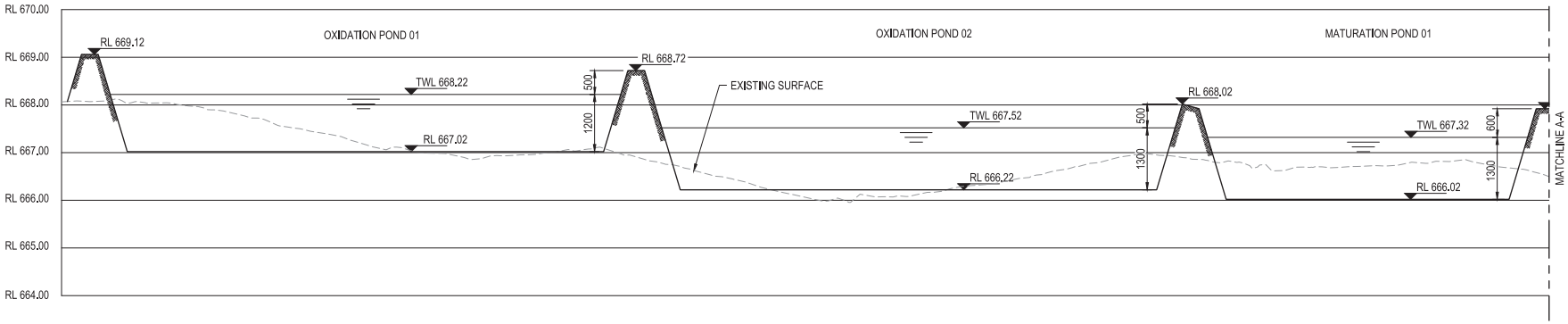
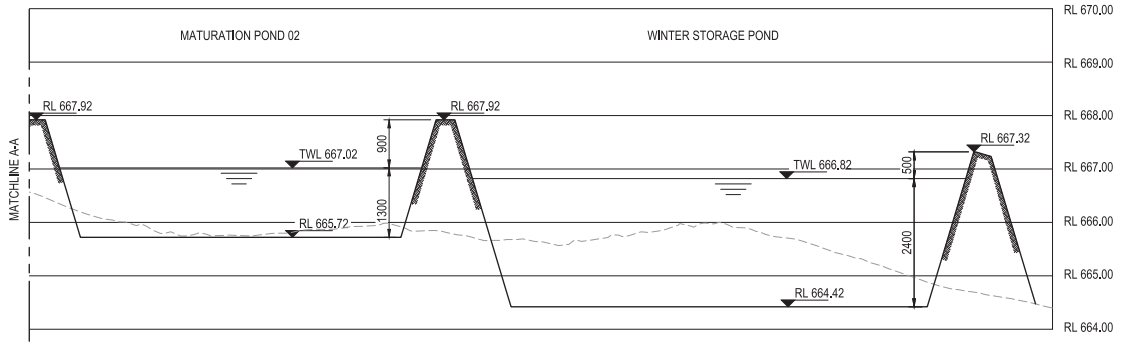
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title STP SET-OUT PLAN AND PIPEWORK LAYOUT

Original Size A1
Drawing No: 22-19174-W101
Rev: 0

Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W100-W103.dwg





HYDRAULIC PROFILE
NOT TO SCALE

NOT FOR CONSTRUCTION

0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19
No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

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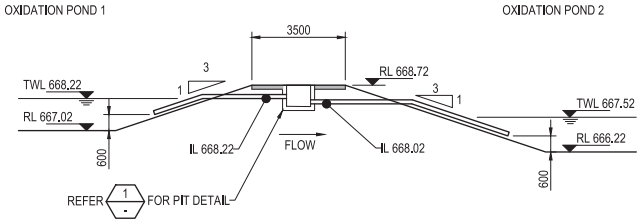
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	NTS	This Drawing must not be used for Construction unless signed as Approved	

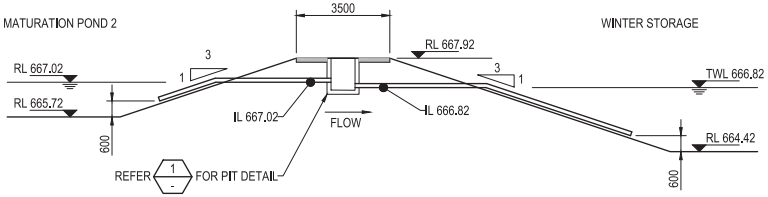
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title HYDRAULIC PROFILE

Original Size A1 | Drawing No: 22-19174-W102 | Rev: 0

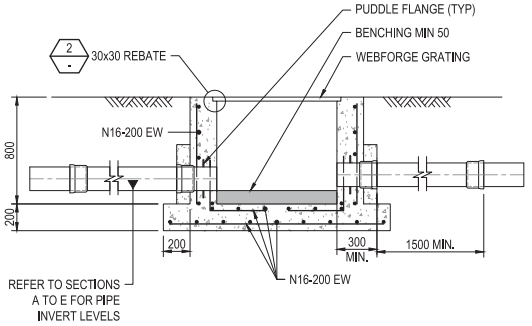
Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W100-W103.dwg



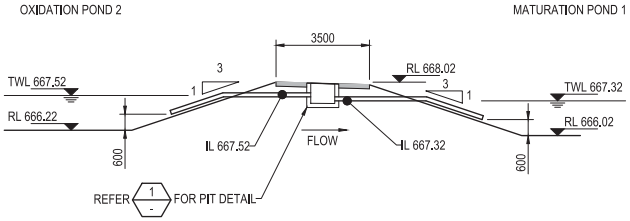
A SECTION
W100 SCALE 1 : 100



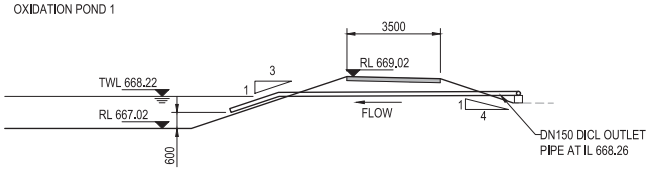
D SECTION
W100 SCALE 1 : 100



H SECTION
- SCALE 1 : 20



B SECTION
W100 SCALE 1 : 100



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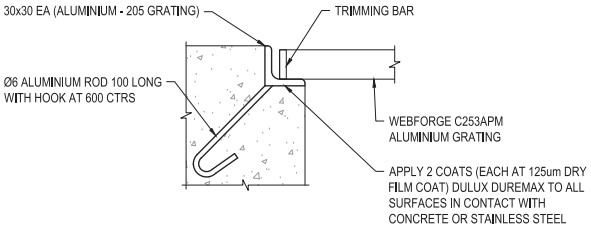
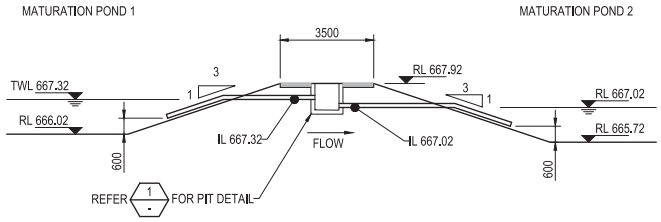
W100 SCALE 1 : 100

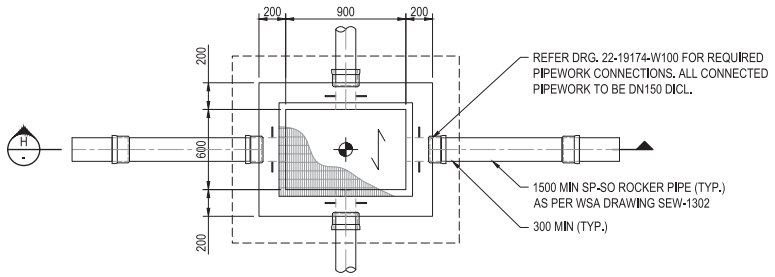


TYPICAL EDGE REBATE FOR GRATING

2 - DETAIL
SCALE 1 : 2



C SECTION
W100 SCALE 1 : 100



1 - DETAIL
SCALE 1 : 20

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SCALE 1:2 AT ORIGINAL SIZE (0 0.02 0.04 0.06 0.08 0.1m)
SCALE 1:20 AT ORIGINAL SIZE (0 0.2 0.4 0.6 0.8 1.0m)
SCALE 1:100 AT ORIGINAL SIZE (0 1 2 3 4 5m)

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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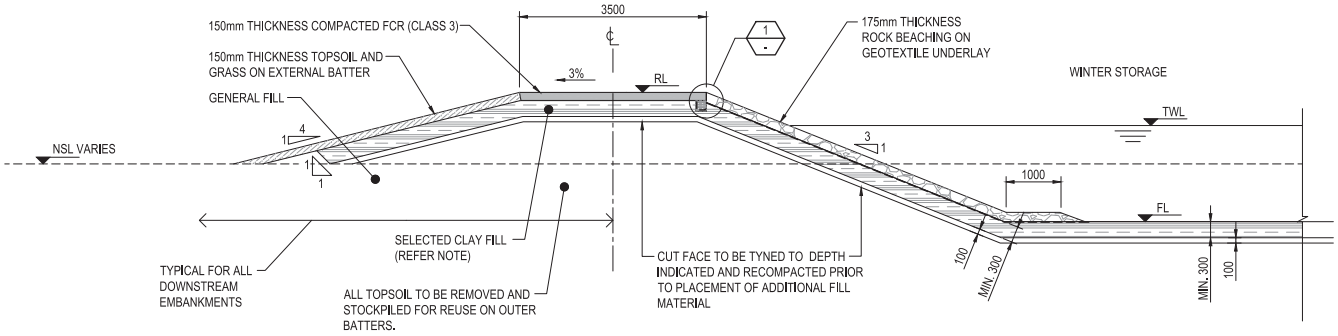
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title SECTION AND PIT DETAILS

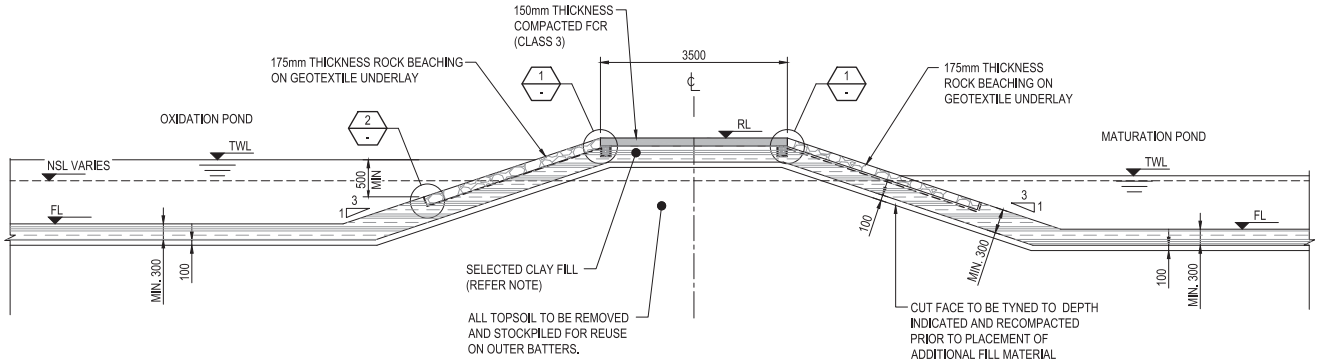
Original Size A1
Drawing No: 22-19174-W103
Rev: 0

Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W100-W103.dwg



WINTER STORAGE TYPICAL EMBANKMENT

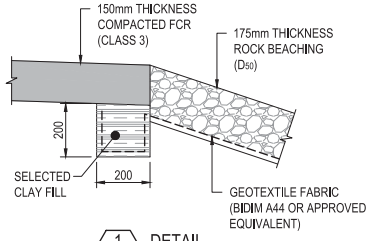
SCALE 1:50



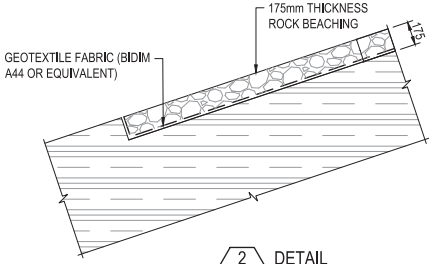
LAGOON TYPICAL EMBANKMENT

SCALE 1:50

ROCK BEACHING (MIN. 500 BELOW TWL)	
POND	TOP WATER LEVEL (TWL)
OXIDATION POND 1	668.22
OXIDATION POND 2	667.52
MATURATION POND 1	667.32
MATURATION POND 2	667.02



1 - DETAIL
NTS



2 - DETAIL
SCALE 1 : 20

NOTE:

1. OUTERMOST 300 OF CLAY LINER TO FLOORS AND INTERNAL EMBANKMENTS TO BE STABILISED WITH 3% LIME.

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

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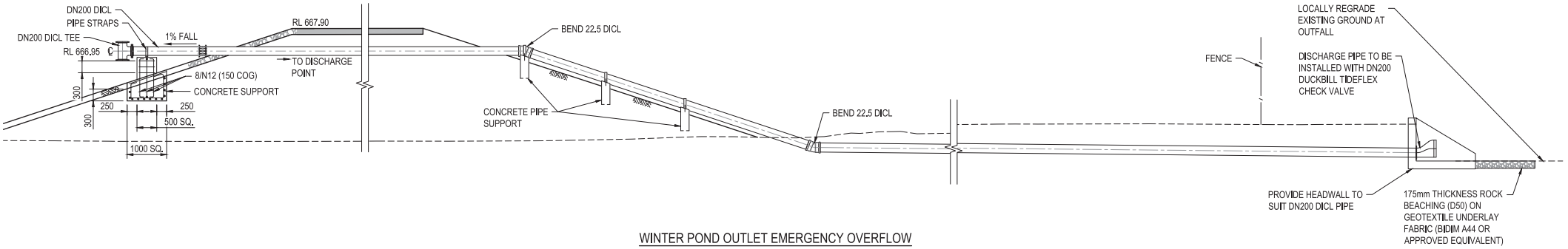
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title STP EMBANKMENT TYPICAL SECTIONS

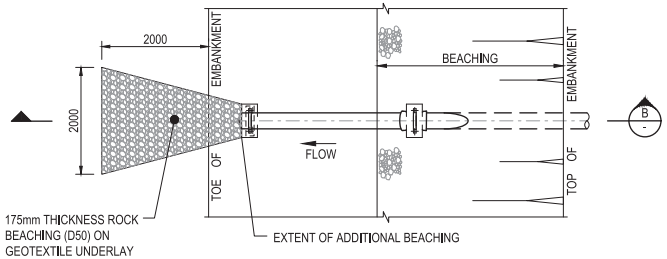
Original Size A1
Drawing No: 22-19174-W104
Rev: 0

Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W104-W105.dwg

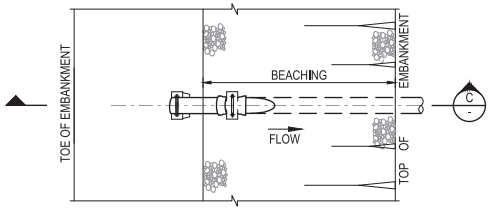


WINTER POND OUTLET EMERGENCY OVERFLOW

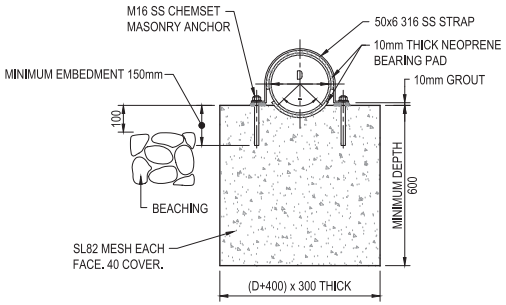
1 / W100 DETAIL
SCALE 1 : 50



TYPICAL INLET DETAIL PLAN
NTS

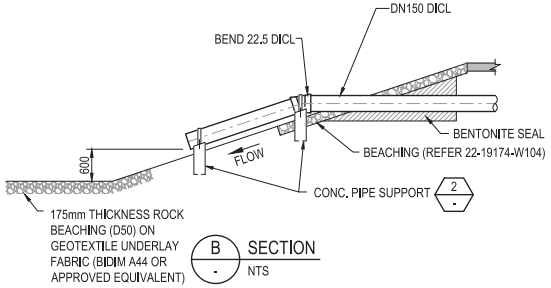


TYPICAL OUTLET DETAIL PLAN
NTS

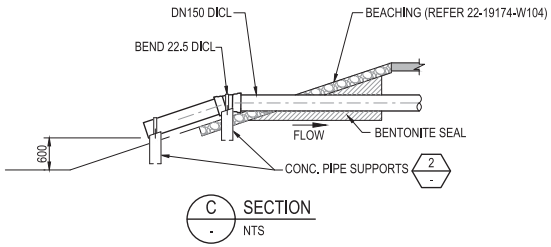


CONC. PIPE SUPPORT

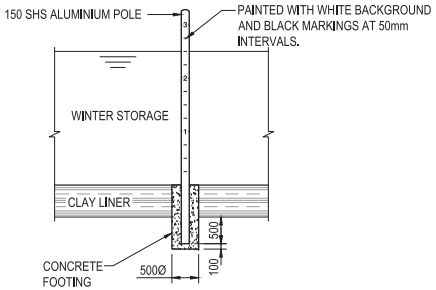
2 / - DETAIL
SCALE 1 : 10



B / - SECTION
NTS



C / - SECTION
NTS



DEPTH GAUGE

3 / W100 DETAIL
SCALE 1 : 50

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No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN		LAC	AMS	LMS	20.06.19

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: TYPICAL INLET AND OUTLET DETAILS

Original Size: A1
Drawing No: 22-19174-W105
Rev: 0

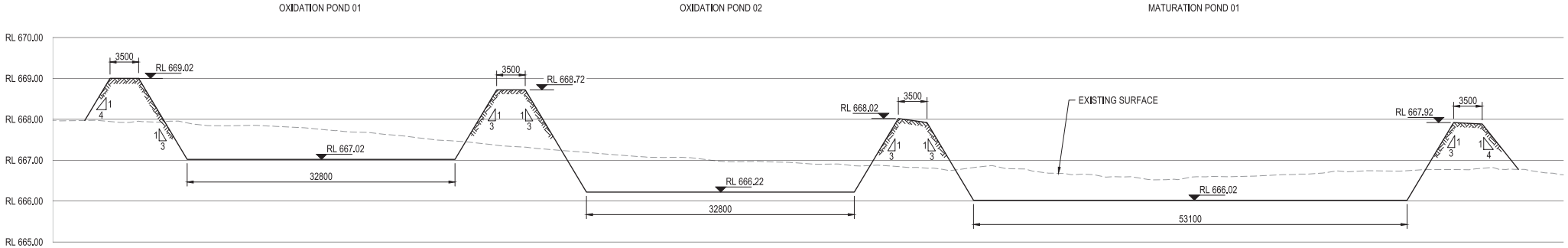
Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W104-W105.dwg

DESIGN TO EXISTING SURFACE VOLUMES	
TOPSOIL STRIPPED FROM SITE (150mm)	3162 m^3
TOTAL CUT WON	15247 m^3
TOTAL CLAY WON FROM SITE	12088 m^3
TOTAL CLAY REQUIRED	4615 m^3
BALANCE CLAY REMAINING IN STOCKPILE	7473 m^3
FILL MATERIAL EXCAVATED TO STOCKPILE	3186 m^3
TOTAL FILL AVAILABLE IN STOCKPILE	10658 m^3
TOTAL FILL REQUIRED	11488 m^3
BALANCE FILL TO BE IMPORTED FROM THE STP SITE	830 m^3

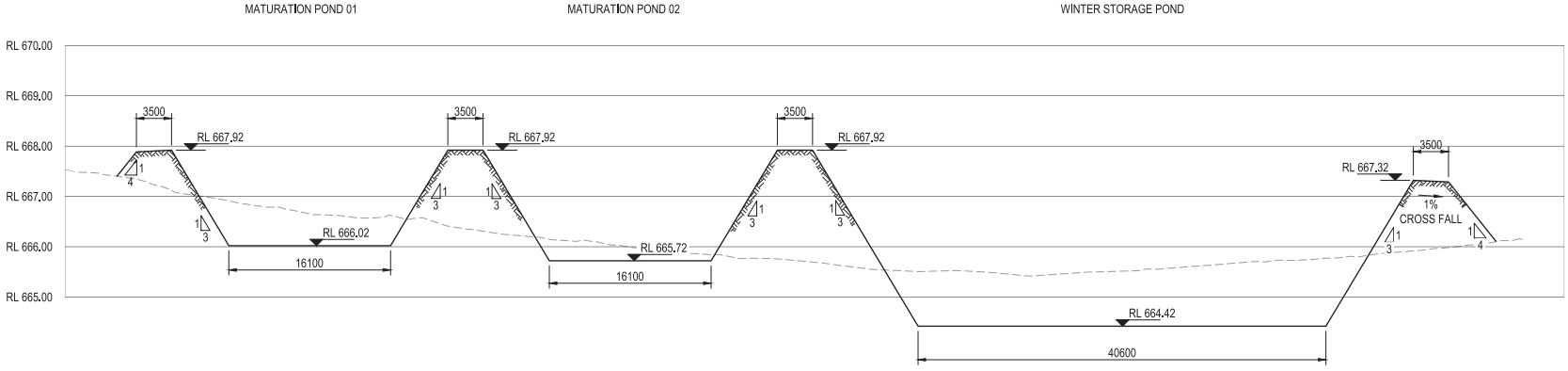
ROCK BEACHING REQUIRED	
OXIDATION POND 01	727 m^2
OXIDATION POND 02	757 m^2
MATURATION POND 01	529 m^2
MATURATION POND 02	686 m^2
WINTER STORAGE POND	2134 m^2
TOTAL	4833 m^2

NOTE:

1. OUTERMOST 300 OF CLAY LINER TO FLOORS AND INTERNAL EMBANKMENTS TO BE STABILISED WITH 3% LIME.



F W100 SECTION
SCALE HOR 1:250 VER 1:50



G W100 SECTION
SCALE HOR 1:250 VER 1:50

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VERTICAL 1:50 AT ORIGINAL SIZE 0 0.5 1 1.5 2 2.5m
HORIZONTAL 1:250 AT ORIGINAL SIZE 0 2.5 5 7.5 10 12.5m

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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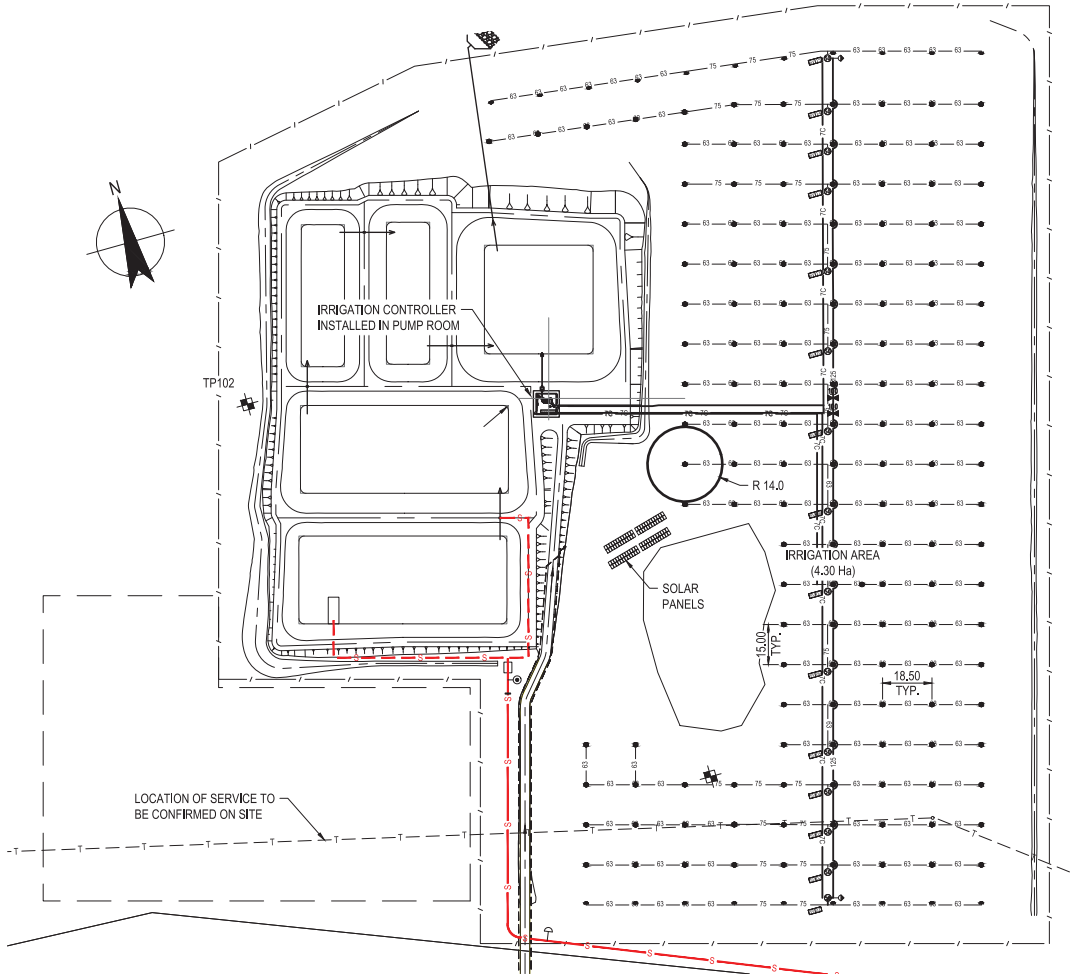
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title EARTHWORKS

Original Size A1
Drawing No: 22-19174-W106
Rev: 0

Plot Date: 20 June 2019 - 11:39 AM Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W106.dwg

LEGEND:	
	NELSON R33LP #26 SPRINKLER ASSEMBLY (FULL CIRCLE)
	NELSON R33LP #26 SPRINKLER ASSEMBLY (WITH ROAD GUARD)
	RAINBIRD 200-PESB-R 50 DN SOLENOID VALVE ASSEMBLY
	RESILIENT SEATED GATE VALVE ASSEMBY
	WATERMARK WENM SOIL MOISTURE SENSOR ASSEMBLY
	50 TORO KINETIC AIR VALVE ASSEMBLY
IC	RAINBIRD ESP-LXM 16 STATION IRRIGATION CONTROLLER
125 125	PN12.5 PE100 MDPE PIPE WITH PURPLE STRIPE AND TRACEABLE MARKER TAPE (SIZE AS SHOWN)
75 75	PN12.5 PE100 MDPE PIPE WITH PURPLE STRIPE AND TRACEABLE MARKER TAPE (SIZE AS SHOWN)
63 63 63	PN12.5 PE100 MDPE PIPE WITH PURPLE STRIPE AND TRACEABLE MARKER TAPE (SIZE AS SHOWN)
SEN	MOISTURE SENSOR CABLE IN 40 DN HD CONDUIT
7c 7c 7c	2.5 mm 7 CORE (WITH SEPARATE 4 MM COMMON) IRRIGATION CABLE IN CONDUIT

ITEM	QTY	UNITS
DN125 PN12.5 PE100 MDPE	490	l/m
DN75 PN12.5 PE100 MDPE	460	l/m
DN63 PN12.5 PE100 MDPE	2260	l/m
2.5mm² 7-CORE CABLE	682	l/m
4mm² 7-CORE CABLE	625	l/m
32mm CONDUIT	500	l/m
DN50 SOLENOID VALVE ASSEMBLY	15	EACH
DN20 ROTOR SPRINKLER ASSEMBLY	142	EACH
DN20 ROTOR SPRINKLER ASSEMBLY WITH ROAD GUARD	20	EACH



PLAN
SCALE 1:1000

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No	Revision	Drawn	Job Manager	Project Director	Date
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0 10 20 30 40 50m
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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:1000	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title IRRIGATION SITE LAYOUT

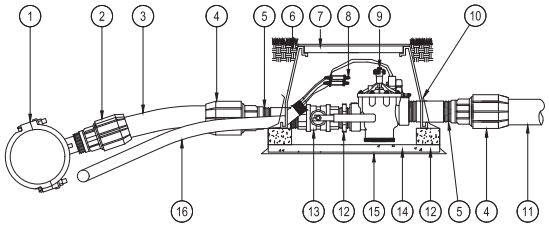
Original Size A1
Drawing No: 22-19174-W107
Rev: 0

Plot Date: 20 June 2019 - 11:40 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W107.dwg

NOTES:

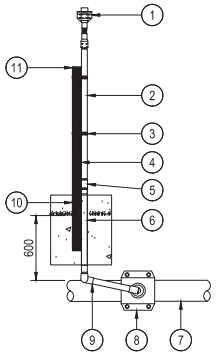
1. THREADS TO BE SEALED WITH PINK THREAD TAPE OR NON SETTING JOINT COMPOUND.
2. COMPACT TRENCHES IN 150mm LAYERS.
3. VALVE BOXES TO BE SURROUNDED WITH 0.5m² OF SALVAGED TURF.
4. LID OF VALVE BOX SET FLUSH WITH FINISHED GROUND LEVEL (ACCEPTABLE TOLERANCE 0 TO 25mm).
5. VALVE TO BE SET TO ENSURE EASY OPERATION.
6. VALVE BOXES TO BE CLEANED OUT PRIOR TO PRACTICAL COMPLETION INSPECTION.

VALVE TABLE		
SIZE	INLET PIPE	RISER
20	32	20
25	40	25
32	40	32
40	63	40
50	75	50
80	90	80



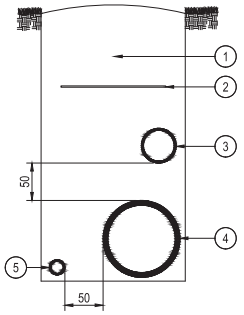
SOLENOID VALVE DETAIL
NTS

KEY	DESCRIPTION
1	MAIN LINE TAPPING FITTING
2	MALE ADAPTER
3	1m PIPE PIECE OF SAME CLASS AS MAINLINE (SEE TABLE FOR SIZE)
4	MECHANICAL FITTING FEMALE ADAPTER
5	SCHEDULE 80 RISER (MINIMUM LENGTH 250mm) SEE TABLE FOR SIZE
6	RECYCLED ROAD BASE BACKFILL MATERIAL
7	JUMBO RECTANGULAR VALVE BOX WITH LOCKING BOLT
8	DBY/R JOINER
9	SOLENOID VALVE WITH PRESSURE REGULATOR
10	DUCT TAPE TO HOLD GEOTECHNICAL FABRIC
11	LATERAL PIPE
12	SCHEDULE 80 NIPPLE
13	STAINLESS STEEL BALL VALVE
14	100mm LAYER OF COMPACTED ROAD BASE
15	GEOTECHNICAL FABRIC
16	CABLE IN CONDUIT (MDPE)



SPRINKLER ASSEMBLY
NTS

KEY	DESCRIPTION
1	NELSON R33LP WITH #26 NOZZLE
2	20 x 1800 GALVANISED STEEL RISER PIPE
3	STAINLESS STEEL WORK DRIVE CLAMP
4	50 x 50 x 1500 GALVANISED STEEL POST
5	20 GALVANISED STEEP COUPLING
6	20 x 800 GALVANISED STEEL RISER PIPE
7	MDPE LATERAL PIPE
8	TAPPING SADDLE
9	20 x 350 SCHEDULE 40 ARTICULATED RISER
10	DENSO WRAP
11	PUSH-ON GALVANISED STEEL SUPPORT



TRENCH DETAIL
NTS

KEY	DESCRIPTION
1	CLEAN TRENCH SPOIL
2	TRACEABLE MARKER TAPE
3	LATERAL (IF IN COMMON TRENCH)
4	MAINLINE
5	CABLE IN CONDUIT (MDPE)

DESCRIPTION	DEPTH TO INVERT		TRACEABLE WARNING TAPE
	MINIMUM	MAXIMUM	
MAINLINES	600mm	1200mm	REQUIRED
LATERALS	600mm	800mm	REQUIRED
POTABLE MAINLINES	500mm	700mm	REQUIRED
EXTRA LOW VOLTAGE CABLE	500mm	700mm	REQUIRED
LOW VOLTAGE CABLE	600mm	800mm	REQUIRED

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	NTS		

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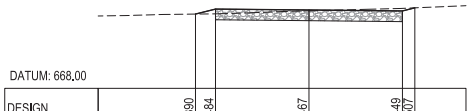
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title IRRIGATION SITE DETAILS

Original Size A1
Drawing No: 22-19174-W108
Rev: 0

Plot Date: 20 June 2019 - 11:40 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W107.dwg

NOTE:

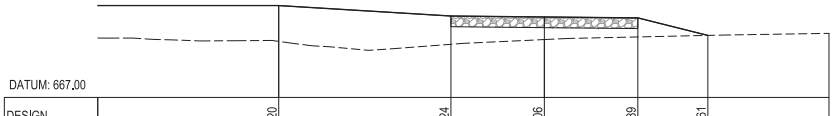
1. REFER TO DRAWING 22-19174-W100 FOR ROAD DETAILS.



DATUM: 668.00

DESIGN SURFACE LEVEL	669.390	669.484	669.467	669.449	669.507
EXISTING SURFACE LEVEL	669.390	669.395	669.451	669.497	669.507
OFFSET FROM CENTRELINE	-2.125	-1.750	0.000	1.750	1.982

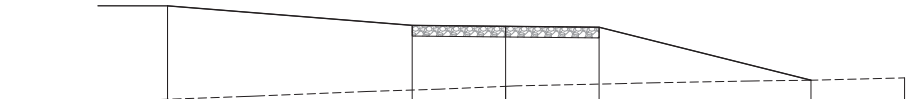
1 / W100 CROSS SECTION
SCALE HOR 1:50 VER 1: 50



DATUM: 667.00

DESIGN SURFACE LEVEL	668.720	668.524	668.506	668.489	668.161
EXISTING SURFACE LEVEL	668.049	667.995	668.083	668.132	668.161
OFFSET FROM CENTRELINE	-4.975	-1.750	0.000	1.750	3.061

2 / W100 CROSS SECTION
SCALE HOR 1:50 VER 1: 50

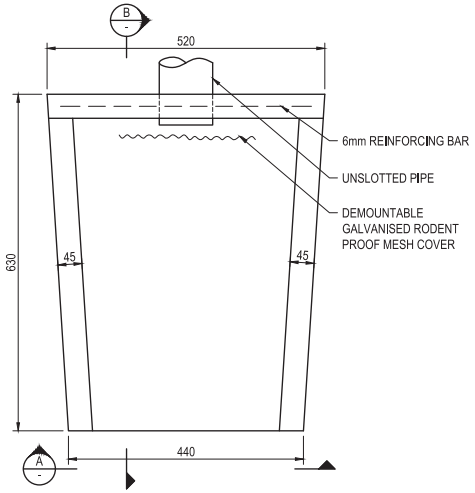


DATUM: 666.00

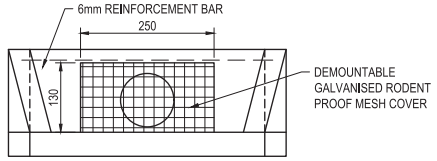
DESIGN SURFACE LEVEL	668.563	668.199	668.181	668.164	667.172
EXISTING SURFACE LEVEL	666.815	666.988	667.057	667.099	667.172
OFFSET FROM CENTRELINE	-6.331	-1.750	0.000	1.750	5.718

3 / W100 CROSS SECTION
SCALE HOR 1:50 VER 1: 50

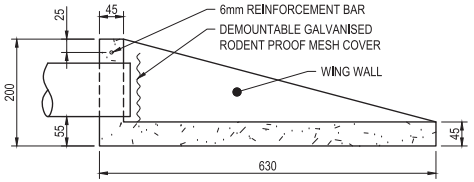
ACCESS TRACK CROSS SECTIONS



1 / W100 DETAIL
SCALE 1 : 5



A / - SECTION
SCALE 1:5



B / - SECTION
SCALE 1:5

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VERTICAL 1:50 AT ORIGINAL SIZE
0 0.5 1 1.5 2 2.5m
HORIZONTAL 1:50 AT ORIGINAL SIZE
0 0.5 1 1.5 2 2.5m
0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

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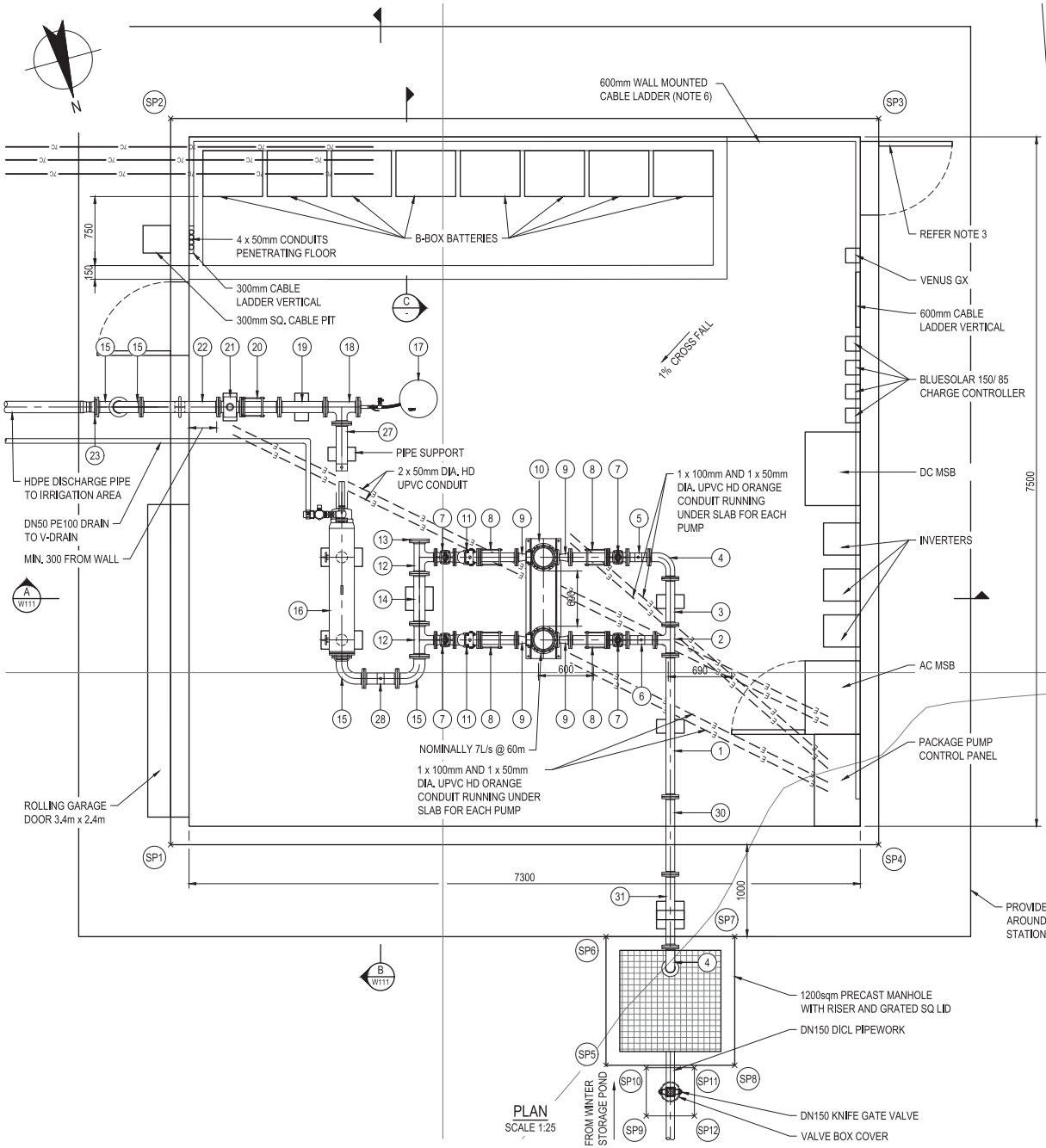
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: ACCESS TRACK CROSS SECTIONS AND SUBSURFACE DRAIN DISCHARGE POINT DETAILS

Original Size: A1
Drawing No: 22-19174-W109
Rev: 0

Plot Date: 20 June 2019 - 11:40 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W109.dwg



PLAN
SCALE 1:25

NOTES:

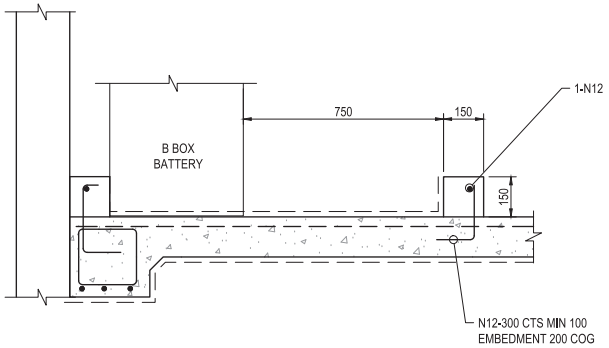
1. SLAB TO ALLOW FOR PUMP PLINTHS AND VALVE SUPPORTS.
2. SHED, GUTTERS FASCIA COLOUR TO BE IN ACCORDANCE WITH PRINCIPALS REQUIREMENTS.
3. MEDIUM DUTY STEEL FRAME DOOR WITH COLOUR BOND FINISH TO MATCH EXTERIOR COLOUR. DOOR HARDWARE TO BE KEYED TO SITES MASTER KEY SYSTEM.
4. SHED ROOF TO DRAIN TO SOUTHERN SIDE AWAY FROM DOOR WAYS.
5. COORDINATE LOCATION OF CONDUITS TO SUIT FINAL PUMP PACKAGE ARRANGEMENT.
6. PROVIDE 600mm WIDE CABLE LADDER MOUNTED TO WALL AT HIGH LEVEL TO FACILITATE CABLING BETWEEN PANELS.

SETOUT TABLE

POINT	EASTING	NORTHING
SP1	312412.253	6660065.508
SP2	312410.160	6660057.891
SP3	312402.735	6660059.930
SP4	312404.827	6660067.548
SP5	312408.323	6660069.077
SP6	312407.952	6660067.727
SP7	312406.602	6660068.098
SP8	312406.973	6660069.448
SP9	312408.046	6660069.723
SP10	312407.908	6660069.218
SP11	312407.403	6660069.357
SP12	312407.541	6660069.862

SCHEDULE OF PIPES AND FITTINGS

ITEM NO.	DESCRIPTION
1	DN80 FL-FL DICL PIPE WITH PUDDLE FLANGE (L=1541)
2	DN80xDN80xDN80 FL-FL-FL DICL TEE
3	DN80 FL-FL DICL PIPE (L=507)
4	DN80 FL-FL DICL 90° BEND
5	DN80 FL-FL DICL PIPE (L=240) WITH 25mm BSP THREADED TAPPING POINT
6	DN80 FL-FL DICL PIPE (L=305) WITH 25mm BSP THREADED TAPPING POINT
7	DN80 FL-FL STOP VALVE
8	DN80 THRUST TYPE DISMANTLING JOINT
9	DN80-DN50 FL-FL ECCENTRIC TAPER
10	LOWARA VSD IRRIGATION PUMP (MODEL 22SV7F075T) OR EQUIVALENT
11	DN80 FL-FL NON-RETURN VALVE
12	DN100xDN100xDN80 FL-FL-FL DICL TEE
13	DN100 DICL BLIND FLANGE
14	DN100 FL-FL DICL PIPE (L=544)
15	DN100 FL-FL DICL 90° BEND
16	SELF CLEANING STRAINER
17	HYDROPNEUMATIC ACCUMULATOR CHARLATTE HYDROCHOC OR EQUIVALENT (MINIMUM VOLUME 150L)
18	DN100xDN100xDN100 FL-FL-FL DICL TEE
19	DN100 FL-FL DICL PIPE (L=500)
20	DN100 THRUST TYPE DISMANTLING JOINT
21	DN100 FLOWMETER
22	DN100 FL-FL DICL PIPE WITH PUDDLE FLANGE (L=840)
23	DN100 STUB FLANGE WITH BACKING RING
24	DN100 BUTTERFLY VALVE
25	DN100 FL-FL DICL PIPE (L=438)
26	DN100 FL-FL DICL PIPE (L=247)
27	DN100 FL-FL DICL PIPE (L=1279) WITH 25mm BSP THREADED TAPPING POINT
28	DN100 FL-FL DICL PIPE (L=362) WITH 25mm BSP THREADED TAPPING POINT
29	DN80 FL-FL DICL PIPE (L=1000)
30	DN80 FL-FL DICL PIPE (L=842)
31	DN80 FL-FL DICL PIPE (L=792)



C - SECTION
SCALE 1:10

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Approved (Project Director)	L. SYLVA		
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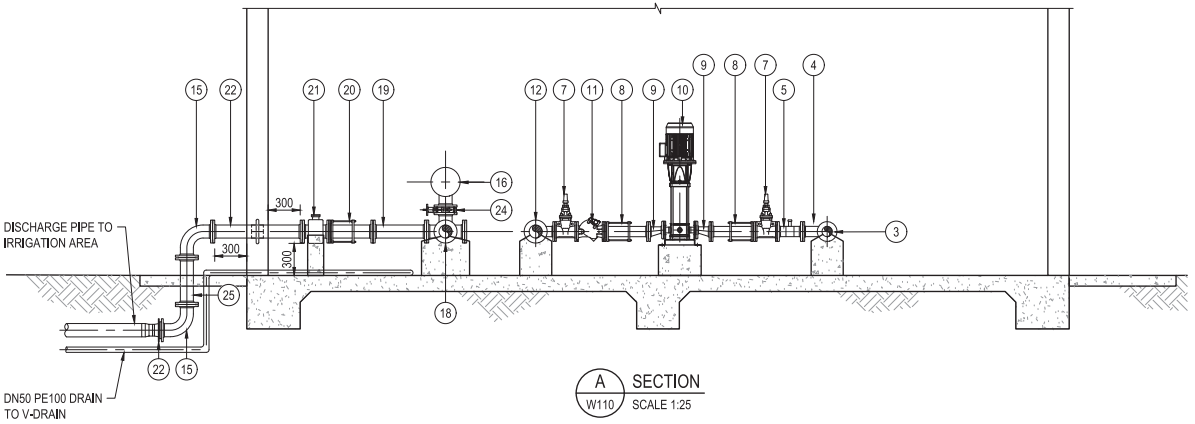
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

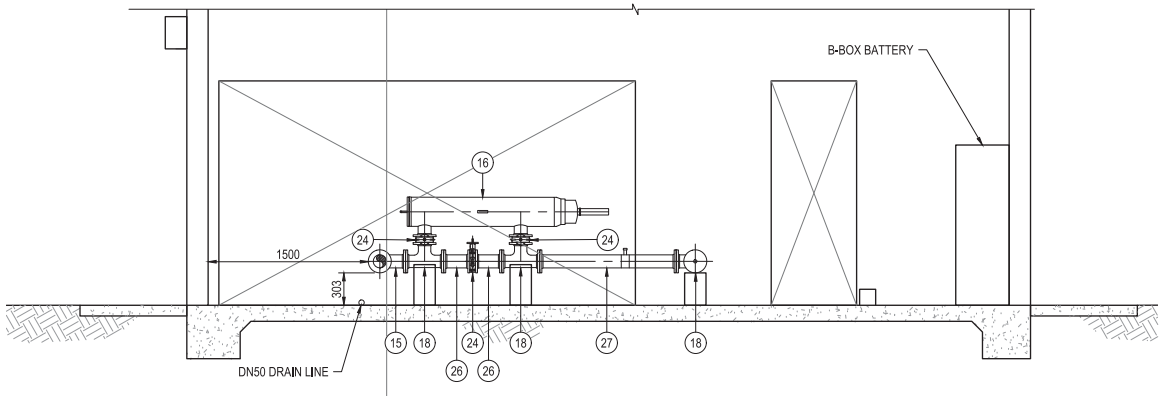
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title WINTER STORAGE POND PUMP STATION PIPEWORK ARRANGEMENT PLAN

Original Size A1 | Drawing No: 22-19174-W110 | Rev: 0

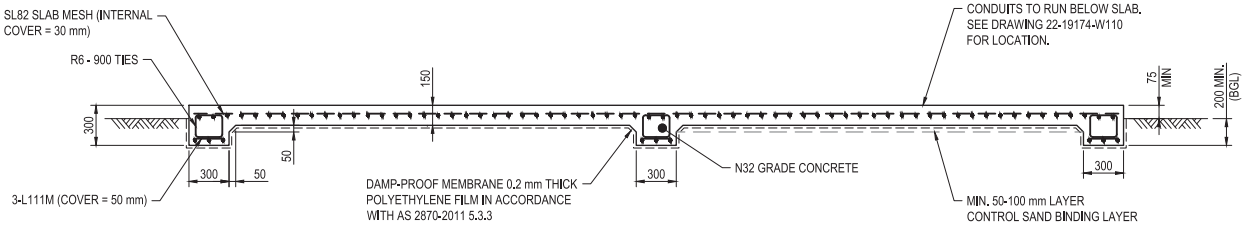
Plot Date: 20 June 2019 - 11:40 AM | Plotted by: Rj Geronimo | Cad File No: G:\22\19174\CADD\Drawings\22-19174-W110-W113.dwg



A SECTION
W110 SCALE 1:25



B SECTION
W110 SCALE 1:25



TYPICAL - FOOTING SECTION
SCALE 1:20

SCHEDULE OF PIPES AND FITTINGS	
ITEM NO.	DESCRIPTION
1	DN80 FL-FL DICL PIPE WITH PUDDLE FLANGE (L=1541)
2	DN80xDN80xDN80 FL-FL-FL DICL TEE
3	DN80 FL-FL DICL PIPE (L=507)
4	DN80 FL-FL DICL 90º BEND
5	DN80 FL-FL DICL PIPE (L=240) WITH 25mm BSP THREADED TAPPING POINT
6	DN80 FL-FL DICL PIPE (L=305) WITH 25mm BSP THREADED TAPPING POINT
7	DN80 FL-FL STOP VALVE
8	DN80 THRUST TYPE DISMANTLING JOINT
9	DN80-DN50 FL-FL ECCENTRIC TAPER
10	LOWARA VSD IRRIGATION PUMP (MODEL 22SV7F075T) OR EQUIVALENT
11	DN80 FL-FL NON-RETURN VALVE
12	DN100xDN100xDN80 FL-FL-FL DICL TEE
13	DN100 DICL BLIND FLANGE
14	DN100 FL-FL DICL PIPE (L=544)
15	DN100 FL-FL DICL 90º BEND
16	SELF CLEANING STRAINER
17	HYDROPNEUMATIC ACCUMULATOR CHARLATTE HYDROCHOC OR EQUIVALENT (MINIMUM VOLUME 150L)
18	DN100xDN100xDN100 FL-FL-FL DICL TEE
19	DN100 FL-FL DICL PIPE (L=500)
20	DN100 THRUST TYPE DISMANTLING JOINT
21	DN100 FLOWMETER
22	DN100 FL-FL DICL PIPE WITH PUDDLE FLANGE (L=840)
23	DN100 STUB FLANGE WITH BACKING RING
24	DN100 BUTTERFLY VALVE
25	DN100 FL-FL DICL PIPE (L=438)
26	DN100 FL-FL DICL PIPE (L=247)
27	DN100 FL-FL DICL PIPE (L=1279) WITH 25mm BSP THREADED TAPPING POINT

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

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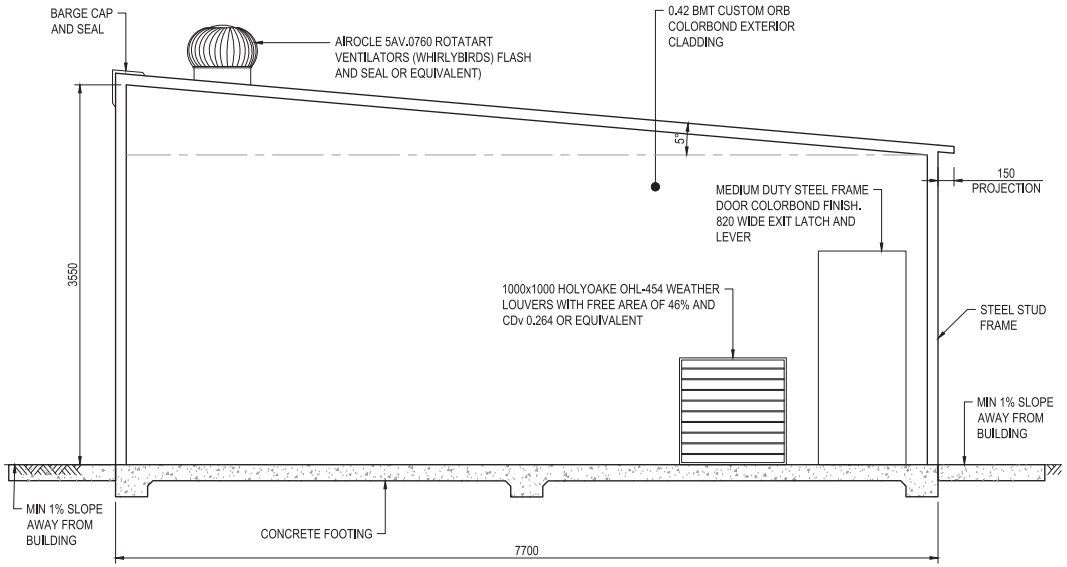
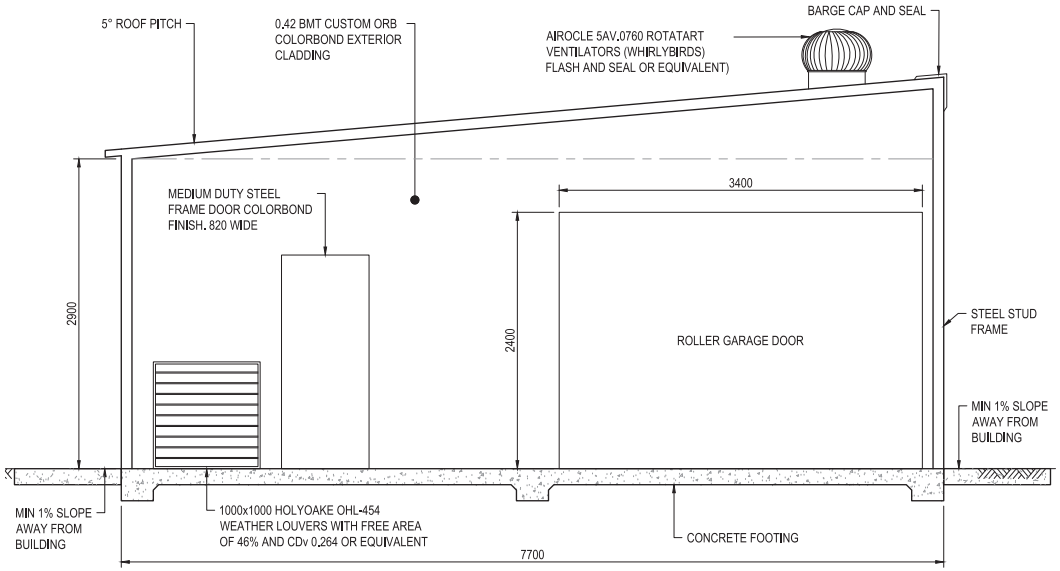
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client	URALLA SHIRE COUNCIL
Project	BUNDARRA SEWERAGE SCHEME
Title	WINTER STORAGE POND PUMP STATION SECTIONS
Original Size	A1
Drawing No:	22-19174-W111
Rev:	0

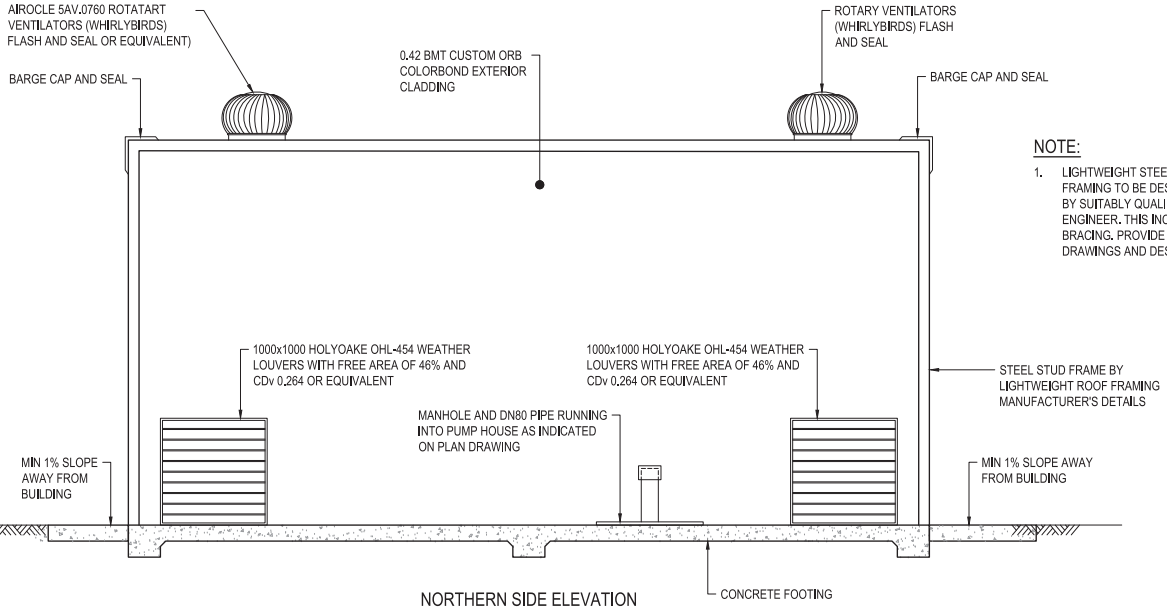
Plot Date: 20 June 2019 - 11:40 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W110-W113.dwg



WESTERN SIDE ELEVATION
SCALE 1:25



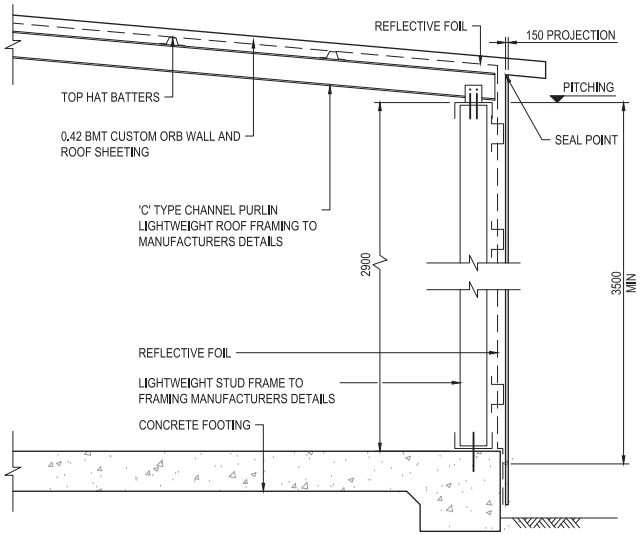
EASTERN SIDE ELEVATION
SCALE 1:25



NORTHERN SIDE ELEVATION
SCALE 1:25

NOTE:

1. LIGHTWEIGHT STEEL WALL AND ROOF FRAMING TO BE DESIGN TO AS/NZS4600 BY SUITABLY QUALIFIED CHARTERED ENGINEER. THIS INCLUDES TIE DOWN AND BRACING. PROVIDE WORKSHOP DRAWINGS AND DESIGN CERTIFICATION.



SECTION
SCALE 1:15

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0	FINAL DETAILED DESIGN		LAC	AMS	LMS	20.06.19

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

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Approved (Project Director)	L. SYLVA		
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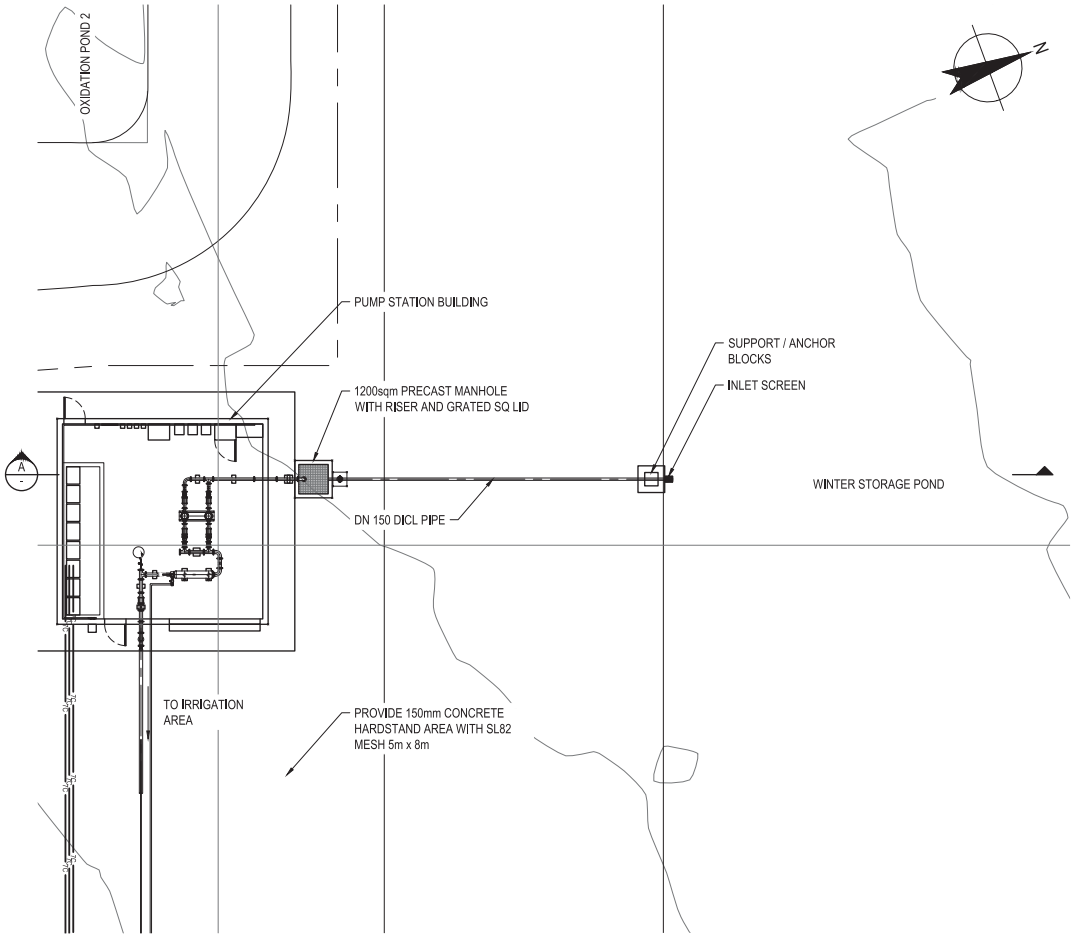
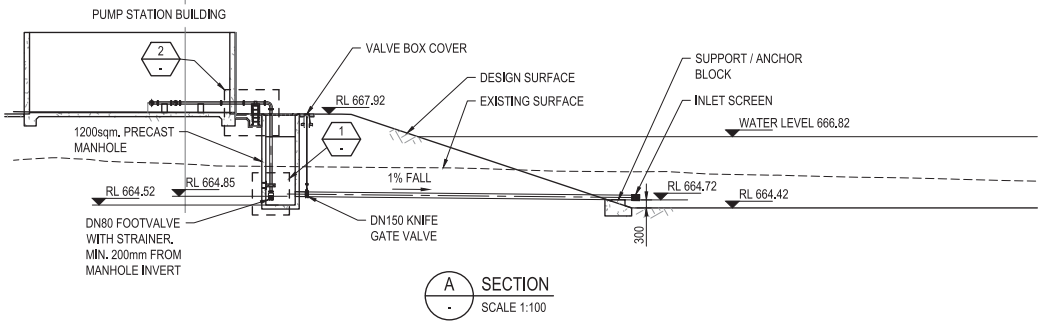
Client	URALLA SHIRE COUNCIL
Project	BUNDARRA SEWERAGE SCHEME
Title	WINTER STORAGE POND PUMP STATION DETAILS
Original Size	A1
Drawing No:	22-19174-W112
Rev:	0

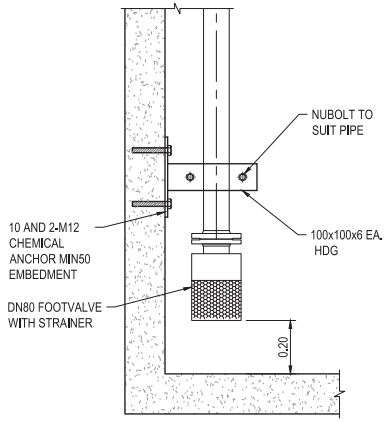
Plot Date: 20 June 2019 - 11:40 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W110-W113.dwg



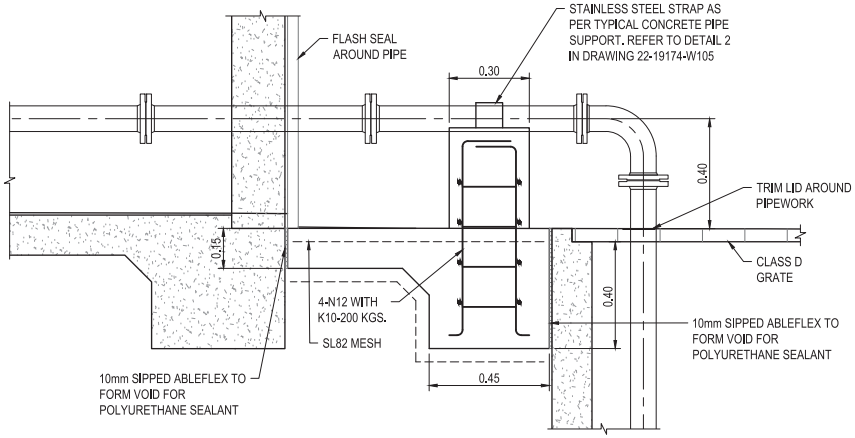
PLAN
SCALE 1:100



A
-
SECTION
SCALE 1:100



DETAIL 1
SCALE 1:10



DETAIL 2
SCALE 1:10

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0	FINAL DETAILED DESIGN		LAC	AMS	LMS	20.06.19

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

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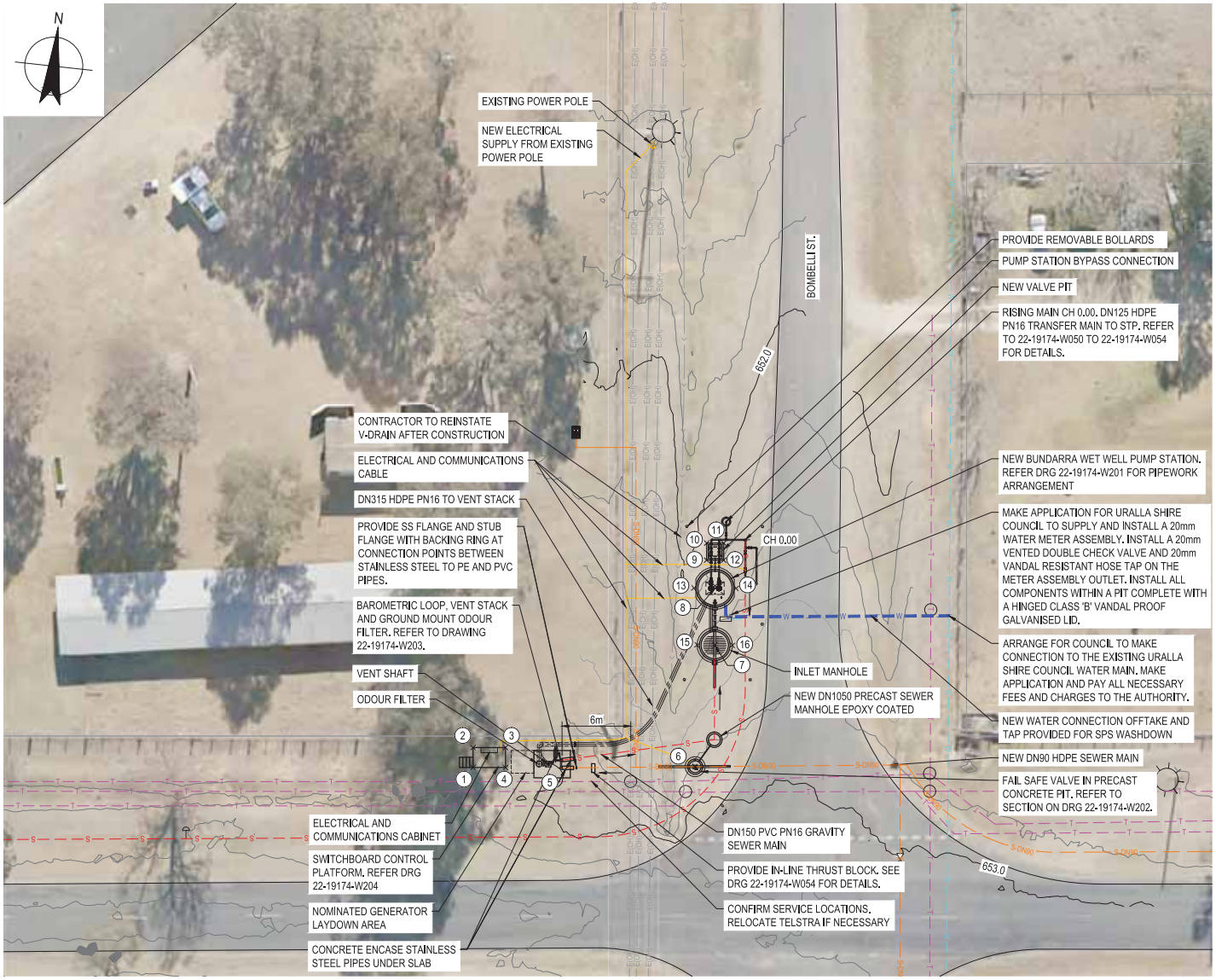
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title WINTER STORAGE POND INLET WORKS

Original Size A1
Drawing No: 22-19174-W113
Rev: 0

Plot Date: 20 June 2019 - 11:40 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W110-W113.dwg



PLAN
SCALE 1:200

LEGEND:

- NEW SEWER MAIN
- NEW TRANSFER MAIN
- NEW UG ELECTRICAL
- NEW WATER CONNECTION
- EXISTING TELSTRA LINE
- EXISTING WATER MAIN
- EXISTING OH POWER LINES
- EXISTING V-DRAIN
- CADASTRE
- ROAD EDGE
- EXISTING POWER POLE
- EXISTING TELSTRA PIT
- BOLLARD

SETOUT TABLE

POINT	EASTING	NORTHING	NATURAL SURFACE LEVEL	CONSTRUCTION SURFACE LEVEL	DESCRIPTION
1	314236.464	6660569.909	-	-	CORNER OF SWITCHBOARD PLATFORM
2	314236.275	6660571.649	-	-	CORNER OF SWITCHBOARD PLATFORM
3	314239.108	6660571.958	-	-	CORNER OF SWITCHBOARD PLATFORM
4	314239.298	6660570.218	-	-	CORNER OF SWITCHBOARD PLATFORM
5	314243.021	6660570.922	653.015	653.15	CENTRE OF VENT SHAFT
6	314255.847	6660572.089	652.528	652.63	CENTRE OF CONCRETE PIT
7	314256.409	6660582.888	652.429	652.63	CENTRE OF INLET MANHOLE
8	314255.867	6660588.060	652.280	652.63	CENTRE OF WET WELL
9	314254.885	6660590.234	652.168	652.63	CORNER OR VALVE PIT
10	314254.729	6660591.726	652.103	652.63	CORNER OR VALVE PIT
11	314256.221	6660591.882	652.172	652.63	CORNER OR VALVE PIT
12	314256.377	6660590.391	652.218	652.63	CORNER OR VALVE PIT
13	314254.048	6660587.668	652.133	652.63	EDGE OF WET WELL
14	314257.727	6660588.061	652.349	652.63	EDGE OF WET WELL
15	314254.866	6660582.730	652.351	652.63	EDGE OF INLET MANHOLE
16	314257.950	6660583.049	652.536	652.63	EDGE OF INLET MANHOLE

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No	Revision	Drawn	Job Manager	Project Director	Date
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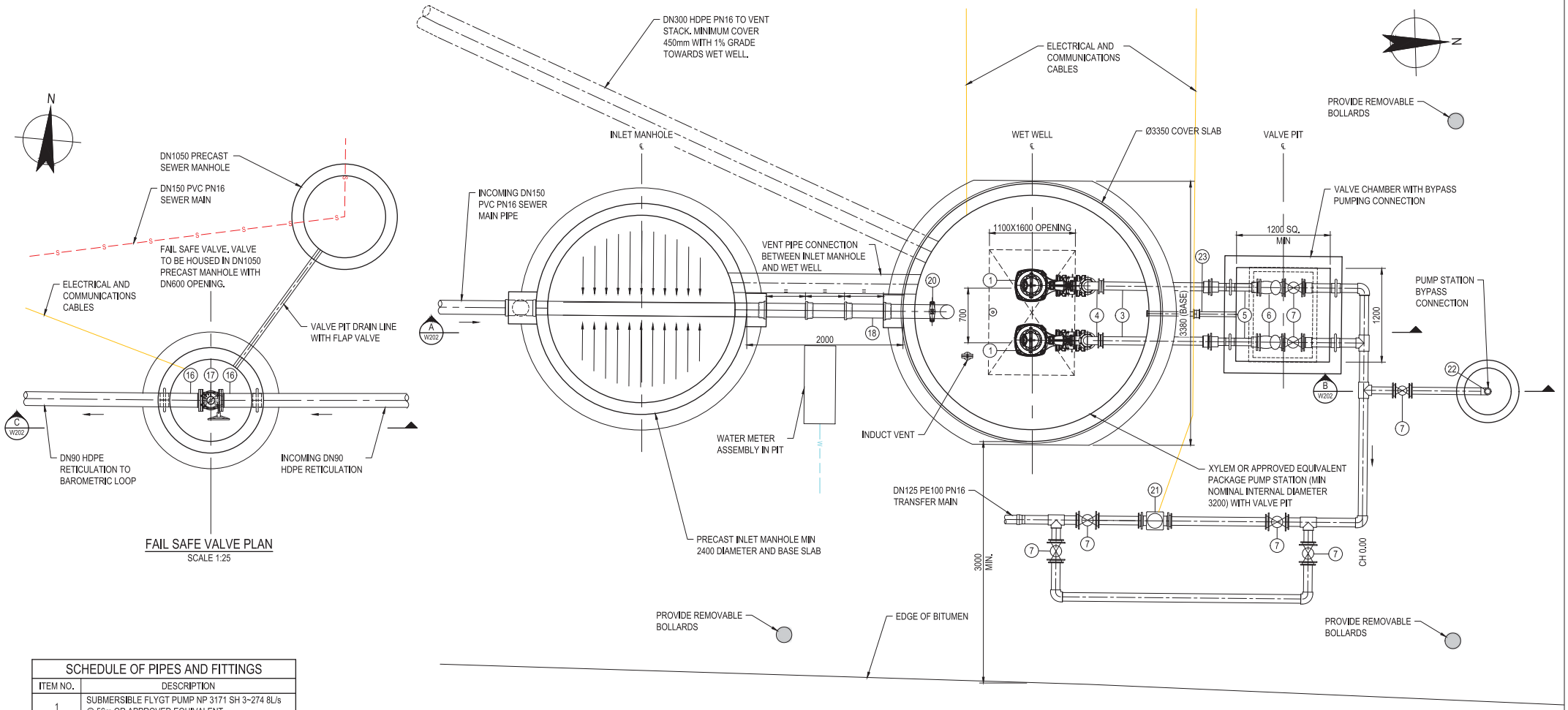
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:200	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION
SITE LAYOUT PLAN

Original Size A1 | Drawing No: 22-19174-W200 | Rev: 0

Plot Date: 20 June 2019 - 11:42 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W200.dwg



PUMP STATION PLAN
SCALE 1:25

SCHEDULE OF PIPES AND FITTINGS	
ITEM NO.	DESCRIPTION
1	SUBMERSIBLE FLYGT PUMP NP 3171 SH 3~274 8L/s @ 56m OR APPROVED EQUIVALENT
3	PACKAGE PUMP STATION DISCHARGE CONNECTION
4	DN80 90° PVC BEND
5	DN80 PVC PIPE WITH PUDDLE FLANGE AND FLANGES WITH METAL BACKING RING
6	DN80 CHECK VALVE
7	DN80 RESILIENT SEATED GATE VALVE
16	DN150 FL-SP DICL PIPE WITH PUDDLE FLANGE L.T.S.
17	DN150 ACTUATED PLUG VALVE WITH FAIL SAFE
18	DN150 PVC PIPE L.T.S.
19	DN125 HDPE PN16
20	DN150 KNIFE GATE VALVE AND SURFACE BOX
21	FLOWMETER
22	4" PE CAMLOCK MALE COUPLING
23	DN50 PVC DRAIN LINE WITH FLAP VALVE

NOTES:

1. INLET MANHOLE AND WET WELL TO BE EPOXY COATED, INCLUDING UNDERSIDE OF ROOF / LID.
2. ALL PIPEWORK MIN. PN16.
3. ELECTRICAL DESIGN BY PUMP MANUFACTURERS. CONDUIT LOCATIONS INDICATIVE ONLY.
4. CONTRACTOR TO BE AWARE OF V-DRAIN DURING CONSTRUCTION.
5. BENCHING TO BE APPLIED AS PER WSAA SEW-1300 SERIES DRAWINGS.
6. MECHANICAL COMPACTION OF ALL BACKFILL FOR STRUCTURES REQUIRED TO BE A MINIMUM OF 98%.
7. WET WELL STRUCTURE LIKELY TO BE ELLIPTICAL SHAPE FROM PACKAGE PUMP SUPPLIER FOR EASE OF TRANSPORT

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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0 250 500 750 1000 1250mm
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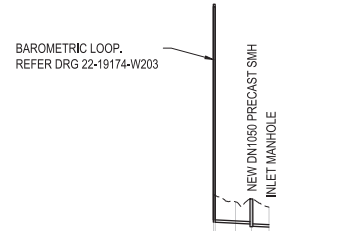
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION
PIPEWORK ARRANGEMENT PLAN

Original Size A1
Drawing No: 22-19174-W201
Rev: 0

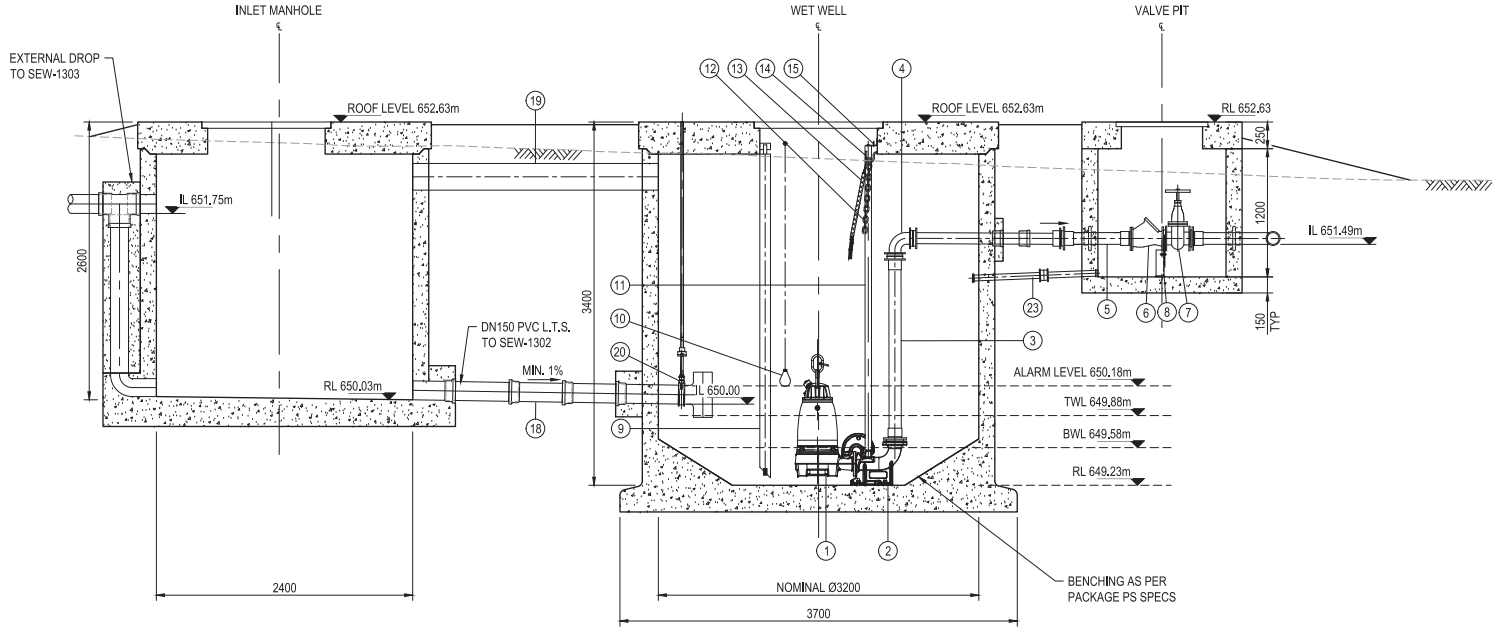
Plot Date: 20 June 2019 - 11:42 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W201-W203.dwg



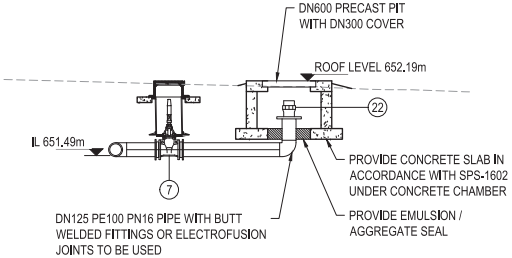
DEPTH TO INVERT	1.06	-7.02	-7.06	1.01	0.80	0.94	1.02	0.74
PIPE INVERT LEVEL	651.93	660.00	660.00	651.93	651.89	651.86	651.78	651.75
EXISTING SURFACE LEVEL	652.98	652.98	652.94	652.94	652.69	652.80	652.80	652.49
CHAINAGE	1791.72	1791.72	1792.38	1792.39	1800.00	1805.97	1805.98	1812.55

GRAVITY SEWER LONGITUDINAL SECTION FROM BAROMETRIC LOOP TO INLET MANHOLE

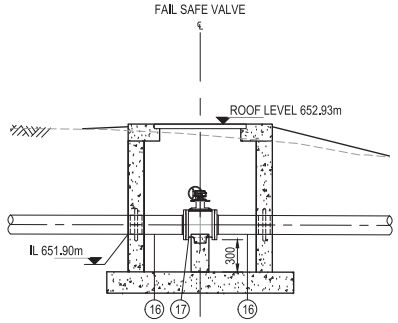
SCALE 1:1000 H 1:100 V



A W201 SECTION SCALE 1:25



B W201 SECTION SCALE 1:25



C W201 SECTION SCALE 1:25

NOTES:

1. OVERFLOW LEVEL 652.63m RL.
2. WET WELL, VALVE PIT AND FAIL SAFE VALVE TO HAVE LOCKABLE COVERS.
3. ANY PENETRATIONS TO WET WELL TO BE FILLED WITH FILL AUTHORISED BY PUMP WELL MANUFACTURER.
4. FOR DETAILS OF PIPE CONNECTION TO MH SEE SEW-1302-V.
5. ASSUME FLOOD LEVEL TO BE SURFACE LEVEL FOR USE BY PACKAGE PUMP STATION SUPPLIER FOR ANTI-FLOTATION CALCULATION FOR INLET MANHOLE AND WET WELL.
6. WET WELL AND INLET MANHOLE TO BE PRECAST WITH FACTORY APPLIED POLIBRID COATING 705 OR HYCHEM TL5 APPLIED TO WALLS AND UNDERSIDE OF ROOF.
7. PROVIDE VALVES OUTSIDE OF VALVE CHAMBER WITH SHROUD AND SURFACE BOX.

SCHEDULE OF PIPES AND FITTINGS

ITEM NO.	DESCRIPTION
1	SUBMERSIBLE PUMP NP 3171 SH 3~274 8L/s @ 56m OR EQUIVALENT
2	SS316 ANCHOR FIXING
3	PACKAGE PUMP STATION DISCHARGE CONNECTION
4	DN80 90° PVC BEND
5	DN80 PVC PIPE WITH PUDDLE FLANGE AND FLANGES WITH METAL BACKING RING
6	DN80 CHECK VALVE
7	DN80 RESILIENT SEATED GATE VALVE
8	PIPE SUPPORT BRACKET
9	LEVEL TRANSDUCERS AND FITTINGS
10	HIGH ALARM LEVEL ENM10
11	GUIDE BAR
12	LIFTING CHAIN
13	CABLE STOCKING
14	CHAIN AND CABLE HOOKS
15	UPPER GUIDE BAR BRACKET
16	DN150 FL-SP DICL PIPE WITH PUDDLE FLANGE L.T.S.
17	DN150 ACTUATED PLUG VALVE WITH FAIL SAFE
18	DN150 PVC PIPE L.T.S.
19	DN125 HDPE PN16
20	DN150 KNIFE GATE VALVE AND SURFACE BOX
22	4" PE CAMLOCK MALE COUPLING
23	DN50 PVC DRAIN LINE WITH FLAP VALVE

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No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

Note: * indicates signatures on original issue of drawing or last revision of drawing

VERTICAL 1:100 AT ORIGINAL SIZE 0 1 2 3 4 5m
HORIZONTAL 1:1000 AT ORIGINAL SIZE 0 10 20 30 40 50m
0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

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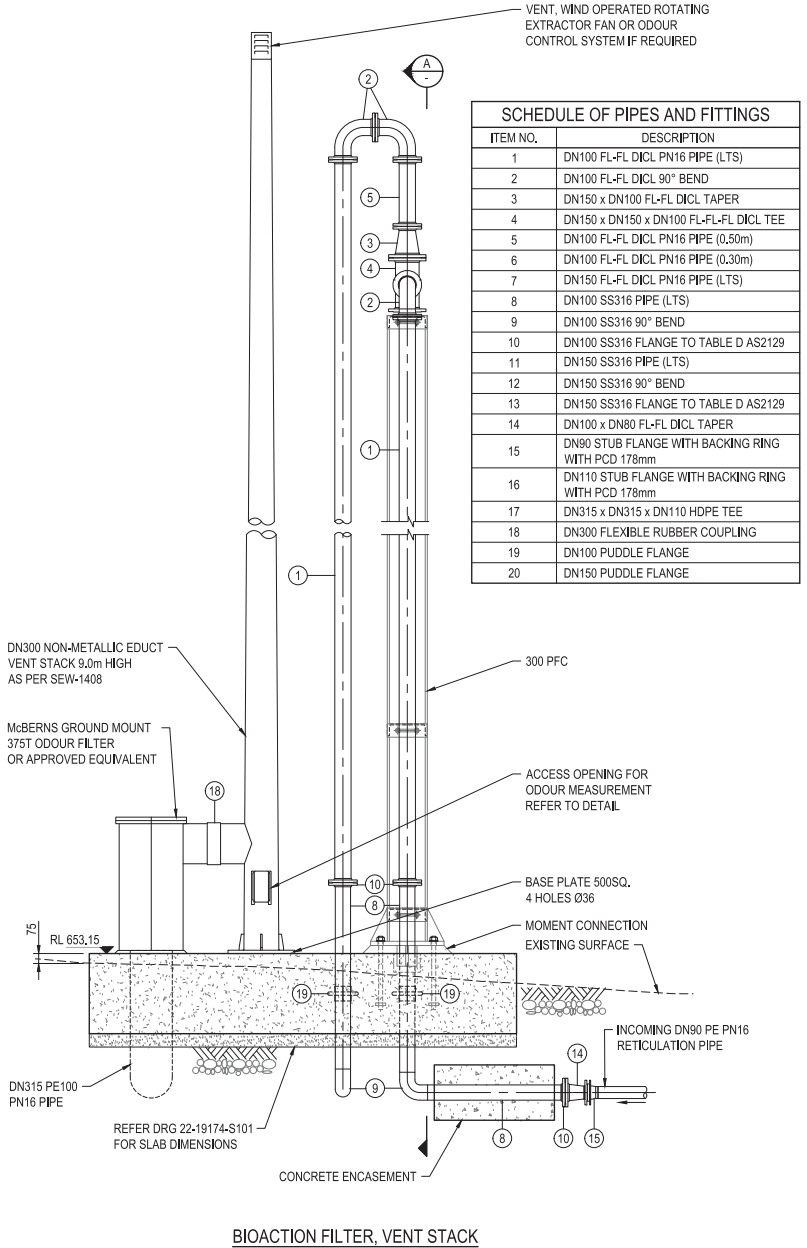
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION SECTION

Original Size A1 Drawing No: 22-19174-W202 Rev: 0

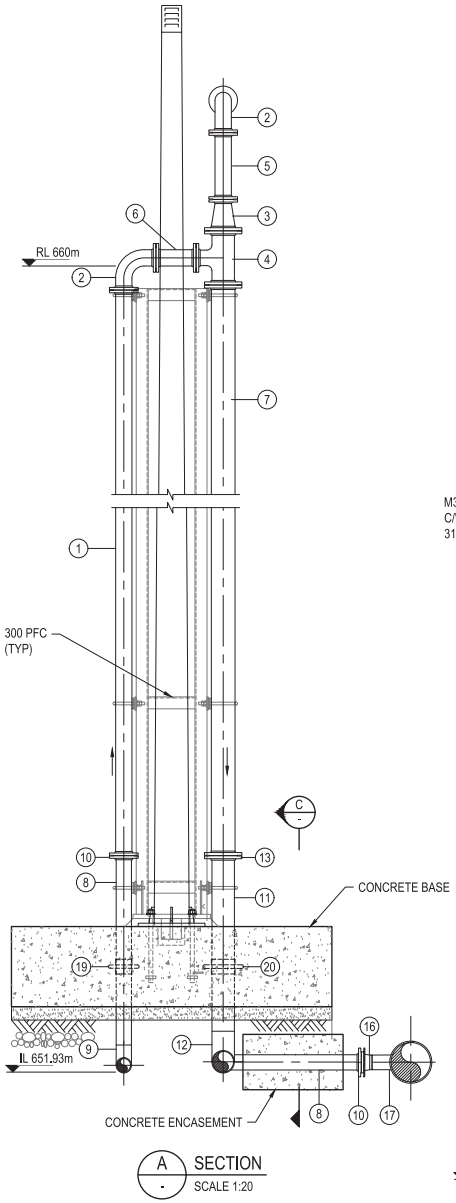
Plot Date: 20 June 2019 - 11:42 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-W201-W203.dwg



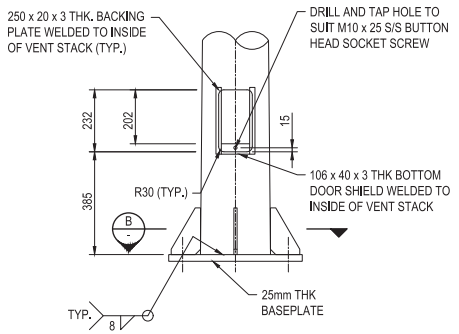
BIOACTION FILTER, VENT STACK AND BAROMETRIC LOOP DETAIL

SCALE 1:20

SCHEDULE OF PIPES AND FITTINGS	
ITEM NO.	DESCRIPTION
1	DN100 FL-FL DICL PN16 PIPE (LTS)
2	DN100 FL-FL DICL 90° BEND
3	DN150 x DN100 FL-FL DICL TAPER
4	DN150 x DN150 x DN100 FL-FL-FL DICL TEE
5	DN100 FL-FL DICL PN16 PIPE (0.50m)
6	DN100 FL-FL DICL PN16 PIPE (0.30m)
7	DN150 FL-FL DICL PN16 PIPE (LTS)
8	DN100 SS316 PIPE (LTS)
9	DN100 SS316 90° BEND
10	DN100 SS316 FLANGE TO TABLE D AS2129
11	DN150 SS316 PIPE (LTS)
12	DN150 SS316 90° BEND
13	DN150 SS316 FLANGE TO TABLE D AS2129
14	DN100 x DN80 FL-FL DICL TAPER
15	DN90 STUB FLANGE WITH BACKING RING WITH PCD 178mm
16	DN110 STUB FLANGE WITH BACKING RING WITH PCD 178mm
17	DN315 x DN315 x DN110 HDPE TEE
18	DN300 FLEXIBLE RUBBER COUPLING
19	DN100 PUDDLE FLANGE
20	DN150 PUDDLE FLANGE

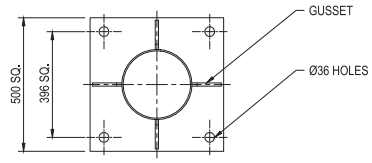


A SECTION
SCALE 1:20

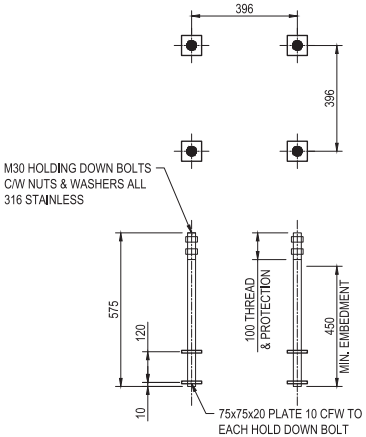


VENT STACK ACCESS OPENING DETAIL

SCALE 1:10

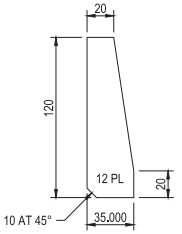


B SECTION
SCALE 1:10



VENT STACK BOLT DETAIL

SCALE 1:10

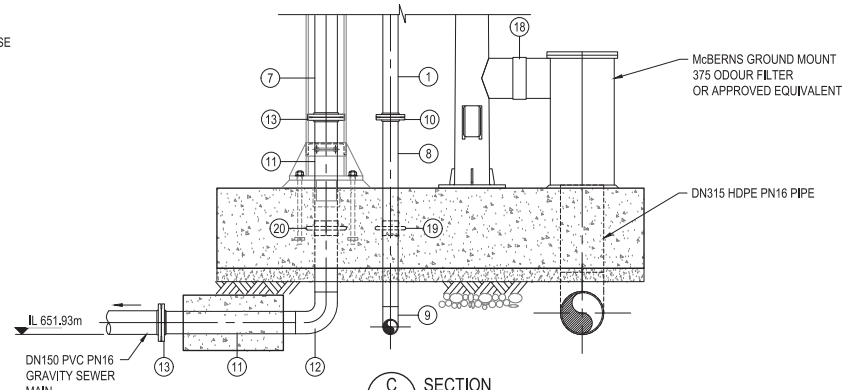


GUSSET DETAIL

SCALE 1:2

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN
2. PROTECT VENTS AGAINST INTERNAL AND EXTERNAL CORROSION BY SUITABLE COATING SYSTEM OR MANUFACTURE FROM CORROSION RESISTANT MATERIAL (EG GRP OR SS)
3. UNLESS SPECIFIED OTHERWISE DESIGN VENT STACKS FOR WIND LOADING TO AS/NZS 1170.2 FOR REGION 'A' CATEGORY 2 WITH A TOPOGRAPHICAL MULTIPLIER (M) OF 0.92.



C SECTION
SCALE 1:20

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No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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SCALE 1:2 AT ORIGINAL SIZE (0 20 40 60 80 100mm)
SCALE 1:10 AT ORIGINAL SIZE (0 100 200 300 400 500mm)
SCALE 1:20 AT ORIGINAL SIZE (0 200 400 600 800 1000mm)

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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

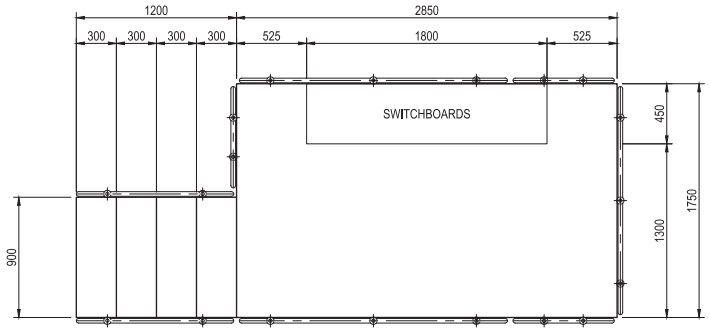
Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: BUNDARRA PUMP STATION
BAROMETRIC LOOP, VENT STACK AND GROUND MOUNT ODOUR FILTER DETAIL

Original Size: A1
Drawing No: 22-19174-W203
Rev: 0

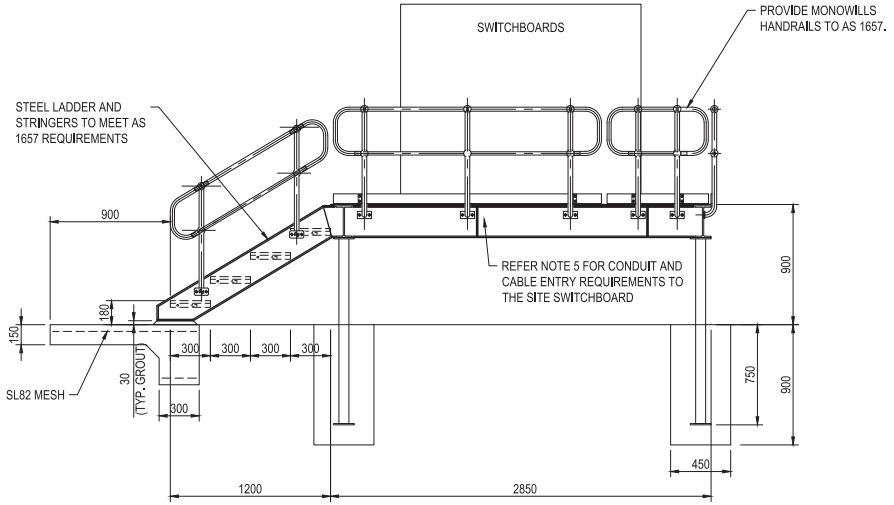
Plot Date: 20 June 2019 - 11:43 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W201-W203.dwg

NOTES:

1. STAIRS AND PLATFORM TO AS1657.
2. SWITCHBOARD DIMENSIONS TYPICAL TO BE CONFIRMED BY PUMP SUPPLIER.
3. STEELWORK AND FOOTINGS TO BE DESIGN BY CONTRACTOR. STEELWORK SHALL BE DESIGN IN ACCORDANCE WITH AS4100 BY A SUITABLY QUALIFIED CHARTERED ENGINEER.
4. PLATFORM SHALL COMPLY WITH AS1170 ENSURING IT CAN WITHSTAND MIN. 2.50 kPa LOAD.
5. ALL CABLES WILL ENTER / EXIT THE SWITCHBOARD FROM THE BOTTOM VIA UNDERGROUND CONDUITS. CONDUITS ENTERING / EXITING THE SWITCHBOARD WILL TURN UP AND RUN VERTICALLY TO THE UNDERSIDE OF THE PLATFORM. FIXED STEEL COVER TO PROTECT CONDUITS.



PROPOSED PLATFORM PLAN
SCALE 1:20



A - ELEVATION
SCALE 1 : 20

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0 200 400 600 800 1000mm
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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:20		

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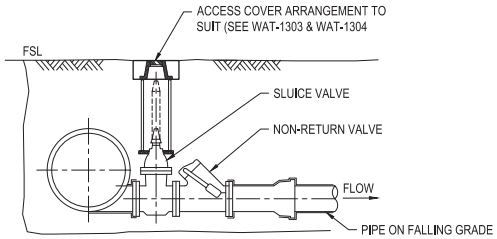
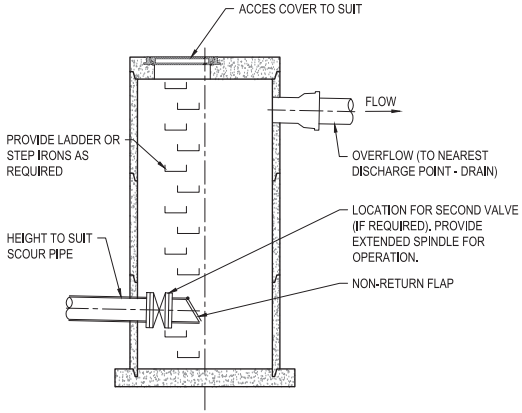
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION
SWITCHBOARD CONTROL PLATFORM DETAIL

Original Size A1
Drawing No: 22-19174-W204
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W204.dwg

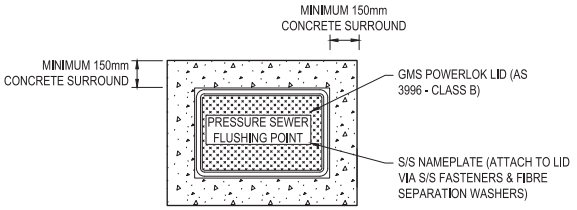


SCOUR CONNECTION DETAIL
SCALE: NTS

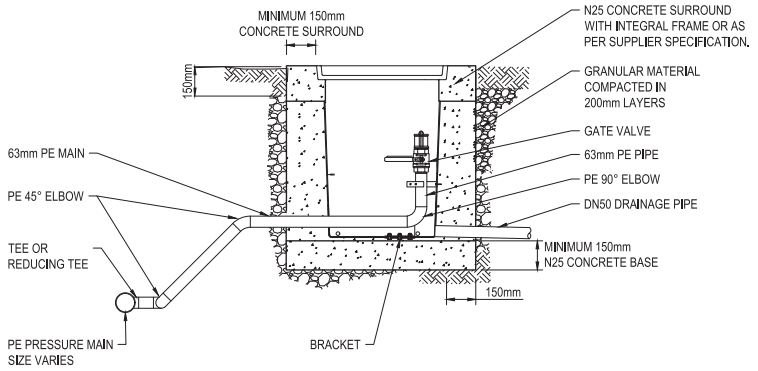


SCOUR DISCHARGE COLLECTION / PUMP OUT SUMP
SCALE: NTS

SCOUR CONNECTION FOR SEWER RISING MAIN



PLAN
NTS



SECTION
SCALE: NTS

FLUSHING POINT - TO SUIT TRAFFICABLE LIGHT DUTY AS 3996 CLASS B

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. USE ONLY APPROVED COMPONENTS.
3. ENSURE COVER IS MARKED AS SHOWN. WHERE THE WARNING / NAME PLATE IS NOT CAST OR MOULDED INTO THE COVER, AFFIX AN ENGRAVED SS NAME PLATE USING SS FASTENERS.
4. PREPARE BEDDING UNDER PIT TO PROVIDE FIRM STABLE FOUNDATION.
5. INSTALL THE CLASS OF COVER AND FRAME AS SPECIFIED IN THE DESIGN DRAWINGS.
6. TEST ASSEMBLY AND CONNECTING PRESSURE SEWERS HYDROSTATICALLY AFTER INSTALLATION IN ACCORDANCE WITH CODE.
7. ALL PRESSURE PIPEWORK ITEMS TO BE PN16.
8. SCOUR CONNECTIONS TO BE INSTALLED AS PER WAT-1307.
9. FLUSHING POINTS TO BE INSTALLED AS PER PSS-1007.

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No	Revision	Drawn	Job Manager	Project Director	Date
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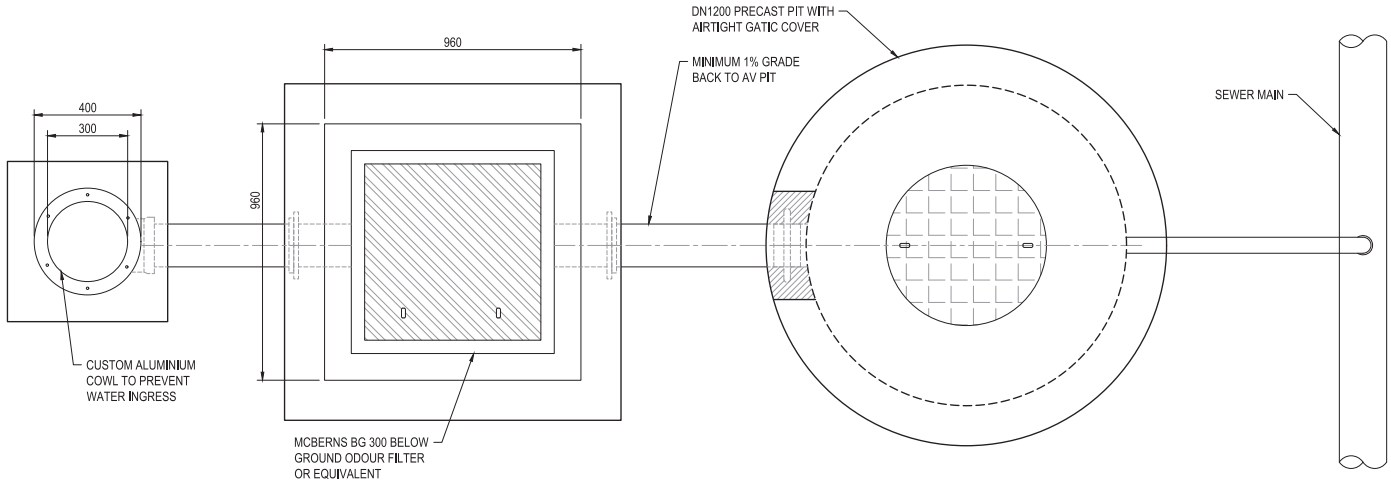
Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	NTS	This Drawing must not be used for Construction unless signed as Approved	

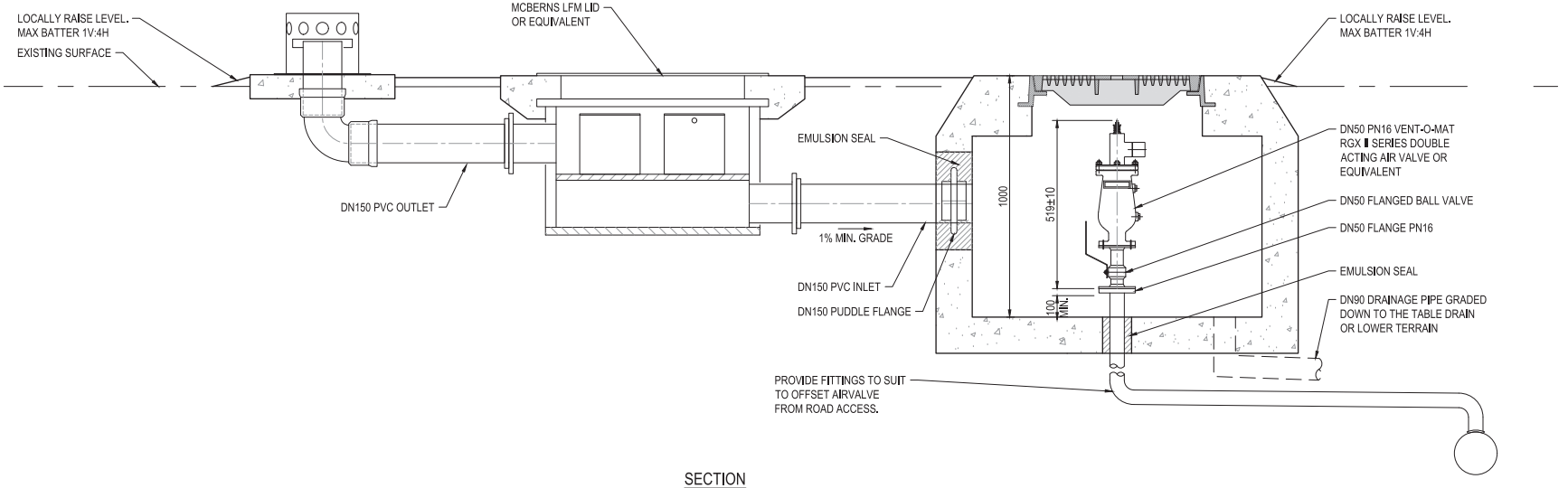
Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: PRESSURE SEWER MAINS TYPICAL DETAILS SCOUR CONNECTION AND FLUSHING POINT

Original Size: A1
Drawing No: 22-19174-W250
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W250-251.dwg



PLAN
SCALE 1:10



SECTION
SCALE 1:10

ODOUR FILTER WITH BELOW GROUND AIR VALVE TYPICAL DETAILS

NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN	LAC	AMS	LMS	20.06.19

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0 100 200 300 400 500mm
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Drafting Check	M. BUMOTAD	Design Check	A. MUNOZ
Approved (Project Director)	L. SYLVA		
Date	17.06.19		
Scale	1:10		

This Drawing must not be used for Construction unless signed as Approved

Client: URALLA SHIRE COUNCIL
Project: BUNDARRA SEWERAGE SCHEME
Title: ODOUR FILTER WITH BELOW GROUND AIR VALVE TYPICAL DETAILS

Original Size: A1
Drawing No: 22-19174-W251
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-W250-251.dwg

GENERAL:

G1. READ THESE NOTES IN CONJUNCTION WITH ARCHITECTURAL AND OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. REFER TO ARCHITECTURAL DRAWINGS FOR SETTING OUT AND DETAIL DIMENSIONS. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES, THEN SPECIFICATION.

G2. CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE LEGISLATION, STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONNEL AND GENERAL PUBLIC IN ACCORDANCE WITH ALL CURRENT WORK HEALTH AND SAFETY ACTS, LEGISLATIVE REQUIREMENTS, ASSOCIATED REGULATIONS AND CODES OF PRACTICE, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE.

G3. REFER DISCREPANCIES TO SUPERINTENDENT BEFORE PROCEEDING WITH WORK.

G4. SUBMIT DETAILS OF PROPOSED CHANGES TO SCOPE, WORK METHODS OR MATERIALS etc FOR APPROVAL BEFORE PROCEEDING. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT.

G5. CHECK STRUCTURAL DRAWINGS AGAINST ARCHITECTURAL, MECHANICAL, ELECTRICAL SERVICES AND OTHER DRAWINGS FOR REQUIREMENTS FOR PENETRATIONS, CONDUITS, DUCTS, PIPES, etc.

G6. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE, BUT INDICATES REQUIRED PROPERTIES OF ITEM. SIMILAR ALTERNATIVES HAVING REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.

G7. OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. NOTIFY RELEVANT SERVICE AUTHORITIES BEFORE COMMENCING WORK ON SITE.

G8. GIVE TWO WORKING DAYS' (48 HOURS) NOTICE SO THAT INSPECTION MAY BE MADE OF CRITICAL STAGES OF WORK.

G9. INSPECTIONS AND REVIEWS UNDERTAKEN BY SUPERINTENDENT OR OTHERS DO NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

G10. DO NOT OBTAIN DIMENSIONS BY SCALING FROM DRAWINGS.

G11. DIMENSIONS ARE IN MILLIMETRES, LEVELS ARE IN METRES UNO, CHAINAGES ARE IN METRES UNO.DATUM FOR LEVELS IS AHD (AUSTRALIAN HEIGHT DATUM). CO-ORDINATES ARE TO MGA94 (MAP GRID OF AUSTRALIA) AMG (AUSTRALIAN MAP GRID).

G12. HAVE SURVEY AND SETTING OUT UNDERTAKEN BY A REGISTERED SURVEYOR.

G13. VERIFY ON SITE SETTING OUT DIMENSIONS AND EXISTING MEMBER SIZES SHOWN ON DRAWINGS BEFORE SHOP DRAWINGS, CONSTRUCTION AND FABRICATION IS COMMENCED. EXISTING STRUCTURES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY.

G14. USE STANDARD BOLT PATTERNS etc. THROUGHOUT THE WORKS TO AVOID CONFUSION OR AMBIGUITY.

G15. TAKE CARE OF HAZARDS ASSOCIATED WITH BURIED, CONCEALED OR OVERHEAD SERVICES. TAKE PRECAUTIONS AND WORKMANSHIP UNDERTAKE EXPLORATION TO ESTABLISH LOCATION OF AND PROTECT EXISTING SERVICES AT SITE. SERVICES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY. SERVICES OTHER THAN THOSE SHOWN MAY EXIST ON SITE. MARK LOCATIONS OF SERVICES CLEARLY ON SITE, AND ON AS-BUILT DRAWINGS. HAND EXCAVATE WITHIN ONE METRE OF IN-GROUND SERVICES.

G16. DISPOSE OF SURPLUS MATERIAL OFF SITE IN ACCORDANCE WITH LOCAL AUTHORITY WASTE REGULATIONS.

G17. IMPLEMENT SOIL AND WATER MANAGEMENT PROCEDURES TO AVOID EROSION, CONTAMINATION AND SEDIMENTATION OF SITE, SURROUNDING AREAS AND DRAINAGE SYSTEMS.

G18. WORKMANSHIP AND MATERIALS TO COMPLY WITH REQUIREMENTS OF AUSTRALIAN STANDARDS, NATIONAL CONSTRUCTION CODE (NCC) AND BY-LAWS AND ORDINANCES OF RELEVANT BUILDING AUTHORITIES. ALL STANDARDS REFERRED TO ARE THOSE CURRENT (AS AMENDED) AT COMMENCEMENT OF CONTRACT.

G19. OBTAIN REQUIREMENTS FOR SERVICES, ADJOINING ELEMENTS etc TO BE EMBEDDED IN, FIXED TO OR SUPPORTED ON WORK AND PROVIDE FOR REQUIRED FIXINGS. PROVIDE FOR TEMPORARY SUPPORT OF ADJOINING ELEMENTS DURING CONSTRUCTION. DRAWINGS DO NOT SHOW DETAILS OF ALL FIXTURES, INSERTS, SLEEVES, RECESSES OR OPENINGS etc REQUIRED.

G20. PROTECT EXISTING STRUCTURES FROM DAMAGE OR CRACKING. MAKE GOOD ANY DAMAGE TO EXISTING ELEMENTS AT COMPLETION OF WORKS.

G21. WHERE NEW WORK ABUTS EXISTING, PROVIDE SMOOTH TRANSITION FREE OF ABRUPT CHANGES.

G22. NEATLY CUT BACK CONCRETE TO BE REMOVED TO A CLEAN TRUE FACE USING A DIAMOND SAW.

G23. HAVE TESTING PERFORMED BY AN INDEPENDENT NATA (NATIONAL ASSOCIATION OF TESTING AUTHORITIES) ACCREDITED AUTHORITY, AND PROVIDE TEST REPORTS TO SUPERINTENDENT.

G24. SEPARATE METALS FROM INCOMPATIBLE MATERIALS (eg STAINLESS STEEL, GALVANIZED STEEL, UNGALVANIZED STEEL AND TREATED TIMBER etc) BY CONCEALED LAYERS OF SUITABLE INERT MATERIALS OF SUITABLE THICKNESSES. USE PLASTIC SLEEVES AND WASHERS FOR BOLTS, etc.

G25. EXTERNAL ELEMENTS ARE THOSE EXPOSED TO WEATHER, RAIN AND WATER PENETRATION IN FINAL WORKS.

G26. SUPPLY RELEVANT NOTES, DRAWINGS AND SPECIFICATIONS etc TO SUB-CONTRACTORS.

G27. UNO=UNLESS NOTED OTHERWISE, SLS=SERVICEABILITY LIMIT STATE, ULS=ULTIMATE LIMIT STATE, NSL=NATURAL SURFACE LEVEL, FSL=FINISHED SURFACE LEVEL.

G28. SUPERINTENDENT=SUPERINTENDENT NOMINATED ON CONTRACT.

G29. BUILD, FABRICATE AND PROCURE ONLY FROM DRAWINGS 'ISSUED FOR CONSTRUCTION'.

G30. KEEP ON SITE A COMPLETE SET OF CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS) AND SITE INSTRUCTIONS.

TEMPORARY WORKS

G31. THESE DRAWINGS DO NOT DETAIL TEMPORARY WORKS. CONSTRUCTION METHODS AND TEMPORARY WORKS ARE RESPONSIBILITY OF THE CONTRACTOR.

G32. PROVIDE SCAFFOLDING, BARRIERS, FALL RESTRAINT, HAND-MID RAILS AND TOE BOARDS FOR WORK AT HEIGHT. ERECT ACCESS STAIRS AT EARLIEST OPPORTUNITY TO REDUCE OPEN SHAFT HAZARDS AND FACILITATE ACCESS. MAINTAIN SAFETY MESH AND BARRIERS TO ALL OPENINGS AND ELEVATED EDGES.

G33. MAINTAIN STRUCTURE IN A STABLE CONDITION DURING CONSTRUCTION AND PROVIDE TEMPORARY BRACING AND/OR SUPPORT AS REQUIRED. SHOW TEMPORARY MEMBERS ON SHOP DRAWINGS. PROVIDE SPREADERS AT LOADS AND/OR LIFTING POINTS WHERE REQUIRED. ENSURE NO PART IS OVERSTRESSED. DO NOT PLACE OR STORE BUILDING MATERIALS ON, SUPPORT FORMWORK OR PROP FROM STRUCTURAL MEMBERS WITHOUT SUPERINTENDENT'S APPROVAL. PROVIDE CALCULATIONS BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO PROVE ADEQUACY OF STRUCTURE FOR PROPOSED CONSTRUCTION SEQUENCE, METHODS AND LOADS INCLUDING PROPPING, CRANE LIFTS etc.

G34. PROVIDE TEMPORARY BRACING WHERE REQUIRED FOR STRUCTURAL ELEMENTS OR FRAMES STABILIZED BY MASONRY, PRECAST CONCRETE OR OTHER ELEMENTS CONSTRUCTED AFTER ERECTION OF THE STRUCTURAL ELEMENT OR FRAME, AND SHOW ON SHOP DRAWINGS.

DESIGN ASSUMPTIONS

G35. STRUCTURAL WORK HAS BEEN DESIGNED FOR FOLLOWING LOADS:
- PERMANENT DEAD LOAD OF STRUCTURE AS SHOWN ON DRAWINGS
- SUPERIMPOSED PERMANENT LOAD:

~ REGION	A3
~ AVERAGE RECURRENCE INTERVAL, R	500 years
~ ULTIMATE REGIONAL WIND SPEED VR (3 sec GUST)	45 m/s
~ SERVICEABILITY REGIONAL WIND SPEED V25 (3 sec)	37 m/s
~ DIRECTIONAL MULTIPLIER	1.0
~ TERRAIN CATEGORY	2
~ TERRAIN/HEIGHT MULTIPLIER (Mz,cat)	0.92
~ SHIELDING MULTIPLIER (Ms)	1.0
~ TOPOGRAPHIC MULTIPLIER (Mt)	1.0

EARTHWORKS, FOUNDATIONS AND FOOTINGS

F1. REMOVE TOPSOIL, MATERIAL CONTAINING GRASS ROOTS OR OTHER ORGANIC MATTER RUBBLE AND / OR DEBRIS AND ALL UNSUITABLE MATERIAL BELOW FOUNDATIONS AND WHERE SHOWN ON DRAWINGS.

F2. STOCKPILE SUITABLE TOPSOIL FOR RE-USE TO 1500 mm MAXIMUM HEIGHT.

F3. DO NOT STOCKPILE MATERIAL AGAINST RETAINING WALLS, BUILDINGS, FENCES OR TREES etc. DO NOT OBSTRUCT THE FREE FLOW OF WATER.

F4. NOTIFY SUPERINTENDENT IF GROUND WATER ENCOUNTERED.

F5. FOOTINGS HAVE BEEN DESIGNED FOR ASSUMED SAFE WORKING BEARING PRESSURE OF 100 kPa IN UNDISTURBED NATURAL SUBGRADE. CONTRACTOR TO CHECK AND CONFIRM ALLOWABLE BEARING PRESSURE WITH A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER.

F6. CONSTRUCT FOOTINGS FOUNDED IN SPECIFIED MATERIALS (AS ABOVE, OR IN GEOTECHNICAL REPORT). REMOVE SOFTENED OR LOOSE MATERIAL AND MATERIAL THAT DOES NOT ACHIEVE THESE PRESSURES. ENSURE FORMATION IS CLEAN AND LEVEL. PROVIDE FORMWORK WHERE SIDES OF EXCAVATIONS NOT STABLE UNO.

F7. PROOF ROLL FORMATION WITH HEAVY DUTY ROLLER.

F8. OBTAIN APPROVAL OF FOUNDATION MATERIAL FOR THE DESIGN PRESSURES FROM SUITABLY QUALIFIED GEOTECHNICAL ENGINEER/SUPERINTENDENT/BUILDING AUTHORITY BEFORE FIXING REINFORCEMENT OR PLACING CONCRETE.

STEEL

S1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS4100, AS/NZS4600, AS/NZS1554 AND AS4673 FOR STAINLESS STEEL.

S2. PROVIDE STEEL IN ACCORDANCE WITH:
- AS1163 GRADE C350 OR C450 FOR RECTANGULAR AND SQUARE HOLLOW SECTIONS,
- AS1163 GRADE C250 OR C350 FOR CIRCULAR HOLLOW SECTIONS, AS NOTED ON DRAWINGS
- AS1397 GRADE G450 FOR PURLINS AND GIRTS,
- AS1443 COLD-FINISHED BARS,
- AS/NZS1594 GRADE 250 HOT-ROLLED STEEL FLAT PRODUCTS,
- AS/NZS3678 FOR PLATES AND FLOOR PLATE,
- AS/NZS3679 PART 2, GRADE 300 FOR WELDED BEAMS AND WELDED COLUMNS,
- AS/NZS3679 PART 1 GRADE 300 OR BHP GRADE 300 PLUS FOR UNIVERSAL BEAMS, UNIVERSAL COLUMNS, PARALLEL FLANGE CHANNELS, ANGLES, FLATS, BARS AND RODS,
- OTHERWISE TO COMPLY WITH AS/NZS3678 OR AS/NZS3679 GRADE 250 UNO.

S3. MANUFACTURERS AND PROCESSORS OF STRUCTURAL STEEL MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH RELEVANT STANDARDS, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL STRUCTURAL STEELWORK.

S4. MARK STEEL GRADES ON STRUCTURAL MEMBERS IN NON-CRITICAL AREAS. USE IDENTIFICATION MARKS COMPATIBLE WITH AND VISIBLE THROUGH PAINT SYSTEM. ENSURE METAL DECKING, FLOOR PLATE AND FLOOR GRATING SECURELY FIXED IN POSITION BEFORE ALLOWING GENERAL CONSTRUCTION ACCESS.PROVIDE 3 mm CAP PLATES SEAL WELDED TO HOLLOW SECTIONS UNO.

S5. CARRY OUT ERECTION OF STEELWORK IN ACCORDANCE WITH AS3828 GUIDELINES FOR THE ERECTION OF BUILDING STEELWORK.

S6. PROTECT STEELWORK FROM DAMAGE DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. SUBMIT PROPOSED METHOD TO REPAIR DAMAGE FOR APPROVAL. PROTECT STEELWORK STORED ON SITE FROM CORROSION OR DETERIORATION OF COATINGS.

S7. PLUMB COLUMNS WITH METAL PACKERS OR SHIMS.

S8. SEQUENCE ERECTION WORKS TO AVOID PINCH POINTS AND SITE CONGESTION.

S9. INSTALL BEAMS WITH NATURAL CAMBER UPWARD. PROVIDE BEAMS WITH AN UPWARDS PRECAMBER AS SHOWN ON DRAWINGS.WHERE STEEL BEARS ON LOAD BEARING MASONRY AND BRICKWORK, PROVIDE 150 mm MINIMUM BEARING ON 20 mm NOMINAL THICK LEVELLING GROUT UNO.

S10. PROVIDE STEEL MEMBERS MADE FROM WHOLE LENGTHS WHEREVER POSSIBLE. SEEK APPROVAL TO MAKE LENGTHS UP OF SECTIONS JOINED BY COMPLETE PENETRATION FULL STRENGTH BUTT WELDS GROUND FLUSH WHERE REQUIRED. WHERE PROPOSED, SHOW JOINTS ON SHOP DRAWINGS. ENSURE MEMBERS ARE CONCENTRIC AT CONNECTIONS (GRAVITY- OR GAUGE-LINES TO INTERSECT) UNO. ACCURATELY PRE-FORM PARTS TO AVOID FORCE AND/OR RESTRAINT DURING JOINING.

S11. DRILL HOLES FULL SIZE OR REAM TO FULL SIZE AFTER SUB-DRILLING OR SUB-PUNCHING. SUB-DRILLED OR SUB-PUNCHED HOLES TO BE AT LEAST 3 mm UNDERSIZE. "OXY" OR FLAME CUTTING OF HOLES IS NOT PERMITTED. BOLT HOLE SIZE TO BE:
- BOLT DIAMETER PLUS 2 mm FOR STEEL TO STEEL CONNECTIONS.
- BOLT DIAMETER PLUS 4 mm FOR STEEL TO CONCRETE CONNECTIONS.
- BOLT DIAMETER PLUS 4 mm FOR HOLDING DOWN BOLTS UP TO M20.
- BOLT DIAMETER PLUS 6 mm FOR HOLDING DOWN BOLTS M24 OR LARGER.

WELDING

S12. DEVELOP WELD PROCEDURES TO SUIT JOINT DETAILS AND SHOW ON SHOP DRAWINGS. USE PREQUALIFIED WELD PROCEDURES AND CONSUMABLES TO AS/NZS1554.1 CLAUSE 4.3 OR DEVELOP QUALIFICATION OF WELD PROCEDURE AND CONSUMABLES BY TESTING TO AS/NZS1554.1 CLAUSE 4.2. LIST APPLICABLE PARAMETERS ON WELDING PROCEDURE QUALIFICATION RECORD AND MAKE RECORD AVAILABLE FOR INSPECTION.

S13. WELDING TO BE UNDERTAKEN BY SUITABLY QUALIFIED EXPERIENCED WELDER UNDER SUPERVISION OF QUALIFIED WELDING SUPERVISOR.

S4. CARRY OUT WELDING TO AS/NZS1554: ALL INTERFACES BETWEEN STEEL SECTIONS TO BE CONNECTED WITH 6 mm CONTINUOUS FILLET WELDS ALL ROUND, BOTH SIDES UNO.
- WELDS TO BE SHOP WELDED UNO.
- WELDS TO BE CATEGORY SP.
- BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO.
- ELECTRODES TO BE LOW CARBON WITH TENSILE STRENGTH OF fuw=490 MPa, PRE-APPROVED TO AS/NZS1554, eg CLASSIFICATION B-E49XX.

S15. EXTENT OF WELD INSPECTION/TESTING TO BE:
- VISUAL SCANNING: 100% OF WELDS
- VISUAL EXAMINATION: 100% OF BUTT WELDS IN TENSION MEMBERS AND 50% OF OTHER WELDS
- RADIOGRAPHIC OR ULTRASONIC: 10% OF BUTT WELDS IN TENSION MEMBERS AND 5% OF OTHER WELDS

S16. GRIND WELDS SMOOTH AND FLUSH WITH PARENT METAL WHERE NOMINATED ON DRAWINGS. GRIND ONLY IN LONGITUDINAL DIRECTION OF MEMBER.

S17. REPAIR FAULTY WELDS AND DEFECTS REVEALED BY WELD INSPECTION/TESTING AND REPEAT THE EXAMINATION.

S18. WELDS TO BE INSPECTED BY INDEPENDENT NATA ACCREDITED QUALIFIED WELDING INSPECTOR TO AS2214. PROVIDE WELDING INSPECTOR'S REPORT TO SUPERINTENDENT.

S19. WELDING SYMBOLS ARE TO AS1101.3. "CFW" INDICATES CONTINUOUS FILLET WELD. "FSBW" INDICATES FULL STRENGTH BUTT WELD WHICH IS EQUIVALENT TO CPBW. "CPBW" INDICATES COMPLETE PENETRATION BUTT WELD.

BASEPLATES AND HOLDING DOWN BOLTS

S20. HOLDING DOWN BOLTS TO BE GRADE 4.6 UNO. SUPPLY HOLDING DOWN BOLTS WITH TWO CLASS 5 HEXAGONAL HEAD NUTS AND EXTRA LARGE HARDENED OR 4 mm PLATE WASHER. HOT DIP GALVANIZE HOLDING DOWN BOLTS, NUTS AND WASHERS TO AS1214. TIE HOLDING DOWN BOLT GROUPS RIGIDLY TOGETHER PRIOR TO INSTALLATION (eg. TACK WELD WITH 10 mm DIAMETER REINFORCING BAR TO FORM A RIGID CAGE) TO ENSURE CORRECT BOLT LOCATIONS, AND SET OUT USING A 3 mm MILD STEEL TEMPLATE SUPPLIED BY STEELWORK FABRICATOR. PROVIDE 4 N12 LIGATURES TO FIX HOLDING DOWN BOLT CAGE SECURELY TO SLAB/FOOTING REINFORCEMENT.

S21. GROUT BASE PLATES, HOLDING-DOWN BOLTS, REBATES etc BEFORE LOADING COLUMNS OR ERECTING WALLS. USE APPROVED HIGH-STRENGTH (40MPa AT 7 DAYS) NON-SHRINK PRE-MIXED RAMMED GROUT. GROUT THICKNESS 15 mm MINIMUM, 40 mm MAXIMUM UNO. CHAMFER GROUT EDGES AT 45 DEGREES UNO. DO NOT LOAD GROUT UNTIL FULL STRENGTH ACHIEVED.

DURABILITY & PROTECTIVE COATINGS

S22. AFTER COMPLETION OF FABRICATION, PREPARATION FOR SURFACE TREATMENT TO BE: ROUND OFF ROUGH WELDS, SHARP EDGES (2 mm RADIUS) etc. SURFACE TO BE FREE OF WELDING SPATTER, SLAG, UNDERCUTS, VISIBLE PORES PITS AND CRATERS, VISIBLE SLIVERS, ROLL-OVERS, LAMINATIONS, ROLLED-IN EXTRANEOUS MATTER, GROOVES (RADIUS OF GOUGES TO BE LESS THAN 4 mm), INDENTATIONS, ROLL MARKS, BURRS, ARISES, CRACKS, etc. PREPARE WELDS, EDGES AND OTHER AREAS WITH SURFACE IMPERFECTIONS TO ISO 8501-3 PREPARATION GRADE P3.

S23. SURFACE PREPARATION: REMOVE OIL, GREASE AND OTHER CONTAMINANTS TO AS1627.1. ABRASIVE BLAST CLEAN TO AS1627.4 CLASS SA 2½ WITH SURFACE PROFILE 40 TO 70 MICRONS OR AS SPECIFIED BY COATINGS MANUFACTURER FOR THE SERVICE CONDITIONS. ASSESS ABRASIVE BLAST CLEANED SURFACE TO AS1627.9 AND SURFACE PROFILE TO AS3894.5. FOR SMALL AREAS WHERE ABRASIVE BLAST CLEANING IS NOT POSSIBLE OBTAIN APPROVAL FROM SUPERVISOR TO USE POWER TOOL CLEANING TO AS1627.2 CLASS St 3/PST 3 AS DEFINED IN ISO 8501.1 FOR STEEL CLEANED TO A METALLIC FINISH WITH MINIMUM 25 MICRON SURFACE PROFILE. REMOVE DUST BY BRUSHING OR VACUUM CLEANING.

S24. APPLY PROTECTIVE COATINGS AS SOON AS PRACTICABLE AFTER PREPARATION, WITHIN FOUR HOURS AND BEFORE FLASH RUST OR RUST BLOOM APPEARS. APPLICATION OF PROTECTIVE COATINGS TO COMPLY WITH MANUFACTURER'S RECOMMENDATIONS.

S25. UNLESS NOTED OTHERWISE ON DRAWINGS OR IN SPECIFICATION, SURFACE TREATMENT OF STEELWORK FOR ATMOSPHERIC CORROSION PROTECTION TO BE HDG390. APPLY PROTECTIVE COATINGS AS PER SYSTEM/SYSTEMS HOT DIP GALVANIZED OF AS/NZS2312 TABLE 6.3 IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. REPORT QA RECORDS IN A FORMAT SIMILAR TO AS3894 PARTS 10 TO 14. NON-SPECIFIED COLOURS WILL BE SELECTED BY SUPERINTENDENT.

CONCRETE

C1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS3600, AS2870, AS3610, AS1379 AS1478, AS3582, AS3799, AS2758.1, AS5100.5 AND AS3972. FOR LIQUID RETAINING STRUCTURES ALSO COMPLY WITH AS3735.

C2. WET CONCRETE TO BE UNIFORM, HOMOGENEOUS, COHESIVE AND ABLE TO WORK READILY INTO CORNERS AND AROUND REINFORCEMENT COMPLETELY FILLING FORMWORK WITHOUT SEGREGATION, EXCESS FREE WATER ON SURFACE, LOSS OF MATERIAL OR CONTAMINATION.
CONCRETE TO HAVE GOOD DIMENSIONAL STABILITY AND ABLE TO RESIST PLASTIC SETTLEMENT CRACKING, THERMAL CRACKING AND SHRINKAGE CRACKING.

C3. FINISHED CONCRETE TO BE A DURABLE, DENSE, HOMOGENEOUS MASS COMPLETELY FILLING FORMWORK, EMBEDDING REINFORCEMENT AND TENDONS, AND FREE OF STONE POCKETS OR HONEYCOMBS, OF UNIFORM COLOUR AND TEXTURE, WITH LOW PERMEABILITY AND ADEQUATE BUT NOT EXCESSIVE STRENGTH FOR GRADE.

C4. CONCRETE BLEED TO BE LESS THAN 3% FOR FLOOR AND ROOF SLABS, LESS THAN 2% FOR WALLS.

C5. AIR ENTRAINMENT IS NOT PERMITTED UNLESS APPROVED IN WRITING BY SUPERINTENDENT.

C6. REVIEW LOCATION OF EMBEDDED ITEMS TO MINIMIZE POSSIBLE ZONES OF POOR COMPACTION THAT MAY COMPROMISE STRUCTURAL INTEGRITY.

C7. EXTERNALLY EXPOSED CONCRETE TO BE CLASSIFICATION B1 UNO.

C8. QUALITY OF CONCRETE ELEMENTS TO BE AS FOLLOWS:

STRUCTURAL ELEMENT	BLINDING	CONCRETE FOOTING
EXPOSURE CLASSIFICATION	B1	A2
STRENGTH GRADE (MPa)	N10	S32
MINIMUM DENSITY (kg/m3)	-	2350
MAX. AGGREGATE SIZE (mm);	-	20
MAXIMUM / PEAK INSITU CONCRETE TEMPERATURE		65°C
CEMENT TYPE:	GB	SR
MINIMUM CEMENTITIOUS CONTENT (kg/m3)	100	

NOT FOR CONSTRUCTION

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	FINAL DETAILED DESIGN		SPB	AMS	LMS	20.06.19

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Client	URALLA SHIRE COUNCIL
Project	BUNDARRA SEWERAGE SCHEME
Title	BUNDARRA PUMP STATION STRUCTURAL STANDARD GENERAL NOTES SHEET 1 OF 3
Original Size	A1
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Rev:	0

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CONT. CONCRETE

C9. SUPPLEMENTARY CEMENTITIOUS MATERIALS INCLUDE AMORPHOUS SILICA FUME, FLY ASH, AND GROUND GRANULATED BLAST FURNACE SLAG (GGBFS OR SLAG) COMPLYING WITH AS3582.

C10. RHEOLOGY, WORKABILITY AND SLUMP TO BE AS REQUIRED FOR PLACEMENT (eg PUMPING, CHUTE etc), COMPACTION AND FINISHING. USE SUPERPLASTICISERS AND HIGH RANGE WATER REDUCERS TO AS1478 TO ACHIEVE ADEQUATE WORKABILITY.

C11. MAXIMUM SULPHATE CONTENT OF CONCRETE TO BE LESS THAN 5% BY MASS OF ACID SOLUBLE SO_3 AS A PERCENTAGE OF CEMENTITIOUS MATERIAL.

C12. TOTAL REACTIVE ALKALI CONTENT IN CONCRETE TO BE LESS THAN 2.8 kg/m3 Na2Oe (EQUIVALENT).

C13. USE CEMENTITIOUS MATERIALS LESS THAN SIX MONTHS OLD. USE BAGGED CEMENT IN ORDER OF RECEIPT.

C14. FOR GENERAL BLENDED CEMENT (GB) CONTAINING ORDINARY PORTLAND CEMENT PLUS AT LEAST 5% SUPPLEMENTARY CEMENTITIOUS MATERIALS:
- SILICA FUME TO BE LESS THAN 10%, OR
- FLYASH TO BE LESS THAN 25%, OR
- GROUND GRANULATED BLAST FURNACE SLAG TO BE LESS THAN 40%.

FOR DOUBLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN SMALLER OF PERCENTAGES GIVEN ABOVE FOR CONSTITUENTS INCLUDED. FOR TRIPLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN 40%.

C15. TEST FINE AND COARSE AGGREGATES FOR POTENTIAL AGGREGATE ALKALI REACTIVITY (AAR) USING CSIRO ACCELERATED MORTAR BAR TEST (REFER SAA HANDBOOK HB-69 APPENDIX B3.2). ALTERNATIVELY USE ASTM C1293 CONCRETE PRISM TEST. PETROGRAPHIC TESTING CAN PROVIDE ADDITIONAL AGGREGATE AAR RISK INFORMATION. TESTS MUST USE SAME CEMENT TYPE AS PROPOSED IN THE WORKS.

C16. SUPPLEMENTARY CEMENTITIOUS MATERIALS SPECIFIED IN TABLE ABOVE ARE IN ADDITION TO MATERIALS INCORPORATED IN GB CEMENT.

C17. ADMIXTURES TO COMPLY WITH AS1478. ADMIXTURES MUST NOT REDUCE STRENGTH OF CONCRETE BELOW SPECIFIED VALUE. ADMIXTURES MUST NOT CONTAIN CALCIUM CHLORIDE
USE ADMIXTURES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. CONCRETE ADMIXTURES SHALL NOT ENHANCE CORROSION OF REINFORCEMENT, NOR BE DETRIMENTAL TO CONCRETE OR STEEL DURING EXPECTED LIFE OF STRUCTURE. DO NOT USE CHEMICAL ADMIXTURES OR OTHER MATERIALS WITHOUT SUPERINTENDENT'S WRITTEN APPROVAL.

C18. MAXIMUM ACID SOLUBLE CHLORIDE ION CONTENT IS 4 kg/m3 OF CONCRETE. DO NOT USE STRONGLY IONIZED SALTS.

C19. DO NOT ADD WATER TO CONCRETE AFTER TRUCK HAS LEFT BATCHING PLANT.

C20. MIX CONCRETE TO ENSURE UNIFORM DISTRIBUTION OF CONSTITUENTS.

C21. SPRAYED CONCRETE TO COMPLY WITH CONCRETE INSTITUTE OF AUSTRALIA'S REFERENCE SPECIFICATION (REFER APPENDIX A OF "RECOMMENDED PRACTICE SPRAYED CONCRETE").

PLACING OF CONCRETE

C22. CONSTRUCTION TOLERANCES TO BE TO AS3610.

C23. FORMWORK, REINFORCEMENT AND COVER, DOWELS, WATERSTOPS,CAST-IN ITEMS etc TO BE INSPECTED AND APPROVED BY SUITABLY QUALIFIED GEOTECHNICAL ENGINEER /SUPERINTENDENT/BUILDING SURVEYOR BEFORE CONCRETE IS PLACED.

C24. REMOVE FREE WATER, DUST AND DEBRIS, STAINS etc FROM FORMS, EXCAVATIONS etc BEFORE PLACING CONCRETE. IN HOT CONDITIONS DAMPEN FORMWORK AND/OR SUB-GRADE BEFORE PLACING CONCRETE.

C25. INSTALL 0.2 mm HIGH IMPACT RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 TO BASE TO RETAIN WATER IN FRESH CONCRETE.

C26. PLACE CONCRETE IN LAYERS LESS THAN 300 mm THICK FOR FIRST LAYER AND 75% OF IMMERSION VIBRATOR LENGTH FOR SUBSEQUENT LAYERS, AND VIBRATE EACH LAYER BEFORE PLACING NEXT.

C27. ELAPSED TIME BETWEEN WETTING OF MIX AND DISCHARGE OF CONCRETE AT SITE MUST BE AS SHORT AS POSSIBLE, AND MUST NOT EXCEED LIMITS GIVEN WITHOUT SUPERINTENDENT'S PRIOR WRITTEN CONSENT.

CONCRETE TEMPERATURE AT TIME OF DISCHARGE (°C)	MAXIMUM ELAPSED TIME (HOURS)
10 - 24	2.00
24 - 27	1.50
27 - 30	1.00
30 - 32	0.75

C28. ELAPSED TIME LIMITS MAY BE VARIED IF TRIALS DEMONSTRATE USE OF SET RETARDERS (TYPE Re OR WRRe TO AS1478) PROVIDE ADEQUATE RETENTION OF WORKABILITY FOR LONGER PERIODS AT REQUIRED TEMPERATURE. SLUMP LIMITS STILL APPLY. RETEMPERING BEYOND MAXIMUM ALLOWED DISCHARGE TIME USING WATER OR ADMIXTURES IS NOT ALLOWED.

C29. USE PLACEMENT METHODS THAT WILL MINIMISE PLASTIC SETTLEMENT AND SHRINKAGE CRACKING. LIMIT VERTICAL FREE FALL BY USE OF CHUTES, etc. KEEP CHUTES VERTICAL, FULL AND IMMERSED IN CONCRETE. PLACE CONCRETE IN LAYERS AND BLEND SUCCEEDING LAYERS BY COMPACTION. MAINTAIN CONCRETE EDGE IN A PLASTIC STATE. PROPERLY COMPACT CONCRETE USING MECHANICAL VIBRATORS (AND HAND METHODS IF REQUIRED) TO REMOVE AIR BUBBLES AND GIVE MAXIMUM COMPACTION WITHOUT SEGREGATION OF CONCRETE. TAKE CARE TO AVOID CONTACT BETWEEN VIBRATORS AND PARTIALLY HARDENED CONCRETE, FORMWORK OR REINFORCEMENT. DO NOT USE VIBRATORS TO MOVE CONCRETE ALONG FORMS.

C30. DO NOT DISTURB CONCRETE ONCE INITIAL SET OCURRED.

C31. OBTAIN SUPERINTENDENT'S WRITTEN APPROVAL OF PLACEMENT METHODS FOR CONCRETE ELEMENTS GREATER THAN 1500 mm HEIGHT.

C32. KEEP ON SITE A LOG BOOK RECORDING EACH PLACEMENT OF CONCRETE INCLUDING DATE, CLIMATIC CONDITIONS, PORTION OF WORK, SPECIFIED GRADE AND SOURCE OF CONCRETE, DELIVERY DOCKET DATA, METHODS OF PLACEMENT AND COMPACTION, PROJECT ASSESSMENT CARRIED OUT, SLUMP MEASUREMENTS, VOLUME AND OTHER NOTABLE MATTERS.

C33. IN COLD WEATHER MAINTAIN TEMPERATURE OF FRESHLY MIXED CONCRETE WITHIN LIMITS SHOWN BELOW. "OUTDOOR" AIR TEMPERATURE IS AIR TEMPERATURE AT TIME OF MIXING, OR PREDICTED OR LIKELY AIR TEMPERATURE DURING NEXT 48 HOURS. BEFORE AND WHILE PLACING CONCRETE MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT > 5C. DO NOT USE CALCIUM CHLORIDE TO ACCELERATE SETTING TIME. DO NOT USE SALTS, CHEMICALS OR OTHER MATERIAL IN MIX TO LOWER THE FREEZING POINT OF CONCRETE. DO NOT ALLOW FROZEN MATERIALS TO ENTER MIXER. EVALUATE THE NEED FOR INSULATION OF CONCRETE SURFACES. DO NOT USE HIGH ALUMINA CEMENT.

C34. KEEP FORMS, MATERIALS, EQUIPMENT IN CONTACT WITH CONCRETE FREE OF FROST AND ICE. HEAT CONCRETE MATERIALS (OTHER THAN CEMENT) TO MINIMUM TEMPERATURE NECESSARY TO ENSURE TEMPERATURE OF PLACED CONCRETE IS WITHIN LIMITS SPECIFIED. MAXIMUM WATER TEMPERATURE: 60C WHEN PLACED IN MIXER.

OUTDOOR AIR TEMPERATURE	TEMPERATURE OF CONCRETE	
	MINIMUM	MAXIMUM
> 5°C	10°C	32°C
< 5°C	18°C	32°C

C35. IN HOT WEATHER PREVENT PREMATURE STIFFENING OF FRESH CONCRETE; REDUCE WATER ABSORPTION AND EVAPORATION LOSSES. MIX, TRANSPORT, PLACE AND COMPACT CONCRETE AS QUICKLY AS POSSIBLE. DURING PLACEMENT TEMPERATURE OF CONCRETE MUST NOT EXCEED TEMPERATURES BELOW:

OUTDOOR AIR TEMPERATURE	TEMPERATURE LIMIT
UNREINFORCED CONCRETE IN SECTIONS > 1 METRE EACH DIMENSION	27°C
CONCRETE fc > 40 MPa IN SECTIONS > 500mm THICKNESS	27°C
CONCRETE IN FOOTINGS, BEAMS, COLUMNS, WALL AND SLABS fc < 32 MPa	32°C
ELSEWHERE	32°C

DO NOT MIX CONCRETE WHEN SURROUNDING OUTDOOR SHADE TEMPERATURE 38C. MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT 32C BEFORE AND DURING PLACING. COOL REINFORCEMENT AND FORMWORK AS REQUIRED. MAINTAIN SPECIFIED TEMPERATURE OF PLACED CONCRETE BY:
- PLACING CONCRETE WHEN AMBIENT TEMPERATURE IS LOW (AT NIGHT)
- COOL CONCRETE USING LIQUID NITROGEN INJECTION BEFORE PLACING, OR
- COVER CONTAINER IN WHICH CONCRETE IS TRANSPORTED TO FORMS, OR
- SHADING AND SPRAYING COARSE AGGREGATE USING COLD WATER, OR USE CHILLED MIXING WATER.

C36. FOR CONCRETE ELEMENTS GREATER THAN 500 mm THICK THAT MAY EXCEED THE MAXIMUM PEAK TEMPERATURE, OR MAXIMUM TEMPERATURE DIFFERENTIAL, OR ARE LIQUID RETAINING OR LIQUID EXCLUDING: UNDERTAKE A CONCRETE EARLY AGE THERMAL / RESTRAINT AND SHRINKAGE CRACK RISK ASSESSMENT (ie WILL CRACKS FORM AND WHAT WIDTH), AND SUBMIT TO SUPERINTENDENT FOR APPROVAL AT LEAST FOUR WEEKS PRIOR TO DELIVERY OF CONCRETE. ASSESSMENT TO ALLOW FOR: CEMENT TYPE AND CONTENT, METHOD OF CONSTRUCTION, ELEMENT TYPE (PILE CAP, PIER, BEAM, FLOOR, ROOF etc), RESTRAINT BY PRIOR CAST CONCRETE, CONCRETE SHRINKAGE AND STRAIN, REINFORCEMENT RATIOS, BAR DIAMETER AND SPACING, CONCRETE THICKNESS, WIDTH AND LENGTH, TEMPERATURE OF ADJACENT CONCRETE, ENVIRONMENTAL CONDITIONS, TIME OF YEAR, TIME OF DAY, CONCRETE CASTING TEMPERATURE, CONCRETE SURFACE INSULATION, FORMWORK STRIPPING TIME, AND ALL OTHER MATTERS INFLUENCING CONCRETE TEMPERATURE AND RESTRAINT.

C37. PROTECT FRESH CONCRETE FROM PREMATURE DRYING - PARTICULARLY IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS, EXCESSIVELY HOT OR COLD TEMPERATURES, RAIN, etc. PROVIDE WIND BREAKS. MAINTAIN CONCRETE AT A REASONABLY CONSTANT TEMPERATURE WITH MINIMUM MOISTURE LOSS FOR CURING PERIOD.

C38. FOR CONCRETE WITH WATER:CEMENT RATIO LESS THAN 0.5, IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS SPRAY EXPOSED SURFACES OF FRESH CONCRETE WITH FOG SPRAY APPLICATION OF ALIPHATIC ALCOHOL RETARDANT IMMEDIATELY AFTER PLACEMENT TO REDUCE RISK OF PLASTIC SHRINKAGE CRACKING. IN SEVERE CLIMATIC CONDITIONS CONSIDER REVIBRATING CONCRETE BEFORE IT REACHES INITIAL SET.

C39. COMMENCE CURING OF CONCRETE TO AS3600 AS SOON AS POSSIBLE AFTER PLACING AND FINISHING OR STRIPPING, AND WITHIN ONE HOUR. ENSURE EXPOSED SURFACES ARE NOT STAINED. ACCEPTABLE METHODS OF CURING INCLUDE:
- RETENTION OF FORMWORK
- PONDING OR CONTINUOUS SPRINKLING WITH WATER (MOIST CURING)
- AN IMPERMEABLE MEMBRANE (USE CLEAR, WHITE OR LIGHT COLOURED PLASTIC IN HOT CONDITIONS) SEALED AROUND EDGES
- AN ABSORPTIVE COVER KEPT CONTINUOUSLY WET AND COVERED BY IMPERMEABLE MEMBRANE
- STEAM CURING
- AN APPROVED CURING COMPOUND. PROVIDE:
- EFFICIENCY INDEX
- CERTIFIED TEST RESULTS FOR WATER RETENTION TO AS3799 APPENDIX B
- EVIDENCE THAT AN ACCEPTABLE FINAL SURFACE COLOUR WILL BE OBTAINED
- EVIDENCE OF COMPATIBILITY WITH CONCRETE AND APPLIED FINISHES (IF ANY)
- METHODS OF OBTAINING REQUIRED ADHESION FOR TOPPINGS, RENDER etc.
- UNIFORM CONTINUOUS FLEXIBLE COATING WITHOUT VISIBLE BREAKS OR PINHOLES, WHICH REMAINS UNBROKEN FOR AT LEAST THE CURING PERIOD AFTER APPLICATION.

C40. DO NOT USE WAX-BASED OR CHLORINATED RUBBER-BASED CURING COMPOUNDS ON SURFACES FORMING SUBSTRATES TO APPLIED FINISHES, CONCRETE TOPPINGS AND CEMENT BASED RENDER.

C41. CURE CONTINUOUSLY UNTIL NUMBER OF DAYS DURING WHICH AIR TEMPERATURE IS ABOVE 10°C TOTALS:
- 3 DAYS FOR EXPOSURES CLASSIFICATION A1 AND A2
- 7 DAYS FOR EXPOSURE CLASSIFICATION B1, B2 AND C.

C42. PREVENT RAPID DRYING OUT AT END OF CURING PERIOD.

C43. FINISH CONCRETE SURFACES TO AS3610 AND AS SHOWN BELOW:
- FORMED SURFACES:
  - EXPOSED SURFACES 3C
  - HIDDEN SURFACES 5
- FINISHES AS LAID:
  - EXPOSED SURFACES STEEL TROWEL UNO
  - HIDDEN SURFACES WOOD FLOAT

C44. BEAM SIZES ARE DESIGNATED DEPTH (INCLUDING SLAB, IF ANY) x WIDTH. PLACE CONCRETE IN SLABS AT SAME TIME AS BEAMS INTEGRAL WITH THEM. SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE THICKNESS OF APPLIED FINISHES OR BLINDING.

C45. PROVIDE EXPOSED EDGES AND RE-ENTRANT CORNERS WITH 45 DEGREES x 25 mm CHAMFERS OR FILLETS UNO

C46. PROVIDE AN UPWARDS PRECAMBER AS SHOWN ON DRAWINGS.

C47. DO NOT MAKE HOLES, PENETRATIONS, RECESSES, CHASES, NOR EMBED PIPES (OTHER THAN THOSE SHOWN ON STRUCTURAL DRAWINGS) WITHOUT APPROVAL OF SUPERINTENDENT. DO NOT PLACE CONDUITS, PIPES etc WITHIN COVER CONCRETE. LOCATE CONDUITS, PIPES etc ONLY IN MIDDLE THIRD OF SLAB OR BEAM DEPTH AND BETWEEN REINFORCEMENT LAYERS, AND SPACED AT 3 x DIAMETER CENTRES MINIMUM. DO NOT CUT REINFORCEMENT AT PENETRATIONS WITHOUT APPROVAL

C48. PROVIDE DRIP GROOVES IN SOFFIT OF BEAMS AND SLABS AT EXTERNAL PERIMETER OF STRUCTURES. ENSURE COVER TO REINFORCEMENT IS ACHIEVED.

C49. REMOVE PROPS AND FORMWORK FOR BEAMS AND SLABS AND ENSURE CONCRETE HAS GAINED ADEQUATE STRENGTH BEFORE CONSTRUCTING WALLS OR PLACING OTHER PERMANENT LOADING ON WORK.

C50. WHERE CONCRETE BEARS ON LOAD BEARING MASONRY AND BRICKWORK, TROWEL SMOOTH AND FLAT A 5 mm THICK LAYER OF MORTAR AND SEPARATE CONCRETE THERE FROM WITH TWO LAYERS OF "SUPER ALCOR".

REINFORCEMENT COVER

C51. COVER IS CLEAR DISTANCE BETWEEN ANY REINFORCEMENT (INCLUDING LIGATURES, TIE WIRE etc) AND OUTSIDE SURFACE OF STRUCTURAL CONCRETE.

C52. COVER MUST NOT BE LESS THAN SPECIFIED. PROVIDE MINIMUM CLEAR COVER TO REINFORCEMENT AS SHOWN BELOW, EXCEPT WHERE SPECIFIED OTHERWISE:

LOCATION	COVER (mm)
FOOTINGS, UNDERSIDE SLABS ON GROUND, etc CAST AGAINST FORMWORK OR BLINDING	50
TOP OF SLAB AND FOOTING	30
ELSEWHERE	50

COVER GIVEN IS ONLY FOR CONCRETE CAST AGAINST FORMWORK OR CONCRETE BLINDING UNO. REQUEST REQUIRED COVER DIMENSION FROM SUPERINTENDENT WHERE CONCRETE IS CAST AGAINST GROUND OR A FLEXIBLE MEMBRANE ON GROUND. CONCRETE THICKNESS MAY BE INCREASED.

C53. PROVIDE 5100 mm BLINDING CONCRETE UNDER STRUCTURAL REINFORCED CONCRETE CAST ON GROUND UNO.

REINFORCEMENT

R1. SYMBOLS ON DRAWINGS FOR GRADE AND TYPE OF REINFORCEMENT ARE AS FOLLOWS:
- R: STRUCTURAL GRADE 250 PLAIN ROUND BAR TO AS/NZS4671
- N: HOT ROLLED GRADE 500 DEFORMED (RIBBED) BAR DUCTILITY CLASS N TO AS/NZS4671
- L: HOT ROLLED GRADE 500 DEFORMED BAR DUCTILITY CLASS L TO AS/NZS4671
- SL: HARD DRAWN WIRE GRADE 500 SQUARE MESH DUCTILITY CLASS L TO AS/NZS4671
- RL: HARD DRAWN WIRE GRADE 500 RECTANGULAR MESH DUCTILITY CLASS L TO AS/NZS4671
- TM: HARD DRAWN STEEL GRADE 500 TRENCH MESH DUCTILITY CLASS L TO AS/NZS4671
- W: GRADE 500 STEEL REINFORCING WIRE TO AS/NZS4671

R2. MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRE-STRESSING MATERIALS MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH AS/NZS4671, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL REINFORCEMENT. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.

R3. PROVIDE DOCUMENTATION TO SHOW THAT REINFORCEMENT SUPPLIER AND MILL COMPLIES WITH AS/NZS4671.

R4. REINFORCEMENT MUST HAVE UNIQUE MARKS TO IDENTIFY SUPPLIER.

R5. DO NOT USE LOW DUCTILITY REINFORCEMENT (GRADE L) UNO.

R6. USE MESH SUPPLIED IN FLAT SHEETS UNLESS APPROVED OTHERWISE.

R7. REINFORCEMENT TO BE CLEAN, FREE OF LOOSE MILL SCALE, RUST, OIL, GREASE, MUD OR OTHER MATERIAL THAT MIGHT REDUCE BOND BETWEEN REINFORCEMENT AND CONCRETE.

R8. SUBMIT PROPOSAL FOR CUTTING OR DISPLACING REINFORCEMENT. CLEAN AND PROTECT EXPOSED CUT ENDS OF REINFORCEMENT USING 6 mm APPROVED EPOXY.

R9. DESIGNATION OF REINFORCEMENT BARS IS AS SHOWN:
eg. 17 N20 - 350 EF
- 17: DENOTES No OF BARS AND TYPE IN GROUP
- N: DENOTES BAR GRADE AND DUCTILITY CLASS
- 20: DENOTES NOMINAL BAR DIAMETER IN mm
- 350: DENOTES SPACING IN mm
- EF: DENOTES LOCATION

R10. TO MINIMIZE TRIP HAZARDS CONSIDER MAXIMUM REINFORCEMENT BAR SPACING FOR TRAFFICABLE AREAS PRIOR TO CASTING CONCRETE OF 200 mm. ALTERNATIVELY PROVIDE SL82 ADDITIONAL IF MAIN REINFORCEMENT SPACING IS GREATER THAN 200 mm.

R11. FOLLOWING ABBREVIATIONS APPLY TO LOCATION OF REINFORCEMENT:

EW:	EACH WAY	FF:	FAR FACE	BB:	BOTTOM BOTTOM (LAID FIRST)
EF:	EACH FACE	B:	BOTTOM	TT:	TOP TOP (LAID LAST)
NF:	NEAR FACE	T:	TOP	C OR CP:	CENTRALLY PLACED

R12. PROVIDE STANDARD COGS AND HOOKS TO AS3600. TERMINATE ENDS OF COLUMN AND BEAM LIGATURES IN A HOOK OF AT LEAST 135 DEGREES. PROVIDE FIRST LIGATURE WITHIN 50 mm OF FACE OF SUPPORT.

R13. COG HALF OF SLAB BOTTOM REINFORCEMENT AT EDGES TO ACHIEVE ANCHORAGE.

R14. PROVIDE ONE CONTINUOUS BAR PARALLEL TO (WITHIN 75 mm OF) CONCRETE EDGES, INCLUDING CONSTRUCTION JOINTS UNO.

R15. PROVIDE N12 DIAGONAL TRIMMER BARS BY 1000 mm LONG AT EACH LAYER OF REINFORCEMENT AT RE-ENTRANT CORNERS, OPENINGS, SERVICE PENETRATIONS etc UNO.

R16. PROVIDE N12-300 DISTRIBUTION BARS LAPPED 500 WHERE NONE SHOWN ON DRAWINGS.

R17. REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY IN TRUE PROJECTION. SET REINFORCEMENT OUT AT EQUAL CENTRES IF SPACING IS NOT NOMINATED.

R18. CAP STARTER BARS AND OTHER REINFORCEMENT TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.

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Approved (Project Director)	L. SYLVA		
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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION
STRUCTURAL STANDARD GENERAL NOTES SHEET 2 OF 3

Original Size A1 Drawing No: 22-19174-S002 Rev: 0

Plot Date: 20 June 2019 - 11:43 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-S001-S003.dwg

CONT. REINFORCEMENT

R19. ENSURE ALL LAID REINFORCING BARS ARE RESTRAINED BEFORE STOPPING WORK TO PREVENT BARS ROLLING UNDERFOOT.

R20. REINFORCEMENT TO BE SUPPLIED TO SITE PRE-BENT TO REQUIRED SHAPES. REINFORCEMENT CAGES TO BE PRE-FABRICATED OFF-SITE AS FAR AS PRACTICABLE.

R21. SECURE REINFORCEMENT IN POSITION AGAINST DISPLACEMENT AND MAINTAIN SPECIFIED CLEAR CONCRETE COVER TO REINFORCEMENT (INCLUDING FITMENTS) BY APPROVED CHAIRS, SPACERS, LIGATURES OR TIES AT 800 mm MAXIMUM CENTRES EACH WAY UNO. PROVIDE ADEQUATE SUPPORT TO PREVENT DISPLACEMENT OF REINFORCEMENT BY WORKMEN OR EQUIPMENT DURING CONCRETE PLACEMENT.

R22. SECURELY TIE REINFORCEMENT WITH WIRE TIES. TURN ENDS OF TIE WIRES INTO CONCRETE, CLEAR OF COVER ZONE.

R23. TIE BUNDLED BARS TOGETHER SO THEY ARE IN CLOSEST POSSIBLE CONTACT WITH 2.5 mm DIAMETER WIRE AT CENTRES LESS THAN 24 TIMES DIAMETER OF SMALLEST BAR IN BUNDLE.

R24. FOR BEAMS, TIE STIRRUPS TO BARS IN EACH CORNER OF EACH STIRRUP. FIX OTHER LONGITUDINAL BARS TO STIRRUPS AT 1000 MAXIMUM CENTRES.

R25. FOR EXTERNAL OR CORROSIVE APPLICATIONS USE HOP DIP GALVANIZED TIE WIRES

R26. SUPPORT REINFORCEMENT ON PROPRIETARY CONCRETE, METAL OR PLASTIC SUPPORTS ADEQUATE TO WITHSTAND CONSTRUCTION AND TRAFFIC LOADS AND MAINTAIN DURABILITY OF FINISHED CONCRETE STRUCTURE. FOR CONCRETE SURFACES WITH B2 EXPOSURE CLASSIFICATION OR GREATER, ONLY USE PROPRIETARY HIGH STRENGTH FIBRE REINFORCED CEMENT SPACER BLOCKS OR SUPPORTS.

R27. ENSURE REINFORCEMENT CAGES ARE ELECTRICALLY CONTINUOUS UNO.

R28. DO NOT PLACE OR MOVE REINFORCEMENT DURING OR AFTER CONCRETE PLACEMENT.

R29. ENSURE EMBEDDED ITEMS (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, DISSIMILAR METAL ITEMS, etc) IN COVER CONCRETE OR EXPOSED TO AIR ARE NOT IN CONTACT WITH REINFORCEMENT. PROVIDE ISOLATION BETWEEN DISSIMILAR METALS, AND BETWEEN REINFORCEMENT AND EXPOSED ITEMS.

R30. OBTAIN SUPERINTENDENT'S APPROVAL OF INSERTS, FIXINGS AND OTHER IT EMBEDDED IN COVER CONCRETE.

R31. DO NOT WELD REINFORCEMENT, CAST-IN ITEMS etc UNLESS APPROVED UNO.

R32. SPLICE REINFORCEMENT ONLY AT LOCATIONS SHOWN ON DRAWINGS OR AS APPROVED BY SUPERINTENDENT. STAGGER LAPS WHERE POSSIBLE. LAPPED SPLICE LENGTHS TO COMPLY WITH AS3600. CLEAR SPACING BETWEEN LAPPED BARS TO BE LESS THAN THREE TIMES BAR DIAMETER. WHERE BAR SIZES VARY USE LAPPED SPLICE LENGTH FOR SMALLER BAR DIAMETER.

R33. LAPPED SPLICE LENGTHS FOR HORIZONTAL BARS WITH MORE THAN 300 mm CONCRETE CAST BELOW THE BAR AND SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f'c	N12	N16	N20	N24	N28	N32
> 25	> 20	770	1150	1570	-	-	-
> 25	> 25	630	980	1350	1740	-	-
> 25	> 32	510	770	1100	1440	1810	2220
> 25	> 40	460	630	890	1200	1530	1890

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.
LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.
EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP FORMED CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS. REFER TO AS3600 OR SUPERINTENDENT.

R34. LAPPED SPLICE LENGTHS FOR VERTICAL BARS (AND HORIZONTAL BARS WITH LESS THAN 300 mm CONCRETE CAST BELOW THE BAR) SPACED AT > 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f'c	N12	N16	N20	N24	N28	N32
> 25	> 20	590	890	1210	-	-	-
> 30	> 25	490	750	1040	1340	-	-
> 40	> 32	390	600	840	1110	1400	1710
> 50	> 40	350	480	690	920	1180	1450

NOT APPLICABLE FOR BARS IN COLUMNS.
DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.
LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.
EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP FORMED CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS. REFER TO AS3600 OR SUPERINTENDENT.

R35. REINFORCEMENT SPLICES IN TENSION MEMBERS MUST BE WELDED OR MECHANICAL SPLICES.

R36. ENSURE REINFORCEMENT COUPLERS PROVIDE FULL TENSION CAPACITY OF REINFORCEMENT.

R37. LAY MESH REINFORCEMENT SO THAT MINIMUM COVER IS TO MAIN WIRES UNO.

R38. PROVIDE MINIMUM MESH LAPS TO CROSS WIRES OF REINFORCING MESH, SO TWO OUTERMOST WIRES OF ONE SHEET OVERLAP TWO OUTERMOST WIRES OF ADJACENT SHEET BY AT LEAST 25 mm, THUS:

MESH TYPE	END LAP	SIDE LAP
RECTANGULAR MESHES	225	125
SQUARE MESHES SL 102 TO SL 42	225	225
SL 81	125	125
TRENCH MESH	500	N/A

USE LAP LENGTHS BASED ON LARGEST WIRE SPACING. DO NOT LAP MORE THAN THREE SHEETS AT ANY ONE POINT.

R39. ALTERNATIVELY USE N12 SPLICE BARS TO LAP ADJACENT SHEETS OF MESH, SPACING OF SPLICE BARS TO MATCH SPACING OF BARS IN MESH, SPLICE BARS TO OVERLAP MESH BY 750 mm MINIMUM UNO.

R40. SPLICE TRENCH MESH BY A LAP OF 750 mm MINIMUM UNO. AT T- AND L-INTERSECTIONS, CONTINUE TRENCH MESH FULL WIDTH OF INTERSECTION. AT L-INTERSECTIONS PROVIDE AN N12 L BAR TO LAP 750 mm WITH OUTSIDE BARS UNO.

R41. DO NOT WELD REINFORCEMENT UNLESS SHOWN ON DRAWINGS OR OTHERWISE APPROVED BY SUPERINTENDENT. WHERE ALLOWED, WELDING OF REINFORCEMENT (INCLUDING TACK-WELDING FOR FIXING PURPOSES) TO COMPLY WITH AS3600 AND AS/NZS1554.3. DO NOT WELD REINFORCEMENT WITHIN 75 mm OF A SECTION THAT HAS BEEN BENT (100 mm FOR N28 AND N32 BARS, 125 mm FOR N36 BARS).

EXTENT OF WELD INSPECTION/TESTING TO BE:

- VISUAL SCANNING 100% OF WELDS
- VISUAL EXAMINATION 50% OF WELDS
- RADIOGRAPHIC OR ULTRASONIC 5% OF FILLET WELDS AND 100% OF BUTT WELDS.

R42. DO NOT BEND OR STRAIN REINFORCEMENT IN A WAY THAT MAY CAUSE DAMAGE. BEND DIAMETERS TO BE TO AS3600. BARS TO BE BENT COLD UNO. GRADE 250 BARS MAY BE BENT AT TEMPERATURES UP TO 850°C. DO NOT COOL HEATED BARS BY QUENCHING.

R43. DO NOT CUT, BEND NOR HEAT REINFORCEMENT ON SITE WITHOUT SUPERINTENDENTS PRIOR WRITTEN APPROVAL.

R44. ENSURE HOT BENDING OF REINFORCEMENT COMPLIES WITH AS3600 CLAUSE 17.2.3.1. DO NOT HEAT D500N REINFORCEMENT. USE TEMPERATURE INDICATOR PAINTS AND/OR CRAYONS TO ENSURE REINFORCEMENT TEMPERATURE DOES NOT EXCEED MANUFACTURERS RECOMMENDED LIMITS, 450 DEGREES MAXIMUM. REINFORCEMENT THAT CHANGED COLOUR DURING HEATING MUST BE DISCARDED.

R45. DO NOT BEND REINFORCEMENT AFTER GALVANISING OR APPLICATION OF OTHER COATINGS.

R46. PERCUSSION ROTARY DRILL HOLES FOR GROUTED BARS AND THREADED RODS (NOTE: CORED HOLES MUST BE ROUGHENED). HOLE DIAMETER AND INSTALLATION TO BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. EMBEDMENT LENGTHS AS PER DRAWINGS.

R47. ENSURE HOLES FOR GROUTED BARS AND THREADED RODS ARE DRY AND CLEANED THOROUGHLY BEFORE INSTALLING ANCHORS. WIRE BRUSH HOLES AND BLOW OUT WITH COMPRESSED AIR TO REMOVE DUST. FILL HOLE WITH ADHESIVE USING A CAULKING GUN FROM BOTTOM OF HOLE OUTWARDS. DISCARD ADHESIVE FROM FIRST TRIGGER PULL. PROVIDE BARS/THREADED RODS WITH CHAMFERED (CHISELLED) ENDS. BARS TO BE DEGREASED, AND FLAKY RUST REMOVED. ROTATE WHILE INSERTING TO ENSURE FULLY COATED AND PUSH FULLY INTO HOLE. PROTECT FROM DISTURBANCE DURING CURING. FOLLOW MANUFACTURER'S RECOMMENDATIONS.

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Approved (Project Director)	L. SYLVA		
Date	17.06.19		
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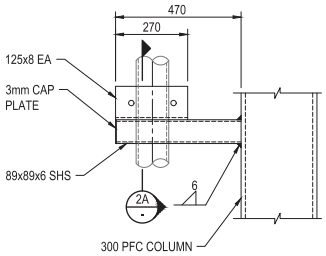
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION
STRUCTURAL STANDARD GENERAL NOTES SHEET 3 OF 3

Original Size A1 Drawing No: 22-19174-S003 Rev: 0

Plot Date: 20 June 2019 - 11:43 AM Plotted by: Rj Geronimo Cad File No: G:\22\19174\CADD\Drawings\22-19174-S001-S003.dwg



2 DETAIL
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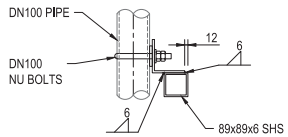

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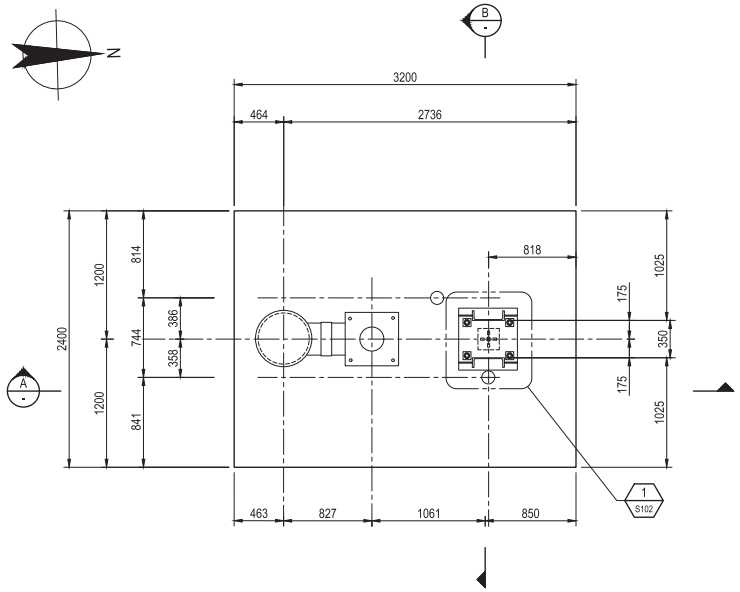
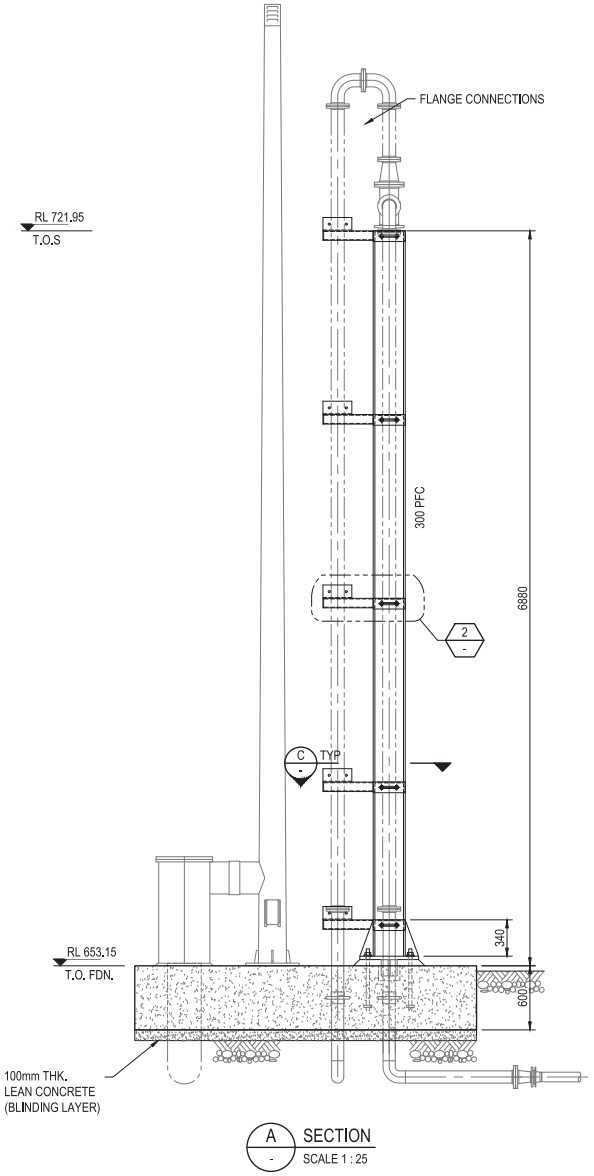


FOUNDATION PLAN
SCALE 1:25



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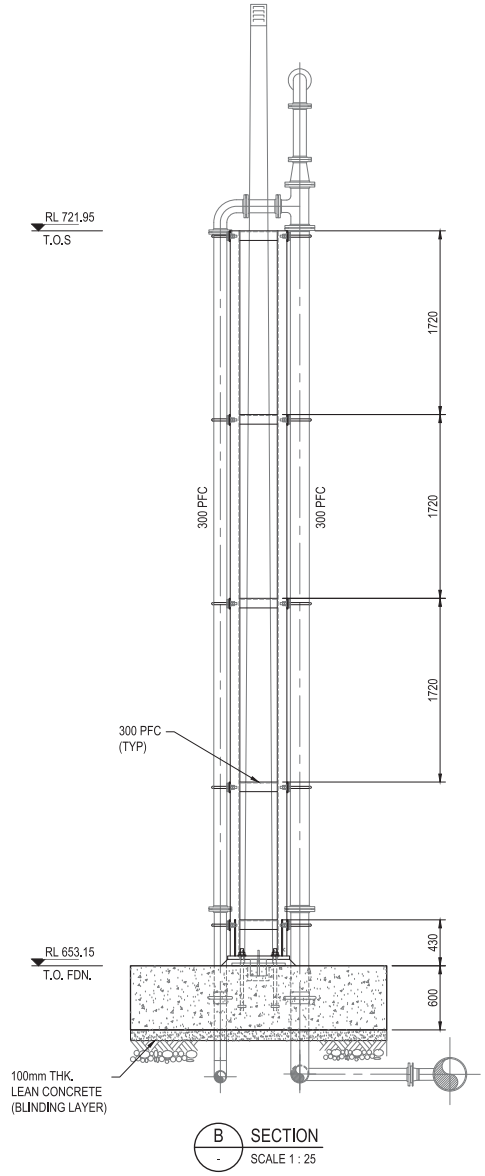

B SECTION
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0 250 500 750 1000 1250mm
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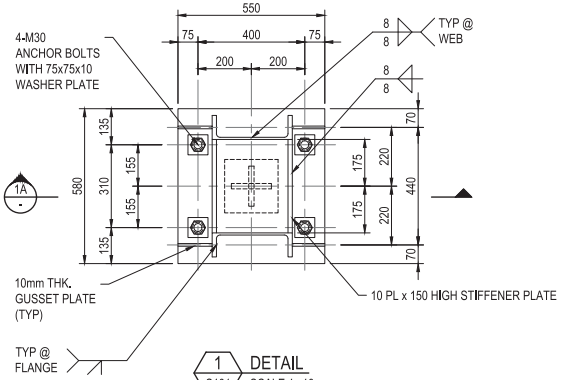
Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION BAROMETRIC LOOP TALL FOUNDATION PLAN AND PIPE SUPPORT FRAMING

Original Size A1
Drawing No: 22-19174-S101
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM
Plotted by: Rj Geronimo
Cad File No: G:\22\19174\CADD\Drawings\22-19174-S101-S103.dwg

NOTE:

1. ALL PLATES SHALL BE 300 + GRADE UNO.



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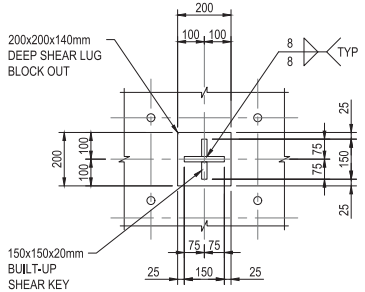

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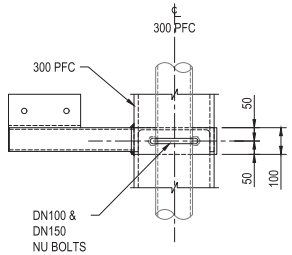

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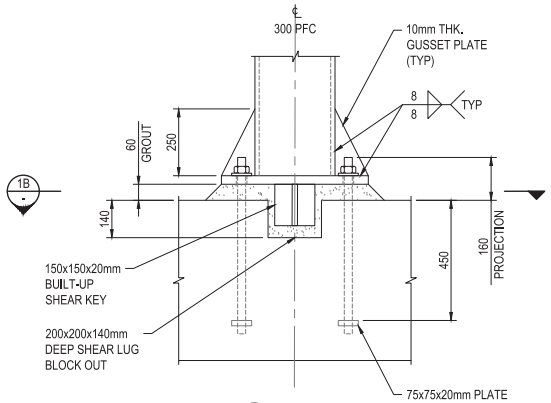

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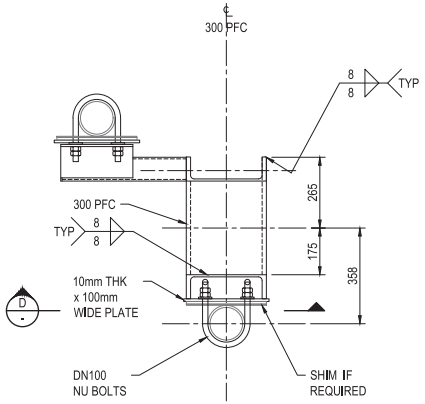

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S101 SCALE 1 : 10

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Client URALLA SHIRE COUNCIL
Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION BAROMETRIC LOOP TALL SECTIONS AND DETAILS

Original Size A1
Drawing No: 22-19174-S102
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM Plotted by: Rj Geronimo
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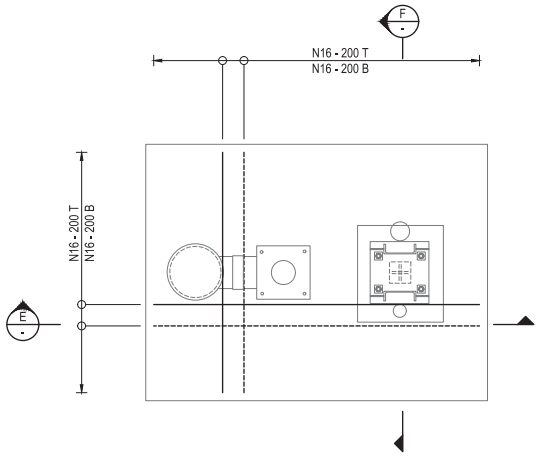
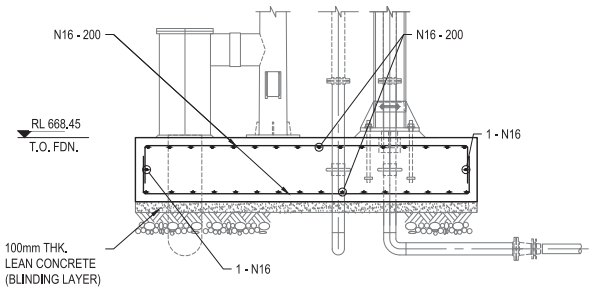


FOUNDATION REINFORCEMENT PLAN
SCALE 1:25



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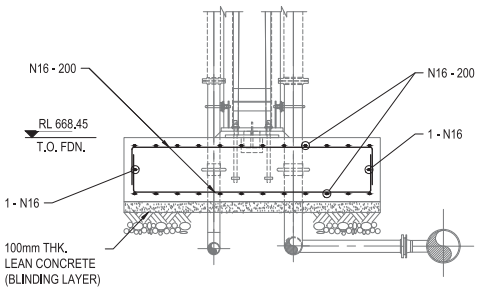

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Project BUNDARRA SEWERAGE SCHEME
Title BUNDARRA PUMP STATION BAROMETRIC LOOP TALL REINFORCEMENT PLAN AND SECTION DETAILS

Original Size A1
Drawing No: 22-19174-S103
Rev: 0

Plot Date: 20 June 2019 - 11:43 AM
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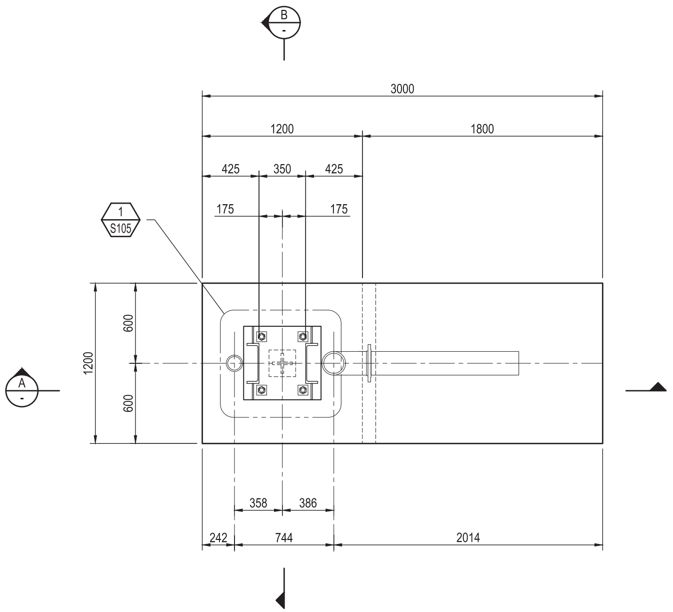

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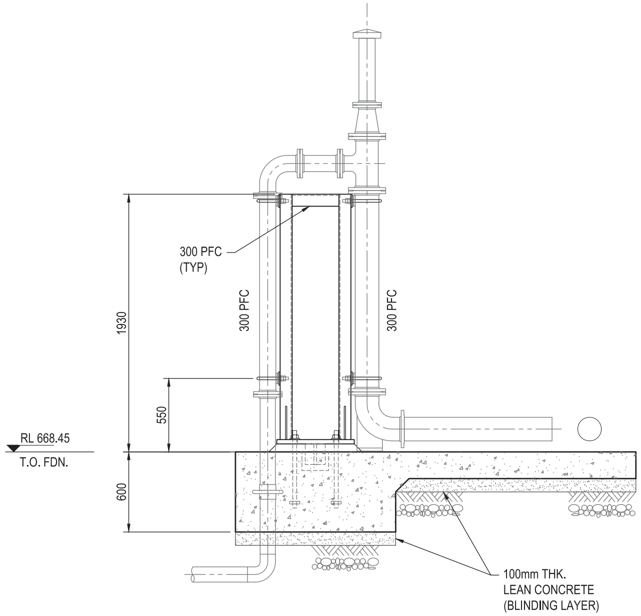

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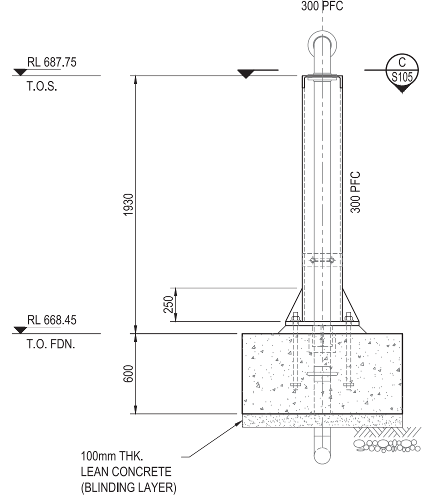

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Title **BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT FOUNDATION PLAN AND PIPE SUPPORT FRAMING**

Original Size A1 Drawing No: **22-19174-S104** Rev: 0

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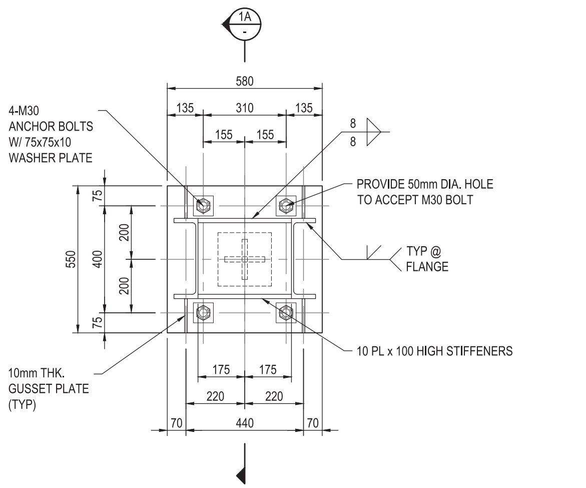

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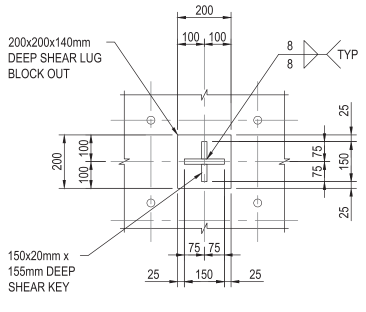

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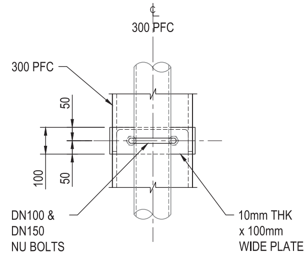

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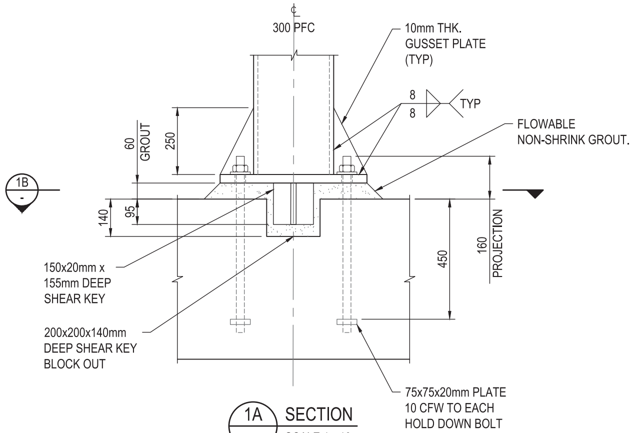

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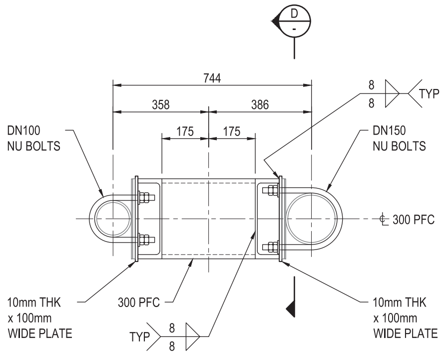

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Title **BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT SECTIONS AND DETAILS**

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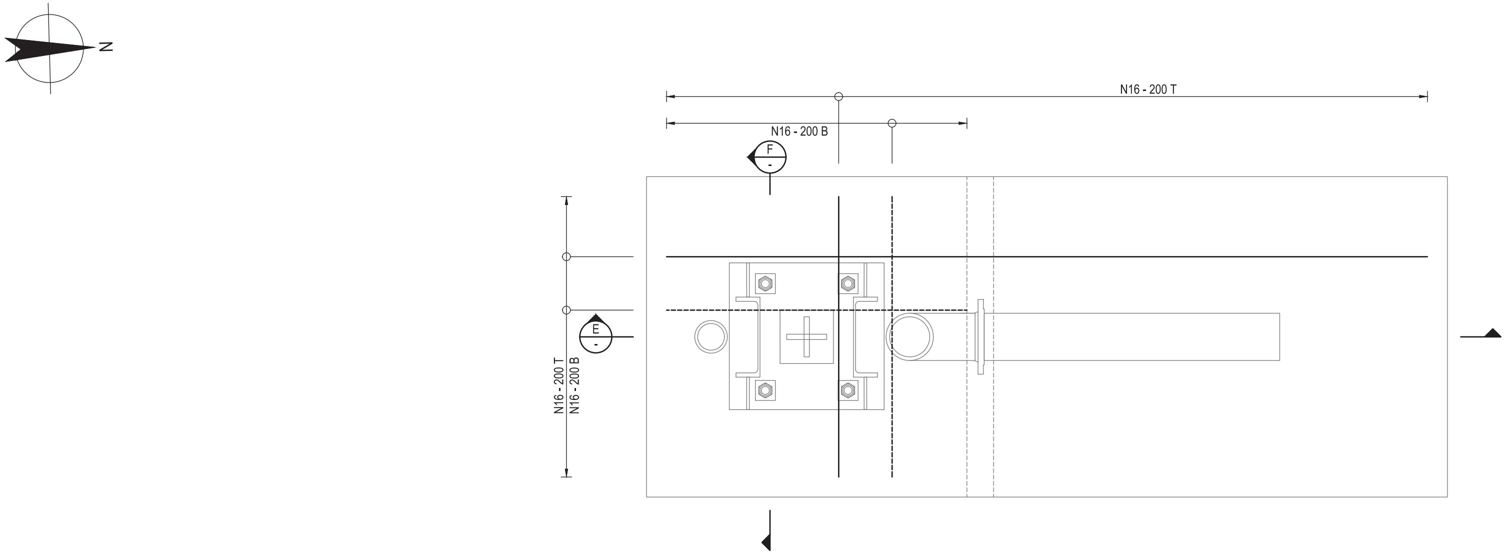

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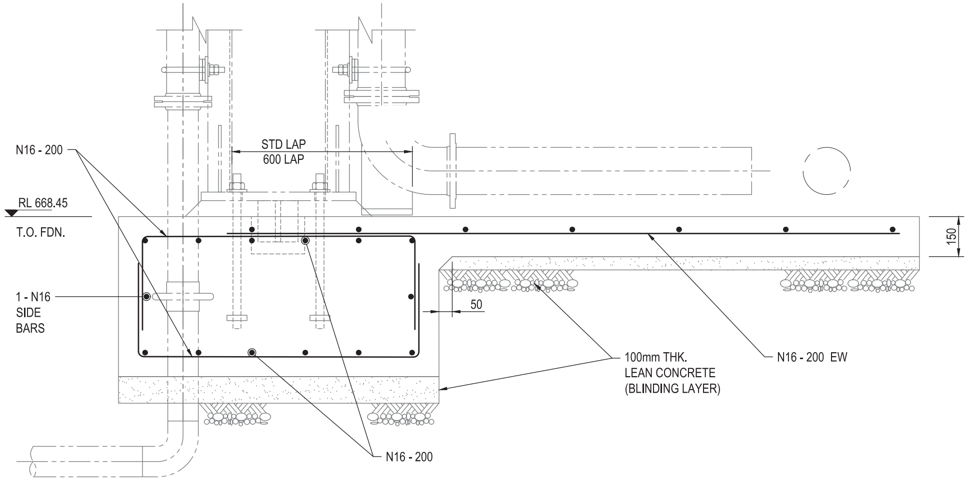

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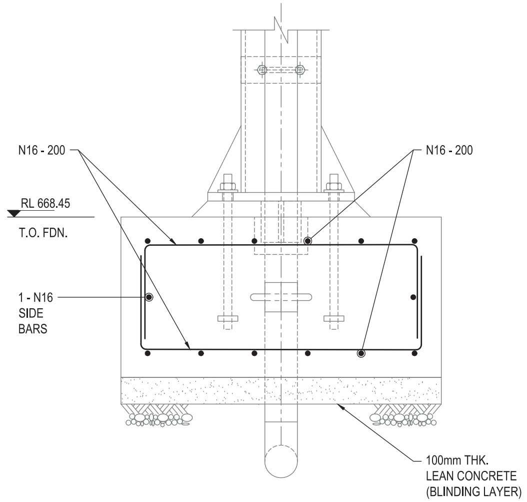

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Project **BUNDARRA SEWERAGE SCHEME**
Title **BUNDARRA SEWAGE TREATMENT PLANT BAROMETRIC LOOP SHORT REINFORCEMENT PLAN AND SECTION DETAILS**

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Appendix B – Cultural Heritage Assessment

BUNDARRA SEWERAGE TREATMENT SCHEME
BUNDARRA, NSW
CULTURAL HERITAGE ASSESSMENT

PREPARED FOR GHD

EVERICK HERITAGE
JULY 2019

Report Reference:

Disspain M. T. Hill and R. Mazlin 2019 *Aboriginal and Non-Aboriginal Cultural Heritage Assessment: Bundarra Sewerage Treatment Scheme, Bundarra, NSW*. Everick Heritage Pty Ltd. Unpublished report prepared for GHD.

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3	Review	P. Fowler	All	14.08.2018	T. Robins
4	Final	T. Hill	All	21.08.2018	T. Robins
5	Revisions	M. Disspain	All	11.09.2018	T. Robins
6	Revised Draft	M. Disspain	All	02.10.2018	T. Robins
7	Final	R. Mazlin	All	10.10.2018	T. Robins
8	Revisions	R. Mazlin	Appendix C	14.01.2019	T. Robins
9	Revisions	T. Hill	Appendix C	22.07.2019	T. Robins

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EXECUTIVE SUMMARY

The following report is an assessment of Aboriginal and non-Aboriginal (historic) heritage relating to the proposed construction of the Bundarra waste water treatment facility, Bundarra NSW (the 'Project Area'). The purpose of the assessment is to identify Aboriginal and historical archaeological constraints for the Project, and if found, establish ways in which any impacts could be mitigated or avoided.

Everick Heritage (the 'Consultant') was commissioned by GHD on behalf of Uralla Shire Council (the 'Proponent') to undertake this assessment. The brief for this Project was to undertake an assessment of suitable standard to ensure that all identifiable Aboriginal objects and historic items are accounted for prior to finalising the plans for this project. In accordance with the relevant administrative and legislative standards for NSW (see Section 2 below), the methods employed in this assessment include:

a) a search of relevant heritage registers;

b) consultation with Anaiwan Local Aboriginal Land Council ('Anaiwan LALC');

c) a site inspection undertaken by Senior Archaeologist Dr Morgan Disspain and Anaiwan LALC CEO Mr Greg Livermore on 6 August 2018;

d) a review of the archaeological and cultural heritage assessments pertinent to the potential heritage values associated with the Project Area; and

e) assessment of the potential for the Project Area to contain significant Aboriginal and non-Aboriginal heritage.

The Proponent proposes to construct a reticulated low-pressure Waste Water Treatment Scheme ('WWTS') to service existing houses that are currently serviced by septic systems at Bundarra, NSW (the 'Proposed Works'). The Proposed Works include:

- excavation of 300 mm wide trenches;
- utilisation of a 6 m wide construction corridor;
- construction of a Sewerage Treatment Plant ('STP');
- drainage and landscaping; and
- construction of infrastructure and laydown areas.

A search was conducted on 31 July 2018 of the Office of Environment and Heritage ('OEH') Aboriginal Heritage Information Management System ('AHIMS') (Service #361004) for Lat, Long from -30.1939, 151.0312 to Lat, Long: -30.1579, 151.0883 with a buffer of 0 m. The search identified one (1) registered Aboriginal site within the search

area, being the Bundarra scar/modified tree (AHIMS ID 20-3-0074) site. The site located in the south eastern corner of the Project Area, but will not be affected by the Proposed Works.

One item on the State Heritage Register (Heritage Council of NSW) was identified, being the Bundarra Police Station and Courthouse, located on the corner of Oliver Street and Bendemeer Street, Bundarra. Additionally, the Uralla Local Environment Plan ('LEP') contains three heritage listed places and one heritage precinct within the Project Area; these places are the Bridge over Gwydir River, the St Mary's Roman Catholic Church, and the McDonald's saw, plane mill and house.

A site inspection for cultural heritage of the Project Area was undertaken by Everick Senior Archaeologist Dr Morgan Disspain, and Anaiwan LALC Aboriginal Sites Officer Greg Livermore on 6 August 2018. As a result of the desktop study, site inspections, Aboriginal community consultation and archaeological investigation of the Project Area, the following was found.

- No Aboriginal cultural heritage items or places were identified during the survey.
- One previously recorded Aboriginal site (Bundarra Scar modified tree AHIMS ID 20-3-0074) was visited during the survey, and it was determined that the Proposed Works will not impact the site.
- Having consideration for the low potential of the highly disturbed roadside verges to contain artefacts, a smaller percentage of these survey units were included within the archaeological survey. The roadside verges were surveyed using vehicular traverses This sampling strategy was agreed to by the sites officer from Anaiwan LALC.
- There is very little topsoil material on the upper slope of the ridge crest within the STP site. It is considered unlikely that the surrounding soils would contain Aboriginal objects, and as such the ridge crest was not identified as a Potential Archaeological Deposit ('PAD').
- There is extensive disturbance and land surface alteration within the town of Bundarra on the river flats of the Gwydir River. As such, it is considered unlikely that the soils would contain any Aboriginal artefacts, and as such, the river flats within the Project Area were not identified as a PAD.
- In consideration of the potential of the ridge crest to contain Aboriginal sites, it was noted that the foot slopes of the ridgeline to the north would have provided better access to resources along the river and floodplain, including swamps and wetlands. The ridge crest that comprises the Project Area was not considered to be a 'pathway' as there was no obvious landscape feature which was identifiable as a destination to the south of the Project Area.

Recommendation 1: Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately:

b) a temporary fence is to be erected around the site, with a buffer zone of at least ten (10) metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material;

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010); and

e) should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.

Recommendation 2: Old Police Station and Courthouse

The following controls should be put in place during construction:

- temporary site fencing installed within one (1) metre of the wall of the courthouse to ensure that the building is clearly designated as a restricted area;
- the requirements for work adjacent to the building are clearly identified in operational plans, drawings and works descriptions;
- all staff and contractors should be provided with an induction regarding access and work requirements adjacent to the building, including provisions for a Find Procedure in the event of identification of historic relics; and
- completion of high resolution images of the location of the sewerage pod prior to and on completion of the works to document the nature and extent of visual impact if any.

The nature of the proposed works is such that approval by the NSW Heritage Council should be undertaken under the standard exemption provision of the Heritage Act. In this instance the standard exemptions should apply:

- Standard Exemption 4: Excavation; and
- Standard Exemption 7: Minor Activities with Little or No Adverse Impact on Heritage Significance.

It is noted that the standard exemptions remove the requirement for formal approval however require that the Proponent writes to the Director-General to seek written notification that the exemption will apply prior to commencement of the works.

Recommendation 3: Aboriginal Human Remains

Although it is unlikely that human remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Bundarra), the Anaiwan LALC, and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the RAPs and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 4: Conservation Principles

It is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values at all stages during the development works. If impacts are unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal community.

DEFINITIONS

The following definitions apply to the terms used in this report:

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal Place (under s. 84 of the NPW Act) by the Minister administering the NPW Act, by order published in the NSW Government Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal Objects.

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal place (under s. 84 of the NPW Act) by the Minister administering the NPW Act, by order published in the NSW Government Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal Objects.

ACHA means Aboriginal Cultural Heritage Assessment

ACHAR means Aboriginal Cultural Heritage Assessment Report

ACHCRP Guidelines means the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) (NSW).

AHIMS means Aboriginal Heritage Information Management System.

AHIP means Aboriginal Heritage Impact Permit.

CoPAI means the OEH *Code of Practice for Archaeological Investigation in New South Wales* (2010) (NSW).

Due Diligence Code means the OEH *Due Diligence Code for the Protection of Aboriginal Objects in NSW* (2010) (NSW).

LALC means Local Aboriginal Land Council.

LEP means Local Environment Plan.

NPW Act means the *National Parks and Wildlife Act 1974 (*NSW).

NPW Regulations means the *National Parks and Wildlife Regulations 2009* (NSW).

NSW means New South Wales.

NTSCORP means Native Title Services Corporation.

OEH means the New South Wales Office of Environment and Heritage.

PAD means Potential Archaeological Deposit.

Project Area means the land subject to this assessment situated to the west of, and incorporating the township of Bundarra, NSW and includes all lands identified in Figure 1.

Proposed Works means all activities associated with construction of the Bundarra Waste Water Treatment Plant including the Sewerage Treatment Plant, and associated infrastructure and pipes. (Figure 2).

Proponent means Uralla Shire Council and all associated employees, contractors and subcontractors of the same.

RAP means Registered Aboriginal Party.

The Project means all activities associated with construction of the Bundarra Waste Water Treatment Plant including the Sewerage Treatment Plant, and associated infrastructure and pipes (Figure 2).

The Consultant means qualified archaeological staff and/or contractors of Everick Heritage Pty Ltd.

WWTS means Waste Water Treatment Scheme.

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

1.1 Purpose of the Cultural Heritage Assessment

The following report is an assessment of Aboriginal and non-Aboriginal heritage relating to the proposed construction of the Bundarra waste water treatment scheme ('WWTS'), Bundarra NSW (the 'Project Area' see Figure 1). The purpose of the assessment is to identify Aboriginal and historical archaeological constraints for the Project, and if found, establish ways in which any impacts could be mitigated or avoided.

1.2 Proponent, Project Brief & Methodology

Everick Heritage Consultants (the 'Consultant') was commissioned by GHD on behalf of Uralla Shire Council (the 'Proponent') to undertake this assessment. The brief for this Project was to undertake an assessment of suitable standard to ensure that all identifiable Aboriginal objects and historic items are accounted for prior to finalising the plans for this project. In accordance with the relevant administrative and legislative standards for NSW (see Section 2 below), the methods employed in this assessment include:

a) a search of relevant heritage registers;

b) consultation with Anaiwan Local Aboriginal Land Council ('Anaiwan LALC');

c) a site inspection undertaken by Senior Archaeologist Dr Morgan Disspain and Anaiwan LALC CEO Mr Greg Livermore on 6 August 2018;

d) a review of the archaeological and cultural heritage assessments pertinent to the potential heritage values associated with the Project Area; and

e) assessment of the potential for the Project Area to contain significant Aboriginal and non-Aboriginal heritage.

1.3 The Project

The Proponent proposes to construct a reticulated low-pressure Waste Water Treatment Scheme ('WWTS') to service existing houses that are currently serviced by septic systems at Bundarra, NSW (the 'Proposed Works' see Figure 2). The Proposed Works include:

- excavation of 300 mm wide trenches;
- utilisation of a 6 m wide construction corridor;
- construction of a Sewerage Treatment Plant ('STP');

- drainage and landscaping; and
- construction of infrastructure and lay down areas.

1.4 Site Locality

The Project Area is located within and nearby the township of Bundarra. The sewerage treatment plant site is situated to the west of the town, while pipes and infrastructure associated with the Project are located throughout the township.

1.5 Report Authorship

The desktop study, site inspections and report writing were undertaken by Senior Archaeologist Dr Morgan Disspain. Technical review was completed by Senior Archaeologist Tim Hill.

Figure 1: Project Area and regional locality.

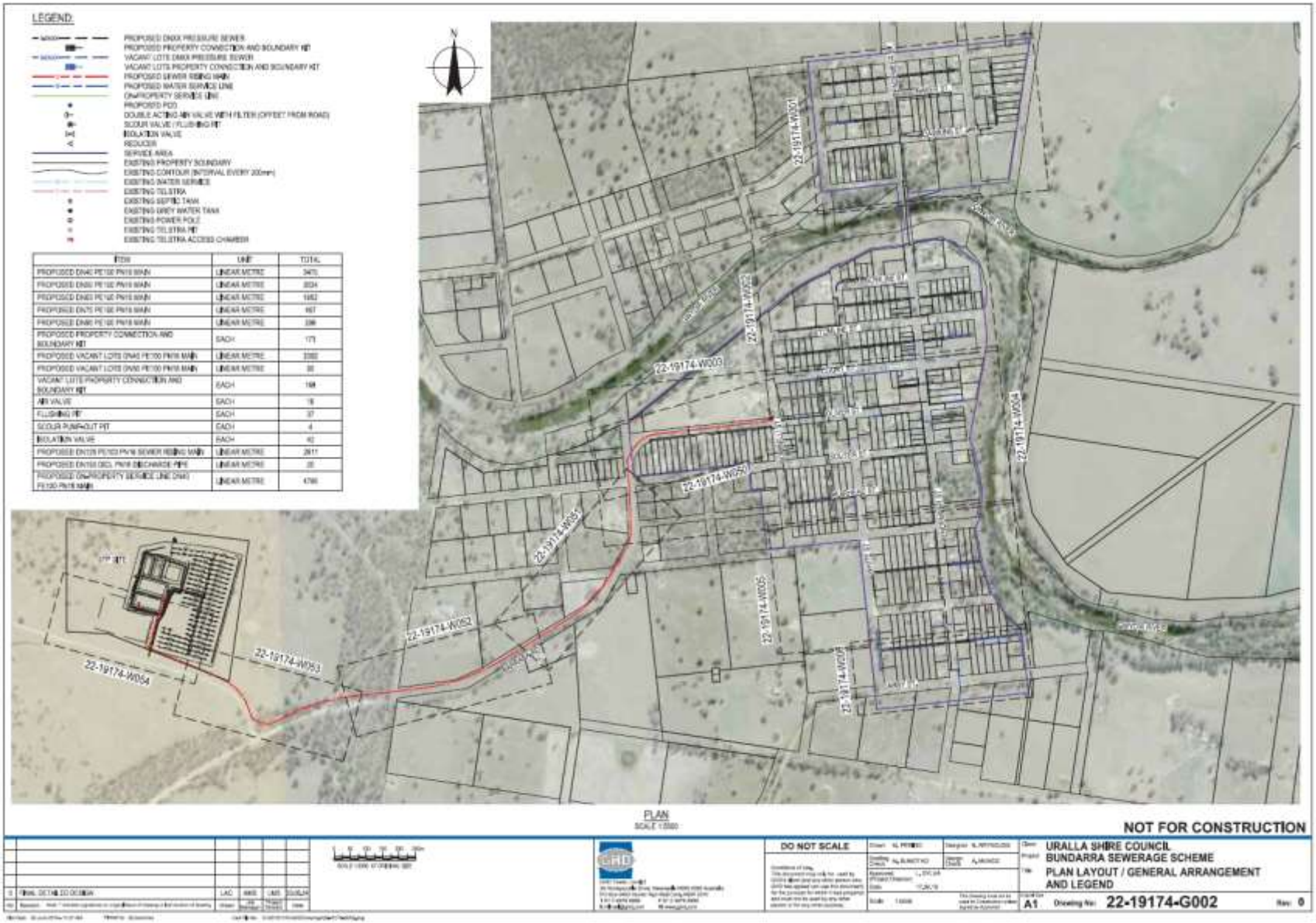

Figure 2: Technical details of the proposed Bundarra WWTS.

2. LEGISLATIVE AND PLANNING CONTEXT

The primary State legislation concerning cultural heritage in NSW are the *National Parks and Wildlife Act 1974* (NSW) ('NPW Act') and the Council Local Environment Plans ('LEP') and Development Control Plans ('DCP). The Commonwealth also has a role in the protection of nationally significant cultural heritage through the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth), *The Protection of Movable Cultural Heritage Act 1986* (Cth) and *the Historic Shipwrecks Act 1976* (Cth).

For the purposes of this assessment the State and local legislation are most relevant. Approval from the OEH will be required should the Project impact on identified Aboriginal Objects. The information below lists the legislative and policy framework within which this assessment is set.

2.1 *The National Parks and Wildlife Act 1974 (NSW) and the National Parks and Wildlife Regulations 2009* (NSW)

The NPW Act is the primary legislation concerning the identification and protection of Aboriginal cultural heritage. It provides for the management of both Aboriginal Objects and Aboriginal Places. Under the NPW Act, an Aboriginal Object is any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area, regardless of whether the evidence of habitation occurred before or after non-Aboriginal settlement of the land. This means that every Aboriginal Object, regardless of its size or seeming isolation from other Objects, is protected under the Act.

An Aboriginal Place is an area of particular significance to Aboriginal people which has been declared an Aboriginal Place by the Minister. The drafting of this legislation reflects the traditional focus on Objects, rather than on areas of significance such as story places and ceremonial grounds. However, a gradual shift in cultural heritage management practices is occurring towards recognising the value of identifying the significance of areas to Indigenous peoples beyond their physical attributes. With the introduction of the *National Parks and Wildlife Amendment Act 2010* (NSW) the former offence provisions under Section 86 of 'disturbing', 'moving', 'removing' or 'taking possession' of Aboriginal Objects or Places have been replaced by the new offence of 'harming or desecrating'. The definition of 'harm' is 'destroying, defacing or damaging an Object'. Importantly, in the context of the management recommendations in this assessment, harm to an Object that is 'trivial or negligible' will not constitute an offence.

The new amendments also significantly strengthen the penalty provisions. The issue of intent to harm Aboriginal cultural heritage has been formally addressed by separating it from inadvertent harm. The penalty for individuals who inadvertently harm Aboriginal Objects has been set at up to $55,000, while for corporations it is $220,000.

Also introduced is the concept of 'circumstances of aggravation' which allows for harsher penalties (up to $110,000) for individuals who inadvertently harm Aboriginal heritage in the course of undertaking a commercial activity or have a record for committing similar offences. For those who knowingly harm Aboriginal cultural heritage, the penalty will rise substantially. The maximum penalty will be set at $275,000 or one-year imprisonment for individuals, while for corporations it will rise to $1,100,000.

Where a land user has or is likely to undertake activities that will harm Aboriginal Objects, the Director General (OEH) has a range of enforcement powers, including stop work orders, interim protection orders and remediation orders. The amended *National Parks and Wildlife Regulations 2009* (NSW) ("NPW Regulations') also allow for a number of penalties in support of these provisions. The NPW Act also now includes a range of defence provisions for unintentionally harming Aboriginal Objects:

a) Undertaking activities that are prescribed as 'Low Impact'.

b) Acting in accordance with the new *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (2010) ('Due Diligence Code').

c) Using a consulting archaeologist who correctly applies the CoPAI.

d) Acting in accordance with an AHIP.

The new NPW Regulations allow for a range of low impact activities to be undertaken without the need to consult the OEH or a consulting archaeologist. Generally, those who undertake activities of this nature will not be committing an offence, even if they inadvertently harm Aboriginal Objects. These activities include:

a) Maintenance – For example on existing roads and tracks, or on existing utilities such as underground power cables and sewage lines.

b) Farming and Land Management – for land previously disturbed, activities such as cropping, grazing, bores, fencing, erosions control etc. *

c) Removal of dead or dying vegetation - only if there is minimal ground disturbance.

d) Environmental rehabilitation – weed removal, bush regeneration.

e) Development in accordance with a Development Certificate issued under the *EPA Act 1979* (provided the land is previously disturbed). *

f) Downhole logging, sampling and coring using hand held equipment.

g) Geochemical surveying, seismic surveying, costeaning or drilling. *

* This defence is only available where the land has been disturbed by previous activity. Disturbance is defined as a clear and observable change to the land's surface, including but not limited to land disturbed by the following: soil ploughing; urban development; rural infrastructure (such as dams and fences); roads, trails and walking tracks; pipelines, transmission lines; and storm water drainage and other similar infrastructure.

The NPW Act provides a legal framework for the protection of Aboriginal objects. Documentation of the assessment process will provide a defense in the event that there is an allegation of harm to Aboriginal objects during construction.

2.2 Due Diligence Code of Practice for the Protection of Aboriginal Objects 2010 (NSW)

The Due Diligence Code of Practice for the Protection of Aboriginal Objects 2010 (NSW) (the 'Due Diligence Code') operates by posing a series of questions for land users before they commence development. These questions are based around assessing previous ground disturbance. An activity will generally be unlikely to harm Aboriginal Objects where it:

a) will cause no additional ground disturbance; or

b) is in a developed area; or

c) is in a significantly disturbed area.

Where these criteria are not fulfilled, further assessment for Aboriginal cultural heritage will typically be required prior to commencing the activity.

The Due Diligence Code has not been applied in this assessment as the works will take place under a regulatory approval process. However, the Due Diligence Code provides a useful format for assessment of works where there is an existing and ongoing use.

2.3 The *Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010)* (NSW)

The *Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010)* (NSW) ('ACHCRP') provide an acceptable framework for conducting Aboriginal community consultation in preparation for impacts to Aboriginal cultural heritage. Proponents are required to follow them where a Project is likely to impact on cultural heritage and where required by Council. It is recommended by the OEH that all cultural heritage assessments involve this level of consultation, although it is not strictly a requirement unless it meets the above criteria.

The ACHCRP typically take a minimum of 90 days to complete. However, in complicated Projects this period may need to be extended by several months. The ACHCRP requires public notice of the assessment, preparation of a proposed methodology, undertaking site meetings and excavations where required, the production of a draft report, which is distributed to the registered Aboriginal groups and the production of a final report.

Although not strictly required, a thorough consultation process will treat the ACHCRP as a minimum standard of community consultation. Generally, consultants must go to further effort to identify the significance of a given site to the Aboriginal community. This will likely include undertaking additional site inspections if requested by Aboriginal stakeholders, fully resourcing the community by providing copies of past archaeological and environmental assessments in the region and meeting with Aboriginal community members to seek their opinions as to the significance of the site.

2.4 *The Heritage Act 1977* (NSW)

The *Heritage Act 1977* (NSW) (the 'Heritage Act') provides protection for the environmental heritage of the State, which includes places, buildings, works, relics, movable objects, or precincts that are of State or local heritage significance. The legislation focuses on identifying places of either local or state heritage significance and protecting them by registration on heritage registers. Significant historic heritage items are afforded little protection (other than at the discretion of councils) where they are not on a heritage register.

Of note are the provisions allowing for interim heritage orders (Part 3), which grants the Minister or the Minister's delegates, (which importantly may include a local government agent) the power to enter a property and provide emergency protection for places that have not yet been put on a heritage register, but that may be of local or State significance.

The Heritage Act also makes allowances for the protection of archaeological deposits and relics (Part 6). An archaeological "relic" means any deposit, object, or material evidence, which relates to the non-Aboriginal settlement of the area. Importantly, a former requirement for an archaeological relic to be 50 years or older has been repealed. The focus is now on the item's potential heritage significance, not its age.

The Heritage Act provides a legal framework for the protection of items and places of heritage significance. The assessment has been undertaken to consider the potential impacts of the Proposed Works on heritage items and the requirement for additional investigation, via a Statement of heritage Impact, a Conservation Policy or a Conservation Management Plan.

3. ABORIGINAL PARTIES CONSULTATION

3.1 Statement Regarding Traditional Owner Knowledge

The Aboriginal community, specifically the RAPs, are the primary determinants of the significance of their cultural heritage. Members of the Aboriginal community have been consulted, and will continue to be consulted, regarding their concerns not only about known archaeological sites in the region, but also about cultural values such as areas with historic and spiritual significance, and other values relating to flora and fauna of the area.

3.2 Consultation with the Anaiwan LALC

Project information, including a site plan, was provided to Anaiwan LALC' by email on 31 July 2018 (see Appendix A). Anaiwan LALC CEO Mr Greg Livermore undertook an inspection of the Project Area on the 6 August 2018, with Senior Archaeologist Dr. Morgan Disspain. Mr Livermore was aware of places of particular cultural significance within the Bundarra area and the identification of Aboriginal sites and as such is qualified to provide advice on the potential of the Project Area to contain Aboriginal cultural heritage values.

A copy of this report was provided to the Anaiwan LALC, to which a reply was received on 2 October 2018 indicating that the LALC had no concerns with respect to the management of cultural heritage within the Project Area. All email correspondence with Anaiwan LALC is provided in Appendix A.

4. ENVIRONMENTAL CONTEXT

4.1 Environment and Landscape

The Project Area encompasses a large area of the town of Bundarra, a small town on the Northern Tablelands of New South Wales, Australia. The town is located on Thunderbolts Way and is on the banks of the Gwydir River, in the Uralla Shire local government area. The New England Tableland is a partly dissected uplifted peneplain. The Main Divide, which separates the east and west flowing rivers in southern New England runs north-south along the eastern perimeter of the Uralla area. The Main Divide is distinguished in the south east by an elongated outcrop of acid porphyry and a line of basalt to the north and is a line of low lying hills that rise only a few hundred feet above the surrounding country. The country to the immediate east and west of the Main Divide is an erosion surface known geologically as a Laterite Surface, which is characterised in the Uralla area by swamps and lagoons, such as those in the Salisbury area, including Racecourse Lagoon and Dangar's Lagoon. Sparse hills are capped with basalt and lateritic deposits, for example ironstone gravel also occur (Rosen 2009).

The surface is generally flat with extensive soil cover which has been exploited for agricultural and pastoral pursuits. Further to the west the Post-Laterite Surface is lower and more dissected and drained by Kentucky Creek and Rocky Creek which flow to the north to join the west flowing Gwydir River.

Much of the Uralla Shire, to the west of Uralla consists of grey-brown podsolic soils and solodized grey-brown podsolic soils on trap rocks and on the south-west border on granite and are vulnerable to erosion (Cruickshank 1976).

4.2 Past Land Use History

There have been several different land uses within the Uralla LGA in the historic period, including pastoralism, mining, forestry, and agriculture. Most of the mining remains within the LGA relate to gold.

The Project Area is within an area which meets the definition of 'Disturbed' under the *Code of Practice for Archaeological Investigation in New South Wales* (2010) (NSW) ('CoPAI'). The CoPAI provides the following definition of 'disturbed land':

> Land is disturbed if it has been the subject of human activity that has changed the land surface, being changes that remain clear and observable. Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks and walking tracks), clearing vegetation, construction of buildings and erection of other structures, construction or installation of utilities and other similar services (such as above or below

ground electrical infrastructure, water and sewerage pipelines, stormwater drainage and other similar infrastructure), and construction of earthworks.

The proposed WWTS site will be located within land subject to the following types of disturbance:

- vegetation clearing recently and within the last 40 years;
- intensive grazing;
- fence construction;
- construction of drainage channels;
- vehicle track construction; and
- trampling by cattle.

The Proposed Works within the remainder of the Project Area, encompassing a corridor along Barraba Road from the STP site to the town of Bundarra and throughout the streets and residential blocks of the town, have been impacted by the following types of disturbance:

- construction of bitumen roads, footpaths and associated infrastructure;
- construction of driveways and residential premises;
- landscaping;
- vegetation clearing; and
- installation of underground infrastructure such as telecommunication lines and water pipes.

4.3 Vegetation

The vegetation of the Project Area in areas that have not been cleared and landscaped in residential blocks or cleared for grazing, consists mainly of grassy woodlands. This vegetation class is eucalypt woodland typically up to 20 m tall with a sparse shrub stratum and continuous groundcover of tussock grasses and a variety of herbs. *Eucalyptus albens* (white box) dominates with *Brachychiton populneus* subsp. *populneus* (kurrajong), *Callitris glaucophylla* (white cypress pine), *E. blakelyi* and *E. melliodora* (yellow box). Shrubs include *Bursaria spinosa* (blackthorn), *Cassinia arcuata* (sifton bush), *Eremophila debilis* (winter apple), *Notelaea microcarpa* (native olive), *Pimelea curviflora* (curved rice flower) and *Templetonia stenophylla* (leafy templetonia). This vegetation class occupies areas with fertile soils usually derived from basalt and low-quartz sedimentaries on flat to undulating terrain below 700 m elevation on the western fall of the Great Dividing Range. Mean annual rainfall varies from 550 to 800 mm.

4.4 Water Sources

The Project Area is located on the bank of the Gwydir River. To the east of the Project Area, Moredun Creek flows into the river, while to the southeast, Georges Creek intersects with the river. The Gwydir River begins high in the Great Dividing Range of northern New South Wales and flows westwards through steep valleys and out onto wide plains. The river splits into many anabranches and creeks on the floodplain, where wetlands and swamps soak up much of the flow of the river.

4.5 Topographic Land Formations and Site Distribution

The review of soil landscapes, their topographies, associated vegetation regimes and land uses, has implications for the types of Aboriginal sites that can be predicted in the Project Area. Table 1 outlines a broad overview of site potential, regional landforms and Project Area land parcels that contain topographic elements of such landforms.

Table 1: Summary of landform site potential.

Site Potential	Landform	Land Parcel/Study Area
High	Ridge lines and hill crests	The broad undulating ridge that runs south to north within the STP site location.
	Creek/river flats and terraces	The creek/river flats and terraces along the Gwydir River.
Low	Side slopes and cultivated alluvial flats.	Lower ridge slopes and cultivated low-lying areas near drainage channel.
Nil	Formed roads and residential premises.	Roads, tracks, footpaths, houses and residential blocks within the township of Bundarra.

5. HERITAGE REGISTER SEARCHES

5.1 OEH Aboriginal Heritage Information Management System

A search was conducted on 31 July 2018 of the OEH Aboriginal Heritage Information Management System ('AHIMS') (Service #361004) for Lat, Long from -30.1939, 151.0312 to Lat, Long: -30.1579, 151.0883 with a buffer of 0 m. (Table 2, Figure 4 and Appendix B). The search identified one registered Aboriginal site within the search area.

The Bundarra Scar modified tree AHIMS ID 20-3-0074 site is located in the south eastern corner of the Project Area. The tree was inspected during the survey (see section 8.1 below).

Table 2: AHIMS Search Results.

Site ID	Site Name	Easting	Northing	Site Features
20-3-0074	Bundarra scar (Vince's property)	314892	6660005	Modified tree

5.2 Other Heritage Registers: Cultural Heritage

The following heritage registers were accessed on 31 July 2018 for Indigenous and historic places within the town of Bundarra, NSW:

- **The World Heritage List:** Contains no places within proximity to the Project Area.
- **Commonwealth Heritage List** (Australian Heritage Council): Contains no places within proximity to the Project Area.
- **The National Heritage List** (Australian Heritage Council): Contains no places within proximity to the Project Area.
- **Register of the National Estate:** Contains no places within proximity to the Project Area.
- **State Heritage Register (Heritage Council of NSW):** Contains one item within the Project Area. This is the Bundarra Police Station and Courthouse, located on the corner of Oliver Street and Bendemeer Street, Bundarra (Table 3).
- **The Aboriginal Place Register (OEH):** Contains no Aboriginal Place listings in the township of Bundarra.
- **Uralla LEP:** Contains four heritage listed places and one heritage precinct within the Project Area (Table 3.)

Table 3: State and local heritage listed places within the Project Area

Item Name	Address	Property Description	Number	Significance
Police Station and Courthouse (former)	31 Bendemeer Street	Lot 1, Sec 66, DP 758181	I05	State
Bridge over Gwydir River	Bendemeer Street		I06	Local
St Mary's Roman Catholic Church	5 Oliver Street	Lot 3, Section 66, DP 758181	I07	Local
McDonald's saw, plane mill and house	29 Tomline Street	Lot 3, Section 57, DP758181	I08	Local
Bundarra Commercial Precinct	Bendemeer Street	From Bowline Street to Souter Street (east side) and to Oliver Street (west side).	C01	Local

Figure 3: LEP Heritage map of Bundarra.

Figure 4: Project Area with location of registered AHIMS sites.

6. SYNTHESIS OF ARCHAEOLOGY AND ETHNOHISTORY

6.1 Ethno Historical Summary

Bundarra is named for the Kamilaroi word for the grey kangaroo. Kamilaroi and Anaiwan people were the earliest inhabitants of the Bundarra area. The Uralla Community Based Heritage Study (Rosen 2009) notes that "The Anaiwan people are believed to have had a common ancestry with the coastal Daingatti, but at some unknown point broke with them and 'all neighbouring groups' so completely that their languages diverged. Later, it has been postulated that the formed ties with the Gumilaroi, to the west".

Godwin (1990:136) provides the following summary of movement across the New England Tablelands:

> The data suggests that small bands moved around the tablelands throughout the year. During the summer months. Some, if not all. Tablelands groups travelled onto the western slopes and held joint ceremonies with people of that area, i.e. Gamilaraay speakers. Small raiding parties occasionally moved into the gorges and onto the coastal plain. There is little evidence of large-scale movement to the east by Nganjaywana and Yugumbil speakers either for ceremonies to escape the exigencies of a tableland winter.

Most models of population movement agree that there was a significant movement of people across the Tablelands for ceremonial activities. An AMBS Heritage Study (2013) makes the following comment on this aspect of traditional Aboriginal culture on the New England Tablelands:

> It has been suggested that the higher regions of the New England Tablelands (greater than 1000 m above sea level) were used predominantly for ritual, rather than economic, activities. This is based on the large number of ritual/ceremonial sites in the higher regions, in proportion to recorded occupation sites, which have comparatively lower artefact densities and are relatively few (Byrne 1993:27-28). Further, it has been noted that sky deities were part of the religious beliefs of the Aboriginal people in eastern NSW, and that ceremonies were often conducted in the higher elevations of people's territory (Bowdler and Coleman 1981:23-5; Davidson 1982:52-5). However, ceremonial and art sites are often the most easily identified by the general population and this, combined with a lack of extensive archaeological studies in the region, may have contributed to the over representation of identified ritual/art sites (Connah et al.1977:127).

6.2 Historical Summary

It is not known who the first people to arrive in the Bundarra areas were, but they were possibly escaped convicts from Port Macquarie or Moreton Bay. Explorer Alexander Cunningham wrote of seeing evidence of cattle and a hut built with axes when he passed through the Bingara region in 1827.

Two early settlers, Edward George Clerk and John Rankin established Bundarrah Station in 1836. Bundarrah was the Aboriginal name for kangaroos. In 1841 Clerk established a homestead called Clerkness on the northern banks of the Gwydir River. This became the name of the pastoral station and Bundarra the name of the town which developed on the opposite side of the bank. The township soon developed around the crossing point with the Bundarra Inn opened in 1847, being one of the first buildings and situated on the northern side of the river.

In 1861 the township expanded when Thomas Oliver surveyed further portions. Five years later, the population of the district was 500 and although there were two steam mills, the area was largely pastoral. In 1852 a post office was established; a police station, court room and lockup by 1860, and the settlement was surveyed in 1861 by Thomas Oliver. Communication was mainly by horse and dray, but the town had a post office, a court of petty sessions, two churches and two hotels. It was around this time that the village was surveyed, and gold mining saw many of the property employees head to the gold fields of Rocky River near Uralla and further afield. Most brick buildings in the town date from the 1860s and these reflect the prosperity that came with mining and the population it attracted to the district. Gold, antimony, tin and diamonds were mined intermittently but the principal industry has always been sheep and cattle production.

During the 1870's Bundarra continued to develop. It became a staging post for Cobb & Co.'s Bendemeer to Inverell service and the telegraph line from Bendemeer to Bundarra was completed. As it was the service centre for smaller settlements which were springing up around the area due to the discovery of tin, more shops and services were being built.

The bridge over the Gwydir River is an iron lattice bridge and was completed in 1881. The bridge was designed by British engineer John Fowler who was a consultant to the New South Wales government.

6.3 Previous Archaeological and Cultural Heritage Assessments

Archaeological reports and models for New England have argued that elevated granite areas were used or occupied in a manner which differs from that taking place in surrounding river valleys. Some argue that these areas were abandoned in winter due to cold temperatures (Rich 1991); were places where ceremonial activities rather than domestic occupation occurred (McBryde 1974) or were generally little occupied because there were few resources in comparison with areas with a sedimentary geology (Appleton and Burke 1995).

6.3.1 Godwin 1983

Godwin (1983) undertook archaeological research on the eastern margin on the New England Tablelands with results showing that archaeological sites existed above 1000 m, calling for a modification of earlier models (e.g. McBryde 1966) of Aboriginal upland exploitation in the New England area.

6.3.2 *Fife 1997*

Studies over the eastern slopes and ranges of the northern Tablelands include those of the Glen Innes Forestry Management areas to within approximately 25 km of Glen Innes. A 1997 study identified 20 artefact scatters including 6 single artefacts and 14 scatters containing three to greater than fifty artefacts. One rock shelter with art and a rock shelter with occupation deposit were also found. The report concluded that Aboriginal people favoured the gentler slopes of the Tablelands near permanent creeks. The rugged eastern escarpment probably had great ceremonial significance that focused on stone arrangement sites several of which are located along the eastern escarpment of the Northern Tablelands (Fife 1997: i-iv).

6.4 Potential Site Types: Aboriginal Archaeological Sites in the Bundarra Region

The most comprehensive 'regional' model for the area is provided by Godwin (1990) in a major review of the earlier archaeological research of Isabelle McBryde. Godwin's model specifically investigates patterns of movement between the coastal, sub-coastal and tablelands (escarpment) areas. For the purposes of understanding the archaeological record the study area is considered to fall into the 'tablelands' area.

Based on the review of previous archaeological and cultural heritage assessments in the Uralla Shire and the broader New England Tablelands region it is reasonable to propose that specific environment contexts including ridge crests and river flats are more likely to contain evidence of Aboriginal occupation. The following site types and potential types have been identified in the above contexts.

6.4.1 *Isolated Artefacts*

These sites consist of single stone artefacts, which may have been randomly discarded or lost. They can occur in almost any environmental context exploited by Aboriginal people. They are commonly stone axes, single cores, hammer stones, pebbles, flakes and grinding stones and/or grooves. Their presence may indicate that more extensive scatters of stone artefacts exist or existed nearby, perhaps obscured by vegetation or dispersed by mechanical means.

There is a low potential for isolated artefacts to be located within the Project Area. Should these occur they are likely related to peripheral use of larger campsites nearby to the Gwydir River.

6.4.2 *Open Campsites/Artefact Scatters*

Open campsites/artefact scatters generally consist of scatters of stone artefacts and possibly bone and hearth features. Their exposure to the elements means that evidence of food resources used on the site (except for

shellfish) is usually lacking. An open campsite containing a large component of shell refuse may be described as a midden. They invariably consist of low or high-density scatters of primary and secondary flakes in addition to the types of artefacts found as isolated finds. Open campsites may also contain burials when located on sand strata. Few open campsites are found on kraznozem and podzolic soils, possibly due to the destructive impacts of land clearing and the heavy vegetation cover. Detection is usually unlikely unless a high degrees of surface visibility is present.

There is a low potential for artefacts scatters to be located within the Project Area. It is likely that larger open campsites will be located on undisturbed ridge crests and river flats to the north of the Project Area nearby to the Gwydir River.

6.4.3 Quarry Sites

A stone quarry may occur where a source of opaline silica exists or other siliceous types of stone occur (e.g. chert, chalcedony and silcrete). The area can be identified by a number of different types of stone tools in various stages of production as well as refuse flakes.

Given that lack of visible suitable bedded rock outcrops or known sources of siliceous material, it is reasonable to expect that no quarry sites will be located within the Project Area.

6.4.4 Scarred Trees

Scarred trees result from the removal of bark for use as covering, shields, containers or canoes. No doubt, as an outcome of widespread intensive land clearing and natural causes very few have survived.

As the Project Area is understood to have been heavily logged in the historic period and subsequently cleared for agriculture, it is reasonable to assume that no scarred trees will be located. Scarred trees may exist within the riparian zone however would not be affected by the WWTS.

6.4.5 Burials

Human burials are typically individual or small group internments which can be found in sandy soil substrates, such as creek lines or within small rock crevices. Most of the known burials have been located by accidental means through mechanical disturbance or natural erosion.

Given that the underlying soil is not sandy, there is a low potential to locate burials within the Project Area.

6.4.6 Ceremonial Sites

Ceremonial grounds are typically places identified by Aboriginal groups as places of importance which were visited by groups to mark or commemorate rites or other occasions. One such example is Bora grounds; earthen mounds crafted in a circular formation which were used for the purposes of ceremonial practices.

No ceremonial sites are known to occur within the Project Area.

6.4.7 Mythological Sites

These sites are natural features, which derive their significance from an association with stories of the creation and mythological heroes.

No mythological sites are known to occur within the Project Area.

7. SITE INSPECTION

7.1 Survey Team

A site inspection for cultural heritage of the Project Area was undertaken by Everick Senior Archaeologist Dr Morgan Disspain, and Anaiwan LALC Aboriginal Sites Officer Greg Livermore on 6 August 2018.

7.2 Assessment Methods

7.2.1 Aboriginal Cultural Heritage

The field methods aimed to inspect exposed ground surfaces as conditions would allow, to record any archaeological material found and to undertake a preliminary assessment of its significance. The potential of the Project Area to contain sub-surface deposits (PADs) was also assessed though observation of soil profiles in any disturbed areas.

Photographs were taken as a record of general features and to document past disturbance. Notes were made of the degree of disturbance and the archaeological potential. A Garmin GPSMAP64 (GDA 94 datum) was used to record the extent of survey coverage. Mapping and plans used in this assessment were provided by GHD and represent the level of information provided to the consultant.

In addition to assessing the cultural heritage potential of the Project Area, the survey aimed to confirm the nature and degree of ground disturbance.

7.2.2 Non-Aboriginal Cultural Heritage

The state and local heritage listed items were visited and photographed, with a view to understanding if/how the Proposed Works will impact the items and precinct.

7.3 Constraints to Site Detection

An assessment of the constraints to site detection is made to assist in formulating a view as to the effectiveness of the field inspection to find Aboriginal sites and cultural heritage materials. It also assists in the forming of a view of the likelihood of concealed sites (PADs), keeping in mind a site-specific knowledge of the disturbance impacts that European land uses, and natural processes may have had on the 'survivability' of Aboriginal sites in a Project Area.

The constraints to site detection are almost always most influenced by post European settlement land uses and seldom by natural erosion processes. The area of surface exposure and the degree of surface visibility within exposed surfaces are usually the product of 'recent' land uses e.g. land clearing, ploughing, road construction, natural erosion and accelerated (manmade) erosion (McDonald et.al. 1990:92).

In this case the major 'manmade' constraints to Aboriginal site survivability and detection within the proposed WWTS are due to the clearing of original forest and the subsequent impacts of grazing, which through taphonomic processes, can have the effect of accelerating movement of artefacts such as stone downward through soft soils. Detection of Aboriginal archaeological sites in the Project Area is severely limited by the presence of improved pastures (Figure 5 and Figure 6). Vegetation has been cleared in the past. Within the town of Bundarra and along the road verges, constraints included vegetation clearing, bitumen road construction, paved and gravel footpath and driveway construction, landscaping, transmission line installation and drainage channel construction (Figure 7, Figure 8, Figure 9 and Figure 10). Based on the observations taken during the survey it reasonable to conclude that it is unlikely that any soils in the upper 300mm contain original surfaces (Table 4).

Figure 5: Typical grass coverage across ridge within the STP site (facing west).

Figure 6: Vegetation coverage at northern end of ridge within STP site.

Figure 7: Example of road side vegetation along Barraba Road towards town (facing northeast).

Figure 8: Bendemeer Street verge facing north at southern end of town.

Figure 9: Dawkins Street verge facing east.

Figure 10: Souter Street verge facing west.

Table 4: Summary of Environment and Ground Disturbance for Survey Unit.

Survey Unit	Environmental Description	Ground Disturbance Summary
Ridge crests	Open sparse grassland with some sparse native trees.	Land clearing. Drainage channels Intensive grazing
Slopes	Open sparse grassland with some sparse native trees	Land clearing Intensive grazing Dam construction
Road verges	Wide roadside verges within town and from the sewerage treatment plant into the township along Barraba Road. Predominantly landscaped grass verges, some with sparse native regrowth or exotic plantings	Land clearing Road construction Driveways Footpaths Subsurface infrastructure

7.4 Survey Coverage

To achieve as thorough and effective an archaeological assessment as possible a pedestrian ground survey of a sample of the STP site was undertaken, while a vehicle survey of a sample of the town of Bundarra was also

undertaken (Table 5 and Table 6). The following summarises the broad conditions for the survey of each identified unit within the Project Area:

a) Ridge crests. Cleared open grassland with some regrowth of native trees. Grass was thin, short and heavily grazed. Rocky granite outcrops scattered along ridge.

b) Slopes. Cleared open grassland with some regrowth of native trees. Grass was thin, short and heavily grazed. Rocky granite outcrops scattered throughout ridge. Large dam constructed at the base of western slope of large ridge in STP site.

c) Road verges. Wide roadside verges within town and from the sewerage treatment plant into the township along Barraba Road. Predominantly landscaped grass verges, some with sparse native regrowth or exotic plantings.

Table 5 and Table 6 present information on the extent to which survey data provides enough evidence for an evaluation of the distribution of archaeological materials across the Project Area. The evaluation of survey coverage provides a measure of the potential for the survey to identify archaeological evidence. The calculations in Table 5 and Table 6 do not provide exact percentages, but reasonable estimates.

Table 5: Survey Coverage.

Survey unit	Landform	Survey Unit Area (m^2)	Visibility (%)	Exposure (%)	Effective survey coverage (m^2)	Effective coverage (%)
STP Ridge Crest	Ridge Crest	15,000	70	20	2,100	14
STP Ridge slopes	Ridge slopes	38,100	70	20	5,334	14
Road verges from WWTS site to town	Undulating hills	44,620	20	5	446	1
Road verges within town	Floodplain	38,666	20	5	386	1

Table 6: Landform Summary- Sampled Areas.

Landform	Landform Area (sq. m)	Area effectively surveyed (sq. m)	% of landform effectively surveyed	Number of sites	Number of artefacts or features
Ridge Crest	53,780	2,100	3.905	0	0
Ridge slopes	121,886	5,334	4.376	0	0
Undulating hills	65,455	446	0.682	0	0
Floodplain	86,0541	386	0.045	0	0

The following should be considered when reviewing the effectiveness of the survey and the survey results:

a) The target total survey area for pedestrian transects in the STP site was 5% of the ridge crest and slopes.

b) The overall low predicted likelihood of identifying sites within the Project Area.

c) The potential that stone artefacts have moved downward through the soil profile because of clearing, trampling and topsoil disturbance.

d) Having consideration for the low potential of the highly disturbed roadside verges to contain artefacts, a smaller percentage of these survey units were included within the archaeological survey. The roadside verges were surveyed using vehicular traverses. This sampling strategy was agreed to by the Sites Officer from Anaiwan LALC.

8. RESULTS

8.1 Aboriginal Cultural Heritage Results

As a result of the desktop study, site inspections, Aboriginal community consultation and archaeological investigation of the Project Area, the following was found.

- No additional Aboriginal cultural heritage items or places were identified during the survey.
- One previously recorded Aboriginal site (Bundarra Scar modified tree AHIMS ID 20-3-0074) was visited during the survey (Figure 11), and it was determined that the Proposed Works will not impact the site.
- Having consideration for the low potential of the highly disturbed roadside verges to contain artefacts, a smaller percentage of these survey units were included within the archaeological survey. The roadside verges were surveyed using vehicular traverses. This sampling strategy was agreed to by the sites officer from Anaiwan LALC.
- There is very little topsoil material on the upper slope of the ridge crest within the STP site. It is considered unlikely that the surrounding soils would contain Aboriginal objects, and as such the ridge crest was not identified as a PAD.
- There is extensive disturbance and land surface alteration within the town of Bundarra on the river flats of the Gwydir River. As such, it is considered unlikely that the soils would contain any Aboriginal artefacts, and as such, the river flats within the Project Area were not identified as a PAD.
- In consideration of the potential of the ridge crest to contain Aboriginal sites, it was noted that the foot slopes of the ridgeline to the north would have provided better access to resources along the river and floodplain, including swamps and wetlands. The ridge crest that comprises the Project Area was not considered to be a 'pathway' as there was no obvious landscape feature which was identifiable as a destination to the south of the Project Area.

8.2 Additional Research

It is not considered that additional archaeological research, in the form of test pit excavations, will significantly inform the management response for sites within the Project Area. This conclusion is based on the following considerations:

- the absence of large scale stone artefact scatters identified during the archaeological survey;
- the absence of known ceremonial or intangible sites in the Project Area and surrounds;
- the nature and extent of known archaeological sites in the surrounding areas;

- the high levels of disturbance within the Project Area; and
- the absence of deep and undisturbed topsoil deposits.

It is considered unlikely that an archaeological excavation program over the PAD areas will identify a stone artefact scatter with either high or moderate conservation value. Stone artefact scatters, should they occur, are likely to be disturbed, have low artefact densities, and are unlikely to contain locally unique artefacts. As such it is reasonable to conclude that these sites, should they exist, will be of low conservation value.

Figure 11: Previously recorded AHIMS Site.

8.3 Non-Aboriginal Cultural Heritage

The WWTS has the potential to impact on items identified as having local or state heritage significance. For an assessment of the impact of the Proposed Works on the heritage listed items, see Appendix C.

9. RECOMMENDATIONS

One previously recorded Aboriginal site is present within the Project Area, but this site will not be impacted by the Proposed Works. The following recommendations are provided to manage impacts to Aboriginal sites within the Project Area.

Recommendation 1: Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least ten (10) metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material;

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010); and

e) should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.

Recommendation 2: Old Police Station and Courthouse

The following controls should be put in place during construction;

- temporary site fencing installed within one (1) metre of the wall of the courthouse to ensure that the building is clearly designated as a restricted area;
- the requirements for work adjacent to the building are clearly identified in operational plans, drawings and works descriptions;
- all staff and contractors should be provided with an induction regarding access and work requirements adjacent to the building, including provisions for a Find Procedure in the event of identification of historic relics; and
- completion of high resolution images of the location of the sewerage pod prior to and on completion of the works to document the nature and extent of visual impact if any.

The nature of the proposed works is such that approval by the NSW Heritage Council should be undertaken under the 'standard exemption' provisions of the Heritage Act. In this instance the standard exemptions should apply;

- Standard Exemption 4: Excavation; and
- Standard Exemption 7: Minor Activities with Little or No Adverse Impact on Heritage Significance.

It is noted that the standard exemptions remove the requirement for formal approval however require that the Proponent writes to the Director-General to seek written notification that the exemption will apply prior to commencement of the works.

Recommendation 3: Aboriginal Human Remains

Although it is unlikely that human remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Bundarra), the Anaiwan LALC, and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the RAPs and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 4: Conservation Principles

It is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values at all stages during the development works. If impacts are unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal community.

.

10. REFERENCES

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APPENDIX A: CONSULTATION WITH AINAWAN LALC

Hi Greg

We are just finalising our ACH report for the Bundarra WWTS project. Thank you for your support on the survey.

Do you typically provide a report or letter of support for these types of jobs and if so do you do it before or after you see the ACHA report? Give me a call if it's easier.

Ta

Tim Hill BA (Hons.)

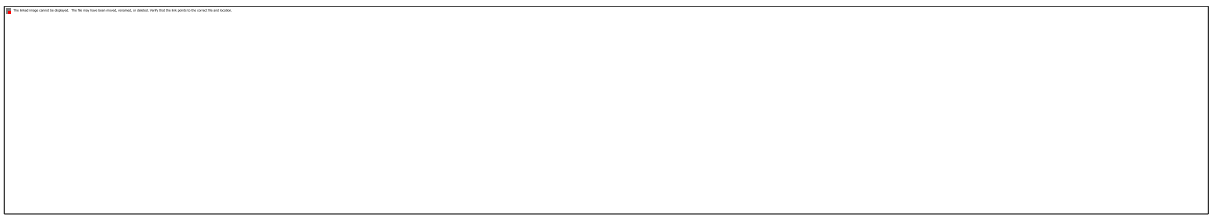
Senior Archaeologist

EVERICK Heritage Consultants Pty Ltd
ABN 78102206682

PO Box 200
Coffs Harbour NSW 2450

Ph: 1300 124 356
Mob: 0422 309 822
Fax: (07) 3368 2440
Email: t.hill@everick.com.au

Web: www.everick.com.au



From: anaiwan lalc <anaiwanlalc@tingha.net>
Sent: Wednesday, 1 August 2018 1:59 PM
To: Tim Hill <t.hill@everick.net.au>
Subject: RE: Heritage Assessment

Hi Tim,
When I spoke with you a couple of weeks ago you said that you factored in a fee for the Cultural Heritage Assessment in your tender for the job and I think from memory something in the vicinity of $900 for the day is that right? also for your information we issue a Tax Invoice for payment.

Normally any extras i.e. LALC Reports, letter of Support on LALC Letterhead in support of your report and findings etc are separate and are billed accordingly.

Cheers
Greg

From: Tim Hill [mailto:t.hill@everick.net.au]
Sent: Wednesday, 1 August 2018 1:03 PM
To: anaiwan lalc
Cc: Morgan Disspain; Ben Luffman
Subject: RE: Heritage Assessment

Hi Greg

I will make some calls and get back to you. But we are tight for time so I will say yes and make it happen.

We have not provided a budget estimate for the LALC to the client but typically we received an invoice from the LALC instead of doing casual pays.

Sorry- I've had an issue with my phone and have had to swap to a new one- can you please send me a text to 0422309822 and I can give you a call back if it's easier.

Ta

Tim Hill BA (Hons.)

Senior Archaeologist

EVERICK Heritage Consultants Pty Ltd
ABN 78102206682

PO Box 200
Coffs Harbour NSW 2450

Ph: 1300 124 356
Mob: 0422 309 822
Fax: (07) 3368 2440
Email: t.hill@everick.com.au

Web: www.everick.com.au

From: anaiwan lalc <anaiwanlalc@tingha.net>
Sent: Wednesday, 1 August 2018 12:33 PM
To: Tim Hill <t.hill@everick.net.au>
Subject: RE: Heritage Assessment

Hi Tim,
Unfortunately, due to previous commitments and me out of the office the only day next week I am available is on Monday 6th August 2018, if this day is OK, can you send me start time and where in Bundy do I meet you guys.

Also, can you confirm Pay Rates for the day for the Sites Officer please.
Cheers
Greg

From: Tim Hill [mailto:t.hill@everick.net.au]
Sent: Tuesday, 31 July 2018 9:26 AM
To: anaiwan lalc
Subject: RE: Heritage Assessment

Hi Greg

Any day will be OK with us- Morgan is available all week and I am available only Wednesday.

Ta
Tim

From: anaiwan lalc <anaiwanlalc@tingha.net>
Sent: Tuesday, 31 July 2018 9:23 AM
To: Tim Hill <t.hill@everick.net.au>
Subject: RE: Heritage Assessment

Hi Tim,
Thanks for the information, what day next week did you have in mind?
Cheers
Greg

From: Tim Hill [mailto:t.hill@everick.net.au]
Sent: Tuesday, 31 July 2018 7:32 AM
To: anaiwanlalc@tingha.net
Cc: Ben Luffman; Morgan Disspain
Subject: FW: Heritage Assessment

Hi Greg

As discussed yesterday- please see attached the design for the Bundarra STP. Can you please indicate the availability of an Aboriginal sites officer next week? my apologies again for the timeframes.

The survey will aim to cover areas of bushland and lesser disturbance in the first instance and then finish up with a sample of the streets.

I will get a copy of the AHIMS searches to you prior to commencement of the survey.

The field work will be completed by either myself or Morgan Disspain.

Ta

Tim Hill BA (Hons.)

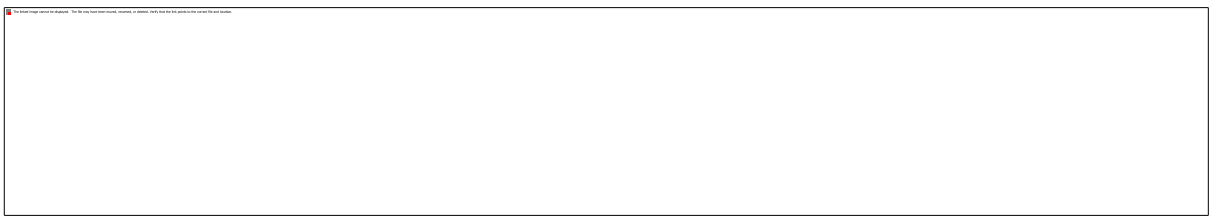
Senior Archaeologist

EVERICK Heritage Consultants Pty Ltd
ABN 78102206682

PO Box 200
Coffs Harbour NSW 2450

Ph: 1300 124 356
Mob: 0422 309 822
Fax: (07) 3368 2440
Email: t.hill@everick.com.au

Web: www.everick.com.au



Anaiwan Letter of Support

ANAIWAN
LOCAL ABORIGINAL LAND COUNCIL
anaiwanlalc@tingha.net
7 Opal Street, Tingha NSW 2369 | P.O. Box 651, Inverell N.S.W. 2360 | Phone (02) 6723 3022, Fax (02) 6723 3023

2nd October 2018

Dr Morgan Disspain

Senior Archaeologist

EVERICK Heritage Consultants

Unit 11, 1A Oak Street

Bellingen NSW 2454

Dear Morgan,

Re: Cultural Heritage Assessment Report for Bundarra Sewerage Treatment Scheme.

Further to a Cultural Heritage Assessment involving Anaiwan Local Aboriginal Land Council at the proposed Bundarra Sewerage Treatment Site on Monday 6th August 2018.

After reviewing your Report and having physically assessed the subject area with you the Anaiwan LALC endorses your Report and advice to GHD and in particular results outlined in Section 8, Page 38, under the heading of **Aboriginal Cultural Heritage Results & Recommendations** Section 9, Pages 40 & 41 respectively.

Consistent with the other recommendations already noted in your report Anaiwan LALC is satisfied that all current Due Diligence procedures were followed and that during the assessment process, no evidence of any sites or objects of Aboriginal Cultural Heritage were found in the proposed works area.

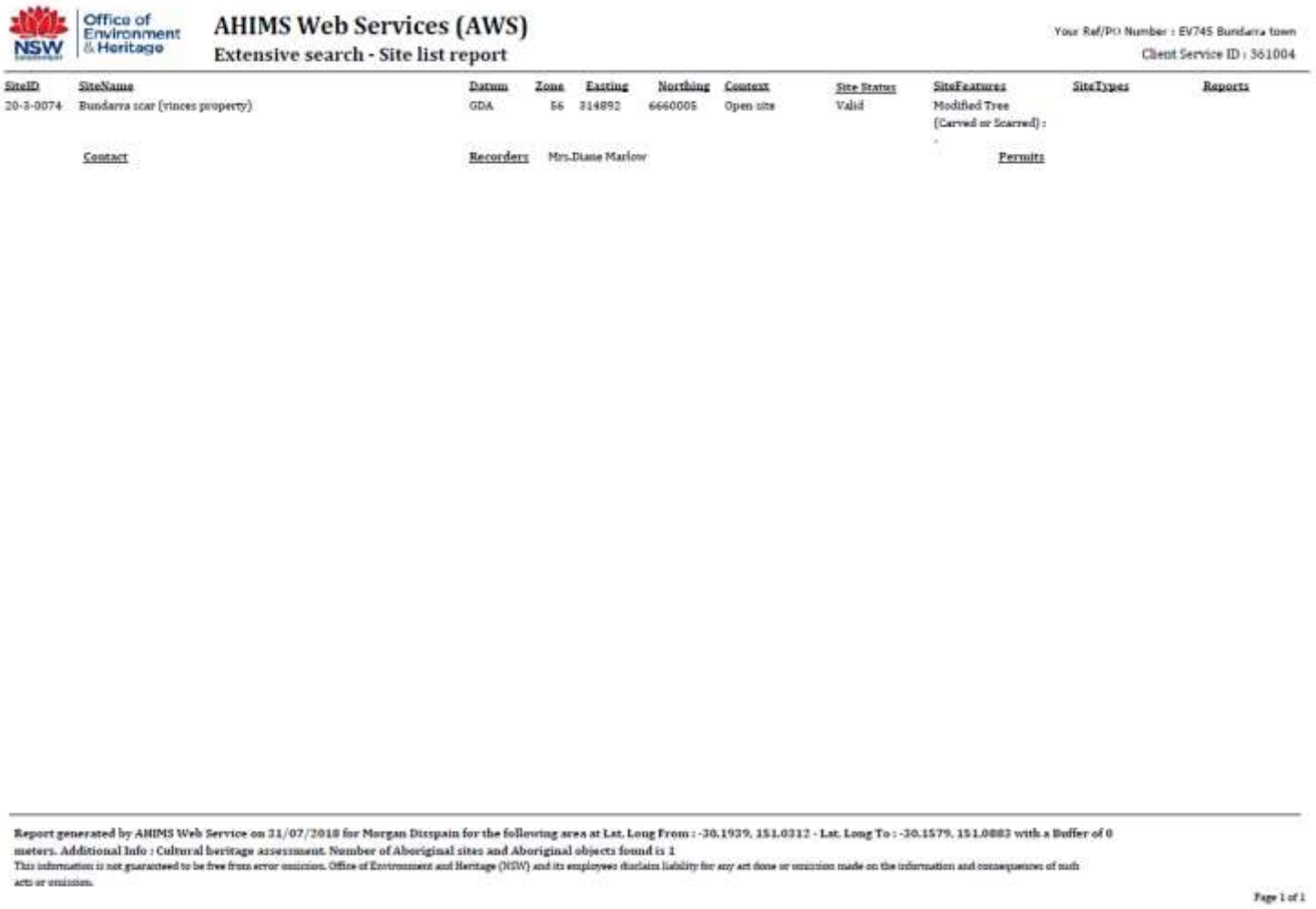
I will mention however that the Scarred Tree referred to in the Report (AHIMS ID 20-3-0074) I don't believe is of Aboriginal origin because closer inspection suggests the scar is a limb tear and the AHIMS Informant was advised of this but chose to register the site despite the advice.

If I am able to assist you further re this letter, please contact me at the Anaiwan LALC office on 0267233 022 during hours.

Regards

Gregory J. Livermore
Chief Executive Officer
Anaiwan LALC

APPENDIX B: AHIMS SEARCH RESULTS



Office of Environment & Heritage

NSW

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : EV745 Bundarra town

Client Service ID : 361004

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
20-3-0074	Bundarra scar (vinces property)	GDA	56	314892	6660005	Open site	Valid	Modified Tree (Carved or Scarred) :		

Contact — Recorders: Mrs.Diane Marlow — Permits

Report generated by AHIMS Web Service on 31/07/2018 for Morgan Dixspain for the following area at Lat, Long From : -30.1939, 151.0312 - Lat, Long To : -30.1579, 151.0882 with a Buffer of 0 meters. Additional Info : Cultural heritage assessment. Number of Aboriginal sites and Aboriginal objects found is 1

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Page 1 of 1

APPENDIX C: STATEMENT OF HERITAGE IMPACT

Heritage Significance Statements

Bundarra Police Station & Courthouse

Name of item:	Bundarra Police Station & Courthouse
Type of item:	Complex / Group
Group/Collection:	Law Enforcement
Category:	Courthouse
Location:	Lat: -30.1716309725 Long: 151.0753837000
Primary address:	Oliver Street, Bundarra, NSW 2359

The former Bundarra Police Station-Court House is significant because the building embodies the establishment, growth and evolution of one of the major influential public departments of NSW. The responsibilities and duties of this Department were of fundamental importance to the development of law enforcement after the introduction of the Police Regulation Act of 1862 NSW. The former Bundarra Police Station Court House has close associations with the development of the Region as a centre for Law Administration. The building also has close association with the Colonial Architect's Office and may be used to demonstrate the design philosophy of that Office in rural regions. The former Bundarra Police Station-Court House is a particularly well-known urban landmark in the town of Bundarra and makes a major contribution to the streetscape qualities of the Bendemeer and Oliver Streets Precinct. The quality of workmanship and the unique use of elements in this building has produced a pleasing and esteemed visual aesthetic. The building is a rare and unusual example of a `modified Victorian Georgian' style reminiscent of the earliest Australian buildings idioms into a system based on a utilitarian scale and use. The quality of the design, including its proportions, details and character are of a high standard. The inclusion of the former Bundarra Police Station-Court House on a number of Federal and local heritage registers underscores its widespread importance as an item of cultural heritage to the local and wider community. This importance is further demonstrated by the efforts of the Bundarra community and the Shire Council to development the `place' as a cultural tourist attraction demonstrating the importance of early Bundarra as a service centre and in law administration in this part of New South Wales.

Table 7: SHR Significance Criteria Assessment.

SHR Criteria	*Significance assessment*
SHR Criteria a) ***[Historical significance]***	The former Bundarra Police Station-Court House embodies the establishment, growth and evolution of one of the major influential public departments of NSW. The responsibilities and duties of this Department were of fundamental importance to the development of law enforcement after the introduction of the Police Regulation Act of 1862 NSW. The former Bundarra Police Station -Court House has close associations with the development of the Region as a centre for Law Administration. The building also has close association with the Colony Architects Office and may be used to demonstrate the design philosophy of that Office in rural regions.
SHR Criteria c) ***[Aesthetic significance]***	The former Bundarra Police Station-Court House is a particularly well-known urban landmark in the town of Bundarra and makes a major contribution to the streetscape qualities of the Bendemeer and Oliver Streets Precinct. The quality of workmanship and the unique use of elements in this building has produced a pleasing and esteemed visual aesthetic. The building is a rare and unusual example of a `modified Victorian Georgian' style reminiscent of the earliest Australian buildings idioms into a system based on a utilitarian scale and use. The quality of the design, including its proportions, details and character are of a high standard.
SHR Criteria d) ***[Social significance]***	The inclusion of the former Bundarra Police Station-Court House on a number of Federal and local heritage registers underscores its widespread importance as an item of "cultural heritage" to the local and wider community. This importance is further demonstrated by the efforts of the Bundarra community and the Shire Council to development the `place' as a cultural tourist attraction demonstrating the importance of early Bundarra as a service centre and in law administration in this part of New South Wales.

Bridge over Gwydir River

Name of item:	Bridge over Gwydir River
Other name/s:	RTA Bridge No. 3763
Type of item:	Built
Group/Collection:	Transport - Land
Category:	Road Bridge
Primary address:	Bendemeer Street, Bundarra, NSW 2359
Local govt. area:	Uralla

The iron lattice truss bridge over the Gwydir River, completed in 1881, has significance because: it has been an important item of infrastructure in the history of New South Wales for over 120 years; it was a technically sophisticated bridge structure for its time; it has strong aesthetic lines and enhances the aesthetics of the environment; it contributed significantly to the social and commercial development of the New England region of New South Wales and it is an excellent representative example of this type of bridge. This bridge has been assessed as being of State significance.

The lattice truss is an example of British bridge technology and they appeared in large numbers in the British colonies of Australia, particularly in New South Wales and Victoria and a few examples in the other colonies. These bridges were almost the exclusive choice for large rail and road bridges such that in New South Wales, 41 of these bridges (27 for roads and 14 for railways) were built between 1871 and 1893. Most were in the Hunter Valley and New England region.

They were a more economical form of construction than the heavy cellular girder bridges, requiring only about half the amount of iron, but the iron was still an expensive import (rolling marks such as Butterley, Shelton and Burbach appear on iron elements of many of the bridges). In terms of costs, indexed to the year 2000, the iron lattice bridges would have cost around $9,000 per square metre of deck whereas for timber truss bridges this unit cost would only have been around $1,500. Despite the high initial costs of the lattice bridges, their durability and low maintenance costs have meant that in the long term they have been very cost-effective structures. The iron lattice bridges were, to the colonial period, what reinforced concrete bridges were to the period 1930-1960 and prestressed concrete bridges have become since the 1970s.

Table 8: SHR Criteria Assessment.

SHR Criteria	Significance assessment
SHR Criteria a) [Historical significance]	The bridge has high historical significance as it is on a main road. It is a large bridge with long spans over a major river, indicative of the then burgeoning road network. It has historic associative value based on its ability to represent the endeavours of local settlers, with their need for safe and reliable access across the Gwydir River. It is associated with bridge designer John A. McDonald. It significantly helped open up the north of New South Wales.
SHR Criteria c) [Aesthetic significance]	Aesthetically, the bridge with its long lattice trusses presents an imposing yet attractive reminder of the past. It has strong aesthetic lines that enhance the aesthetics of its environment. As such, the bridge has aesthetic significance.
SHR Criteria d) [Social significance]	Because of their numbers, the complete set of lattice truss bridges gain high social significance. The bridge also has great significance to the local community, as is evident from the community holding centenary celebrations. The centenary celebrations for the 100-year-old Gwydir Bridge at Bundarra was the largest celebration ever to occur in living memory of the residents. The bridge has contributed significantly to the social and commercial development of northern New South Wales.
SHR Criteria e) [Research potential]	The bridge has high technical significance because of its integrity and good condition, which contributes to its ability to demonstrate aspects of technology, design and style in bridge construction. The bridge is a good example of British bridge technology.
SHR Criteria g) [Representativeness]	A good representative example of an iron lattice truss bridge.
Integrity/Intactness:	Intact

McDonald's Saw, Plane Mill and House

Name of item:	McDonald's Saw, Plane Mill and House
Type of item:	Complex / Group
Group/Collection:	Manufacturing and Processing
Category:	Mill settlement
Location:	Lat: -30 12 45 Long: 150 53 05
Primary address:	29 Tomline Street, Bundarra, NSW 2359
Parish:	Bundarra
County:	Darling
Local govt. area:	Uralla

Dis-used mill, residence and outbuildings in varying states of disrepair. All buildings are timber framed and clad in either weatherboard or corrugated iron. The machinery is electrically powered and remains in-situ. At the time of the first historical study, the records were held in a store room on the site. Some volumes were removed by H. Abrahams (Uralla Historical Society research assistant) for preservation.

Machinery items include:

- Vertical pit saw (powered by AGE 415 v 3 phase induction motor type AK 6328).
- Bench profile planer (made by T. Robinson and son Ltd., Rochdale, England
- sharpening wheel patent 1923.
- Toror generator (AGE induction motor type AKT 952).
- Small circular saw.
- Large circular saw about 30'', 75 cm (Made by Sully and Ford, Glen Innes); powered by AGE Induction Motor Type RS 7126).
- Planer (made by T and R recs Engineers Hollingwwod.

- Planer (made by Haigh Oldham).
- Other items - safes, dis-used joiners, finer joinery machines, planers, drills, wheels, tools and spare blades.

A marvellous collection of buildings showing how an owner operated business functioned. The house with gambrel roof and very interesting front fenced dates from the 1910-1915 period.

Table 9: Australian and NSW historic themes.

Australian theme (abbrev)	New South Wales theme	Local theme
3. Economy-Developing local, regional and national economies	Commerce-Activities relating to buying, selling and exchanging goods and services	Former saw and plane mil-
4. Settlement-Building settlements, towns and cities	Utilities-Activities associated with the provision of services, especially on a communal basis	Former saw and plane mill-
5. Working-Working	Labour-Activities associated with work practises and organised and unorganised labour	Saw and plane mill and house-

St Mary's Roman Catholic Church

Name of item:	St Mary's Roman Catholic Church
Other name/s:	St Mary of the Angels
Type of item:	Built
Group/Collection:	Religion
Category:	Church
Location:	Lat: -30 12 45 Long: 150 53 05
Primary address:	5 Oliver Street, Bundarra, NSW 2359
Parish:	Bundarra
County:	Darling
Local govt. area:	Uralla

St Mary of the Angels Roman Catholic Church has landmark, historical association, aesthetic, social and representative significance. Landmark significance arises from its corner position and that the large dominant building is located on a small ridge. It is historically linked with the development of the Roman Catholic church in the New England and is part of a group comprising the adjoining presbytery, and opposite the former school and convent. The development of the Catholic church as part of a religious precinct provides the opportunity for research projects to investigate the development of the church, the school, the convent and the presbytery in Bundarra and the wider New England Tablelands. The church is representative of the number of catholic buildings approved and blessed by the Armidale Bishop O'Connor.

Table 10: SHR Criteria Assessment.

SHR Criteria	Significance Assessment
SHR Criteria a) [Historical significance]	The church is historically part of the spread of Catholicism in rural New England.
SHR Criteria b) [Associative significance]	There are historic associations with the Catholic Church, Bishop O'Connor, and architect J.F. O'Connor.

SHR Criteria	Significance Assessment
SHR Criteria c) [Aesthetic significance]	This is a dominant brick building in Bundarra with a distinctive front façade.
SHR Criteria d) [Social significance]	The church, former school and former convent have social significance to the community of Bundarra.
SHR Criteria e) [Research potential]	The development of the Catholic Church as part of a religious precinct provides the opportunity for research projects to investigate the development of the church, the school, the convent and the presbytery in Bundarra and the wider New England Tablelands.
SHR Criteria g) [Representativeness]	The church is representative of the number of catholic buildings approved and blessed by the Armidale Bishop O'Connor.

Bundarra Commercial Precinct Heritage Conservation Area

Name of item:	Bundarra Commercial Precinct Heritage Conservation Area
Other name/s:	Commercial Precinct
Type of item:	Conservation Area
Group/Collection:	Commercial
Category:	Commercial Office/Building
Location:	Lat: -30 10 00 Long: 150 05 00
Primary address:	Bendemeer Street, Bundarra, NSW 2359
Parish:	Bundarra
County:	Hardinge
Local govt. area:	Uralla
Boundary:	From Bowline Street to Souter Street (east side) and to Oliver Street (west side)

Bundarra commercial precinct is focused around the wide, open vista, straight street with views between terminating items - the bridge over the Gwydir and the Barnet courthouse. The streetscape includes a variety of trees and buildings demonstrating not only distinctive styles but also use of building materials and spatial relationships. Buildings vary from small timber structures to substantial two storey brick structures, from the 19th century to 1950s, residential and commercial, memorials and street plantings. Social significance arises from residents' pride in their town and continued use of the buildings as homes and businesses. The town provides the opportunity to research the varied architectural styles as well as its development as an historic service town. The size and scale of building stock, the main street's width and spatial relationships, are representative of the importance of Bundarra as a service centre on a major route and, due to its being at a river crossing, as a major communications link from the days of bullock drays to motor vehicles, and hence why such services were located here. The Bundarra commercial precinct has landmark, historical association, streetscape, social, research and representative significance. (see also individual entries).

Buildings of particular interest include:

- St Mary the Virgin Anglican Church -. designed by J. Horbury Hunt and built 1874.
- Police station.
- St Mary of the Angels Catholic church - 1913.
- St Mary of the Angels presbytery and house.
- Commercial Hotel - circa 1874.
- Bundarra Bridge - 1881 probably built by Rouse who constructed bridges at Manilla and Bingara.
- Bundarra hospital - circa 1910.
- General store and barn of Flemish bond brickwork.
- School of arts building - 1931.
- Post office - first established in 1852.
- Former Roman Catholic hall - now Bundarra Engineering.
- Former Commercial Banking Company building.
- Former McDonald's saw and planing mill.
- School principal's residence.
- Day's residence.
- Cracknell's residence.
- Cemetery - with graves dating from 1860s.

Table 11: SHR Significance Criteria Assessment.

SHR Criteria	Significance Assessment
SHR Criteria a) [Historical significance]	The townscape and collection of period building stock demonstrates a once thriving service centre for the surrounding agricultural hinterland, since by-passed by the evolution of modern transport modes.
SHR Criteria b) [Associative significance]	The commercial precinct is related to the development of Bundarra as a service town. The buildings demonstrate the diversity of services offered to the public by private enterprise and government including postal, banking, accommodation, food and refreshments, services to the car and transport industry, agriculture, religious and recreational.
SHR Criteria c) [Aesthetic significance]	An examination of the various commercial buildings demonstrates the construction techniques used for a diversity of architectural styles varying from the timber shops, the pressed metal fronts, the varied galvanised roof styles and the use of brick and cement rendering. The buildings vary in size and there are particular examples of large public and private buildings such as the former C.B.C. bank building, the two storeyed

	brick Commercial Hotel; the school of arts; the Commercial Hotel; the post office and the courthouse.
SHR Criteria d) [Social significance]	Social significance arises from the use of some of the commercial buildings as residences as well as the working relationship developed between the business employees and the customers.
SHR Criteria e) [Research potential]	Bundarra township and its diversity of churches and public buildings provide the opportunity to research the development of the location as a service town. It also provides the opportunity to research the varied architectural styles and use of building materials.
SHR Criteria f) [Rarity]	This is the only commercial precinct in Bundarra.
SHR Criteria g) [Representativeness]	Bundarra township is representative of the varied businesses that were developed for the residents of the district and the public travelling from Uralla north through to Tingha and Inverell, and south to Bingara and Barraba.

Site Inspection and Assessment

A site inspection of the Project Area was undertaken by Dr Morgan Disspain of Everick Heritage Consultants, on 6 August 2018. The site inspection focused on the proposed WWTS pipeline and its potential impacts to adjacent heritage items.

The site inspection did not identify any ancillary heritage items which should be additionally considered by the study.

Bundarra Police Station & Courthouse

Figure 12: Bundarra Police Station and Courthouse western wall

Figure 13: Rear of the Bundarra Police Station and Courthouse

Figure 14: Front of Bundarra Police Station and Courthouse

Figure 15: Bundarra Police Station and Courthouse from across the street showing wide verge to the east

Bridge over Gwydir River

Figure 16: Bridge over Gwydir River facing northeast from Bowline Street

Figure 17: Bridge over Gwydir River showing railings

Figure 18: Bridge over Gwydir River showing footpath to the east.

Figure 19: Underneath bridge over Gwydir River facing north across the river

Figure 20: Underneath bridge over Gwydir River facing south from southern river bank.

McDonald's Saw, Plane Mill and House

Figure 21: McDonald's Saw, Plane Mill and House facing west

St Mary's Roman Catholic Church

Figure 22: St Mary's Roman Catholic Church facing north from Oliver Street

Figure 23: St Mary's Roman Catholic Church

Bundarra Commercial Precinct Heritage Conservation Area

Figure 24: Bundarra Commercial Precinct Heritage Conservation Area facing south along Bendemeer Street

Figure 25:Bundarra Commercial Precinct Heritage Conservation Area facing north along Bendemeer Street

Statement of Heritage Impact (SoHI)

The *Statement of Heritage Impacts Guideline* (NSW Heritage Office 2002) has been used to evaluate and explain how the proposed works might impact on the heritage values of the heritage items. An assessment of heritage impact should also address how the heritage value of the sites/places can be conserved or maintained, or preferably enhanced by the Proposed Works.

Nature of Potential Impacts

For the purposes of the study the potential impact to the heritage items will be installation of new sewerage pressure systems at each premise (Figure 26 and Figure 27). They will be installed next to the existing septic tank and all that will be seen after installation is the lid, which will be at ground level. During construction, there will be a trench excavated along the road reserve, but once the pipe is installed this will be backfilled and the area returned to pre-existing conditions, so nothing will be visible.

Figure 26: Proposed low pressure sewerage pod to be installed at each property.

It is proposed that the pipe will cross the Gwydir River the bridge crossing. The PE DN90 pipe will be laid under the beams supporting the pathway and held by brackets. The pipe is black in colour, and the brackets attaching it to the bridge are metallic. Figure 27 shows the pathway and supporting beams (see also Figure 32 below). The location of the proposed low-pressure sewerage pods in relation to other heritage items are provided below (Figure 28- Figure 31).

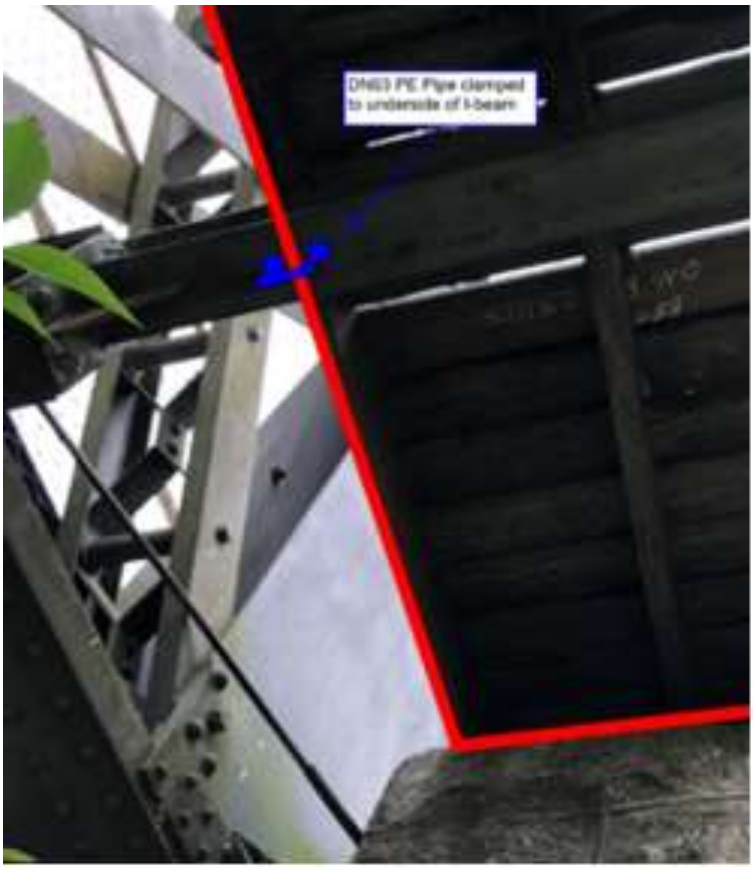


Figure 27: Proposed placement of the pipe across the bridge over Gwydir River.

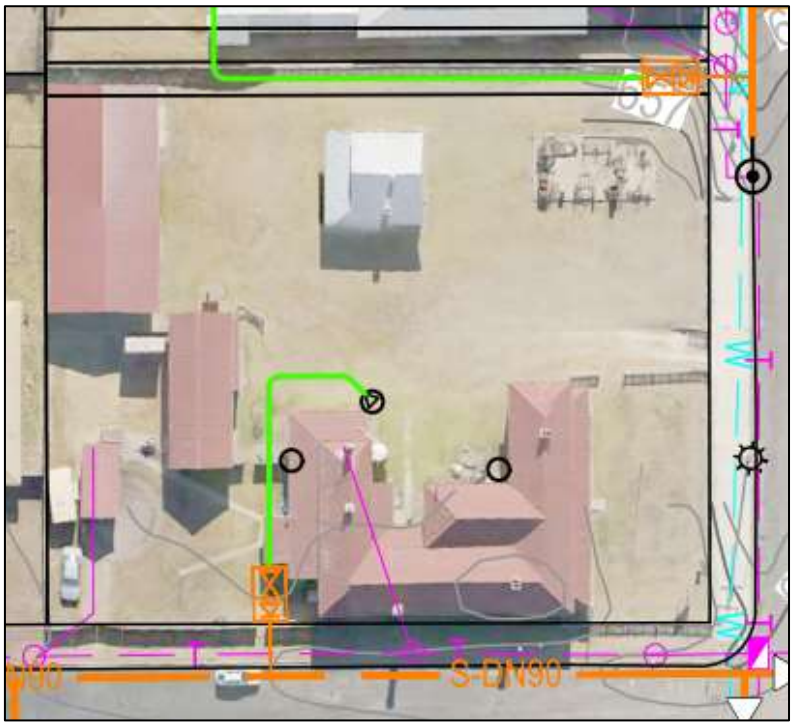


Figure 28: Pipes and pod location at Bundarra Police Station and Courthouse. Pod location indicated by black partly-filled circle. Empty circles indicate position of existing septic tanks.

Figure 29: Pipes and pod location at McDonald's Saw, Plane Mill and House. Pod location indicated by black partly-filled circle. Empty circle indicates position of existing septic tank.

Figure 30: St Mary's Roman Catholic Church pipe plans showing no pod installation at premises.

Figure 31: Pipe layout within Bundarra Commercial Precinct Heritage Conservation Area.

The potential impacts for each heritage item are outlined below (Table 12).

Table 12: Nature of Potential Impacts

Heritage Item	*Some aspects of the proposal respect or enhance the heritage significance of the item or conservation area*	*Some aspects of the proposal will detrimentally impact on heritage significance of the Heritage item*	*Have more solutions been considered, and if so or why have they been discounted?*
Bundarra Police Station and Courthouse	The new sewerage system respects the building in that no equipment will be attached to the building itself, ensuring that the aesthetics of the structure are unimpaired.	The new sewerage system will detrimentally impact the heritage item in that the top of the green plastic pod will be visible at ground surface level.	The decision to install a green plastic pod at the premises has been informed by the requirement of each property connected to the new WWTS system to have this below ground infrastructure installed to enable connection to the system. Alternatives would be to install the pod on adjacent properties of within the road easement.
Bridge over Gwydir River	The proposal to install PE DN90 pipe on top of the beams supporting the pathway of the bridge respects the heritage significance of the item by being partly hidden within the structure of the bridge. The visual impact will be lessened by ensuring the colour of the pipes and the brackets are similar to the steel rails of the bridge to which they are attached.	The proposal to install PE DN90 pipe on top of the beams supporting the pathway of the bridge detrimentally impacts the heritage significance of the item by being partly visible from the pathway of the bridge. The pipeline will not increase rusting or corrosion of the bridge structure.	The decisions to install the pipes attached to the bridge has been informed by the requirement to transport waste water across the river as efficiently as possible. Installing the pipe below ground surface and beneath the river is an alternative that would require extensive ground disturbance.
McDonald's Saw, Plane Mill and House	The proposal to install a new low-pressure sewerage pod will result in a green plastic pod installed at the rear of the building. The new sewerage system respects the building in that no equipment will be attached to the building itself,	The proposal to install a new low-pressure sewerage pod will result in a low-profile green plastic pod installed at the front of the house. The new sewerage system impacts the building in that the pod will be visible from the street.	The decision to install a green plastic pod at the premises has been informed by the requirement of each property connected to the new WWTS system to have this below ground infrastructure installed to enable connection to the system.

Heritage Item	*Some aspects of the proposal respect or enhance the heritage significance of the item or conservation area*	*Some aspects of the proposal will detrimentally impact on heritage significance of the Heritage item*	*Have more solutions been considered, and if so or why have they been discounted?*
	ensuring that the aesthetics of the building are unimpaired.		Alternatives would be to install the pod on adjacent properties of within the road easement.
St Mary's Roman Catholic Church	The proposal does not include any infrastructure within the curtilage of this heritage item. As such, it respects the item in that no visible alterations will be made to the St Mary's Roman Catholic Church.	The proposal does not include any infrastructure within the premises of this heritage item. As such, it will not detrimentally impact the St Mary's Roman Catholic Church.	The decision to install a green plastic pod at the premises has been informed by the requirement of each property connected to the new WWTS system to have this below ground infrastructure installed to enable connection to the system. Alternatives would be to install the pod on adjacent properties of within the road easement.

Heritage Item	*Some aspects of the proposal respect or enhance the heritage significance of the item or conservation area*	*Some aspects of the proposal will detrimentally impact on heritage significance of the Heritage item*	*Have more solutions been considered, and if so or why have they been discounted?*
Bundarra Commercial Precinct Heritage Conservation Area	The proposal to install new low-pressure sewerage pod at properties within the Bundarra Commercial Precinct Heritage Conservation Area will result in a green plastic pod being installed at each connected premises. Most of the pods are proposed to be installed at the rear of the buildings, and as such, respect the heritage significance of the precinct. Additionally, the new sewerage system respects the precinct in that no equipment will be attached to the building itself, ensuring that the aesthetics of the buildings are unimpaired, and all trenches will be backfilled and rehabilitated to be as they were prior to pipe laying.	The proposal to install new low-pressure sewerage pod at properties within the Bundarra Commercial Precinct Heritage Conservation Area will result in a green plastic pod being installed at each connected premises. A small number of these pods will be installed at the side of the buildings, a and as such, may detrimentally impact the significance of the heritage precinct by being visible from the street.	The decision to install a green plastic pod at the premises within the heritage precinct has been informed by the requirement of each property connected to the new WWTS system to have this below ground infrastructure installed to enable connection to the system. Alternatives to installing some of the pods at the side of the buildings would be to install them at the rear of the buildings to avoid being able to be viewed from the street.

Requirement for a Conservation Management Plan

The following statements are provided to consider the requirement for a Statement of Significance ('SOS'), Conservation Policy ('CP') or Conservation Management Plan ('CMP') as set out in the NSW Heritage Office Guidelines for a SoHI.
(http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf).

Having consideration for the below, it is considered that a Conservation Policy is required for the Bundarra Police Station and Courthouse based on its listing as a State Heritage Item (refer Table 13). For the remaining heritage items, the Bundarra Commercial Precinct Heritage Conservation Area, St Mary's Roman Catholic Church, McDonald's Saw, Plane Mill and House and the Bridge over the Gwydir River a Statement of Heritage Impact is considered to be sufficient.

Table 13: Statements addressing requirements for Conservation Management Plan ('CMP').

Proposed change to a heritage item	***Options considered***	***SOS / CP /CMP required?***
Minor additions (see also minor partial demolition) ***Bridge over Gwydir River***	*How is the impact of the addition on the heritage significance of the item to be minimised?* The proposed pipeline will be installed within the structure of the existing bridge, positioned in a narrow channel between the vehicle bridge and the footbridge.	SOS
	Can the additional area be located within an existing structure? If no, why not? Yes, the pipes will be attached to the pre-existing structure of the bridge, requiring minimal fixtures. Currently, no pipes exist on the bridge that could be used for the transport of waste water from the north of the river to the south.	
	Will the additions visually dominate the heritage item? The pipes will be installed in a narrow channel within the existing structure. Providing the pipes and fixtures are of a colour similar to the existing structure, they will not visually dominate the bridge.	
	Is the addition sited on any known, or potentially significant archaeological deposits? If so, have alternative positions for the additions been considered?	

Proposed change to a heritage item	***Options considered***	***SOS / CP /CMP required?***
	The pipes are not located on any known or potentially significant archaeological deposits.	
	Are the additions sympathetic to the heritage item? In what way (e.g. form, proportions, design)? The additions of the pipes are sympathetic to the heritage item in that they are relatively small compared with the overall structure of the bridge. They will be partly hidden between the footpath and the vehicle bridge and being black/metal, they will blend into the steel structure of the bridge.	
New services (e.g. air conditioning, plumbing) ***Bundarra Police Station and Courthouse*** ***Bundarra Commercial Precinct Heritage Conservation Area*** ***St Mary's Roman Catholic Church*** ***McDonald's Saw, Plane Mill and House***	*How has the impact of the new services on the heritage significance of the item been minimised?* The locations of the green sewerage pods have mostly been chosen with a view to minimising the visual impact on the heritage items: the new sewerage pods will be installed at the rear of the premises in the case of the McDonald's Saw, Plane Mill and House, and most of the buildings within the heritage precinct. There is no proposal to install a pod at the Roman Catholic Church. The green colour of the pods may blend in with the grass of the premises, dependant on each individual item's landscaping. No pipework or services will be visible on the heritage listed buildings themselves, minimising the visual impact of the new services.	Bundarra Police Station and Courthouse: CP Remaining Heritage Items: SOS
	Are any of the existing services of heritage significance? In what way? Are they affected by the new work? The existing services (septic tanks) within the heritage items are not of heritage significance. These outdated septic systems will be replaced with the new sewerage pods.	
	Has the advice of a conservation consultant (e.g. architect) been sought? Has the consultant's advice been implemented?	

Proposed change to a heritage item	*Options considered*	*SOS / CP /CMP required?*
	The advice of a conservation consultant has not been sought because the new services are not directly attached to the buildings, but rather situated at ground level within the properties boundaries.	
	Are any known or potential archaeological deposits (underground and under floor) affected by the proposed new services? There are no known or potential archaeological deposits that will be affected by the proposed new sewerage pods and pipelines.	

Summary Statement of Heritage Impact

The Proponent proposes upgrade the septic systems of the properties within the town of Bundarra to connect to a new STP. This involves the installation of green plastic pods at the following heritage listed items:

- McDonalds Saw, Plane Mill and House;
- St Mary's Roman Catholic Church; and
- buildings within the Bundarra Commercial Heritage Precinct Conservation Area.

The Proposed Works also include installation of pipework underneath the heritage listed Bridge over the Gwydir River.

The pod locations are behind the buildings and as such, will not visually dominate the heritage items. No pipework or services will be attached to the buildings themselves. The pipe crossing the bridge will be partly hidden between the footpath and the road of the bridge and will be of a colour similar to the steel structure that is supporting it Figure 32). As such, the Proposed Works will not significantly detrimentally impact on the listed heritage items.

Having consideration for the NSW Heritage Office Guidelines is concluded that a Conservation Management Plan is not required for the Proposed Works. However, the assessment has determined that a Conservation Policy is required to address heritage impacts to the NSW State Heritage listed Bundarra Police Station and Courthouse.

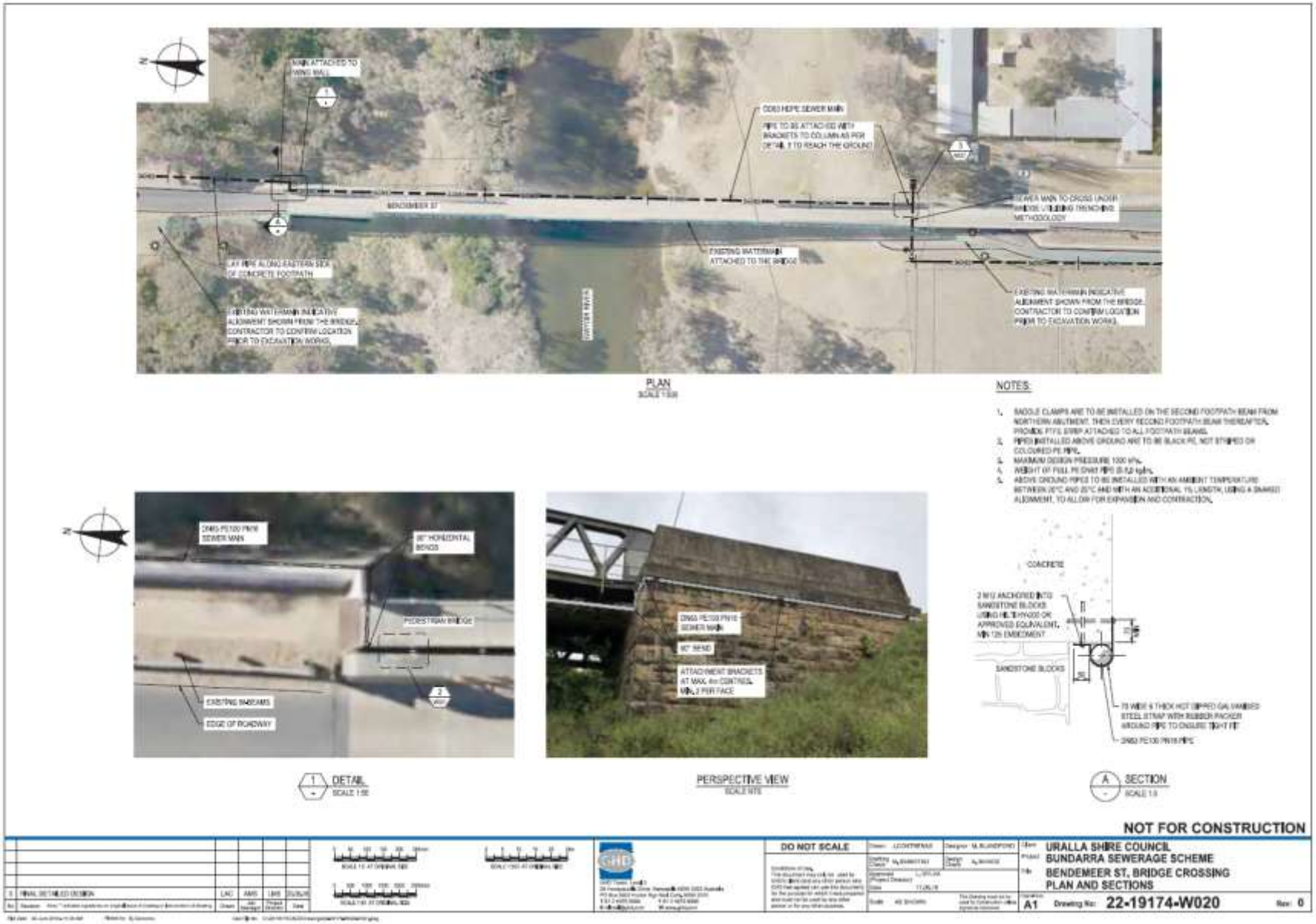


Figure 32: Proposed Bridge over Gwydir River crossing

Conservation Policy for Bundarra Police Station and Courthouse

The following Conservation Policy should be applied for all works relating to the installation of the new sewerage services at the Bundarra Police Station and Courthouse, Oliver Street, Bundarra NSW.

Feasible Uses

New sewerage pod and associated pipes have been identified as a 'feasible use' as they have only a minimal visual impact on the Bundarra Police Station and Courthouse if positioned so as not to be visible from Bendemeer Street.

Fabric and Setting

The sewerage pod will not impact on the fabric or setting of the Bundarra Police Station and Courthouse. For the purposes of the installation of the green plastic sewerage pod, the pod should be installed in a location where it will not be visible from Bendemeer Street.

Interpretation

No interpretation material will be developed as a result of the Proposed Works.

Controls and Interventions

The following controls should be put in place during construction:

- temporary site fencing installed within 1metre of the wall of the courthouse to ensure that the building is clearly designated as a restricted area;
- the requirements for work adjacent to the building are clearly identified in operational plans, drawings and works descriptions;
- all staff and contractors should be provided with an induction regarding access and work requirements adjacent to the building, including provisions for a Find Procedure in the event of identification of historic relics; and
- completion of high resolution images of the location of the sewerage pod prior to and on completion of the works.

Priorities for Urgent Conservation Works

There are no priorities for urgent conservation works as the Bundarra Police Station and Courthouse is not owned or subject to use by the Proponent.

Consultation with the NSW Heritage Council

The nature of the proposed works is such that approval by the NSW Heritage Council should be undertaken under the standard exemption provision of the Heritage Act. In this instance the standard exemptions should apply:

- Standard Exemption 4: Excavation; and
- Standard Exemption 7: Minor Activities with Little or No Adverse Impact on Heritage Significance.

Appendix C – Ecological Impact Assessment

Uralla Shire Council

Bundarra Sewerage Scheme REF
Ecological Impact Assessment

August 2019

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Appendices

1. Introduction

1.1 Background

Bundarra is located approximately 73 km to the north west of Uralla in NSW (Figure 1) and is currently served by on- site sewer systems, predominantly in the form of septic tanks. These systems then dispose of household effluent into absorption trenches or onsite irrigation, which introduces environmental and health issues to the community and the Gwydir River catchment. The current wastewater service levels in Bundarra village differ from the rest of Uralla Shire Council area, which Council propose to address by establishing a sewer reticulation and a wastewater treatment system.

The identified issues associated with the current system include (Public Works, 2016):

- Pollution from on-site sewage treatment systems due to the presence of clay soils which have poor soil permeability, especially during wet weather periods. Overflows, saturated backyards and diversion to vacant land and drains are likely to occur when the absorption potential is limited.
- Odour generation due to relatively poor condition of the absorption trenches and/or septic tanks.
- Ongoing maintenance requirements for residents.
- Ongoing inspection workload by Council staff.

Therefore, the Uralla Shire Council is proposing to construct a low-pressure sewerage system and an oxidation pond sewerage treatment plant (STP) with effluent re-use by irrigation (hereafter referred to as 'the project'). It is expected that this reticulated wastewater system would have a significant beneficial impact on sanitation and public health to the community of Bundarra.

1.2 Purpose of report

The purpose of this report is to present the findings of an ecological impact assessment, which has been undertaken by GHD to support the Review of Environmental Factors (REF).

The primary aim of this assessment is to identify biodiversity values present within and surrounding the project footprint, and determine whether any threatened biota listed under the following legislation are likely to be significantly impacted by the project:

- NSW *Biodiversity Conservation Act 2016* (BC Act)
- *Fisheries Management Act 1994* (FM Act)
- The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The aims and scope of this report are to:

- Outline the methods used for the ecological impact assessment.
- Describe the existing environment of the study area in terms of its ecological values, including type and condition of vegetation communities and habitats.
- Identify the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the BC Act and FM Act within the study area.

- Identify the presence or likely presence of Matters of National Environmental Significance (MNES), particularly threatened flora and fauna species and populations, migratory species and Threatened Ecological Communities (TECs) listed under the EPBC Act within the study area and/or with the potential to be impacted by the project.
- Identify potential direct impacts within the project footprint and indirect impacts within the study area.
- Assess the likely significance of impacts on threatened biota listed under the BC Act and FM Act (as relevant), and identify the requirement (or otherwise) for a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR).
- Assess the significance of impacts on MNES and identify whether the project is likely to constitute a controlled action under the EPBC Act and the likely requirement (or otherwise) for approval under that Act.
- Identify measures to minimise and mitigate potential impacts on biodiversity values within the study area.

1.3 Project description

The project is summarised by the following key elements:

- A pressure sewer system within the service area of the village of Bundarra, with an approximate length of 11 km and pipe sizes ranging from diameter 40 mm up to diameter 110 mm.
- DN63 mm pipe bridge crossing through the Gwydir River.
- A total of 173 pump units installed within the occupied lots.
- Pressure sewer lines provision for all the vacant lots (168).
- One pumping transfer station within the town, pumping to the STP.
- A 2.6 km DN125 mm sewer rising main from the pumping transfer station to the STP.
- Treatment works based on two oxidation ponds (3,200 m^2 each) and two maturation ponds (1.0 ML each). Ponds are in a series-mode arrangement.
- Winter storage pond with a total storage volume of 5.1 ML.
- 4.3 hectares of surface irrigation area.

Therefore the project consists of three main components, the pressure sewer system, the transfer pump station and rising main, and the STP with winter storage and irrigation area.

1.3.1 Pressure sewer system

The alignment of the reticulation network within the village of Bundarra is located mainly along laneways and secondary roads, minimising main road crossings.

Along Bendemeer Street between Souter Street and Bowline Street, pipes will be located along the road, requiring bitumen cutting and reinstatement. Bendemeer Street crossings are proposed to be constructed using trenchless methodology.

The alignment will cross Gwydir River via a pipe bridge crossing, with the PE DN63 pipe to be laid below the beams supporting the pathway and held by brackets.

1.3.2 Transfer pump station and rising main

The alignment of the rising main connecting to the STP will be located within the road reserve on the north side of Oliver Street, the west side of Brown Street as it changes direction, then on the north side of Barraba Road. The rising main would finally turn onto Mount Drummond Rd to discharge into the inlet works of the proposed treatment plant. The following cover and gradients have been adopted for the detail design:

- The transfer main is to be constructed at a minimum cover of 600 mm within road reserve and other trafficable areas and 450 mm in other locations except at road crossings and proposed creek crossing where deeper cover is required.
- Maximum trench depth is 2 m (to be confirmed in detail design phase).
- Minimum vertical clearance to services to be 300 mm unless noted otherwise by specific utility requirements.
- Minimum gradient to be 0.2 % (or 1 in 500) to allow air pockets to travel towards air valves.

The transfer pump station will be located adjacent to the existing showground, at approximately 2 Bombelli Street, near the entrance to the showgrounds. The pump station is proposed to be a traditional wet well (with collecting manhole) and submersible pumps.

1.3.3 Wastewater treatment

A ponds treatment system comprising two in series oxidation ponds followed by two in series maturation ponds is proposed and will be located within the STP site, which is situated to the west of the Bingara Road and Barraba Road junction on Lot 38 DP 753656. The components associated with the system comprises:

- Inlet chamber.
- Two oxidation ponds arranged in series.
- Two maturation ponds, arranged in series, for effluent disinfection.
- A winter storage dam to store effluent flows during low or no reuse demand periods.
- Irrigation area.

Two oxidation ponds will be provided, each sized to achieve significant reduction in carbonaceous matter (BOD5). The oxidation ponds will have a surface area of 3,200 m^2 each and would operate in series. The ponds will be 1.2 m deep with 0.5 m freeboard (i.e. total depth from top of bank to floor is 1.7 metres).

Disinfection of effluent from an oxidation pond system will be achieved by providing maturation ponds immediately downstream. The maturation, or tertiary, ponds are sized to provide 20 days detention time to allow natural die off of pathogens. Disinfection occurs by exposure of micro-organisms to natural ultraviolet radiation and their detention in a "food-starved" environment. Two maturation ponds in series would be provided to maximise effluent detention without short-circuiting of flow.

The disinfected effluent would be stored in a winter storage dam for reuse application. The irrigation scheme system will comprise the following:

- Spray irrigation system, based on impact sprinklers DN20 rotator sprinklers (or equivalent).
- Irrigated area: 4.3 ha, based on 15 sets of sections, each sprinkler covering a radius of 14 m each, and including 2,000 m^2 of exclusion area to account for rock outcrops.
- A combination of DN63, DN75 and DN125 irrigation PE100 PN12.5 pipes.
- Irrigation control system: moisture, rain, wind.

- Wet weather storage pond (approximately 5.1 ML).
- Effluent transfer pumping station to draw water from the storage pond (one duty and one standby pump, 7.5 kW each).
- Buffer zone of 50 m from the STP site boundary.
- V-drain on the eastern side of the property to capture overrun flows to be directed to the natural drainage line.

The outcomes of the water balance indicate that a total irrigation area of 4.3 hectares and a winter storage pond of 5.1 ML are required to contain a wet weather events for a 50th percentile rainfall year. This means that after an extended period of rain event (greater than the mean event), the irrigation area will not be able to receive more reuse water and the winter storage pond will be full. Winter storage overflow (tertiary treated water) may occur to the nearest drainage line to the east of the STP site boundary, which finally discharges to the Gwydir River, downstream of the town. It is expected that this may occur every two years. Once the wet weather event ends, irrigation water reuse would start to operate again and no discharge will be experienced for the winter pond.

It is anticipated there will be an ancillary facility at the STP and two within Bundarra. The exact layout of the ancillary facilities would be determined by the construction contractor but is likely to consist of:

- Site sheds
- Parking
- Equipment laydown areas
- Waste receptacles
- Spoil (sub and topsoil) stockpile areas
- Storage areas for construction materials (could include some hazardous materials such as fuels and chemicals).

Upon completion of the works, everything from the ancillary facilities would be removed and the area rehabilitated.

1.4 Study area and project footprint

The study area subject to this ecological assessment is comprised of the following component areas:

- STP site, representing 20 hectares of Lot 38 DP 753656 within which the ponds treatment system and ancillary facility will be located.
- A fenced pad of approximately 10 m x 10 m where the transfer pump station will be located.
- Five (5) m buffers on either side of pipeline infrastructure.

The study area is shown on Figure 2.

The project footprint is expected to be smaller than the study area and will include a construction buffer of three (3) m on either side of pipeline infrastructure; the area within the fenced pad where the transfer pump station will be located (see Figure 3); and the wastewater treatment system footprint, including temporary ancillary facilities laydown (see Figure 4).

1.5 Terms and definitions

The following terms are used in this report:

- *Project footprint*: refers to the areas where the pipelines, pumping station, STP infrastructure and construction works will be located; refer to Section 1.4.
- *Study area*: area considered in this assessment; refer to Section 1.4.
- *Locality*: the area within a 25 km radius of the study area.

1.6 Scope and limitations

This report: has been prepared by GHD for Uralla Shire Council and may only be used and relied on by Uralla Shire Council for the purpose agreed between GHD and the Uralla Shire Council as set out in Section 1.2 of this report.

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

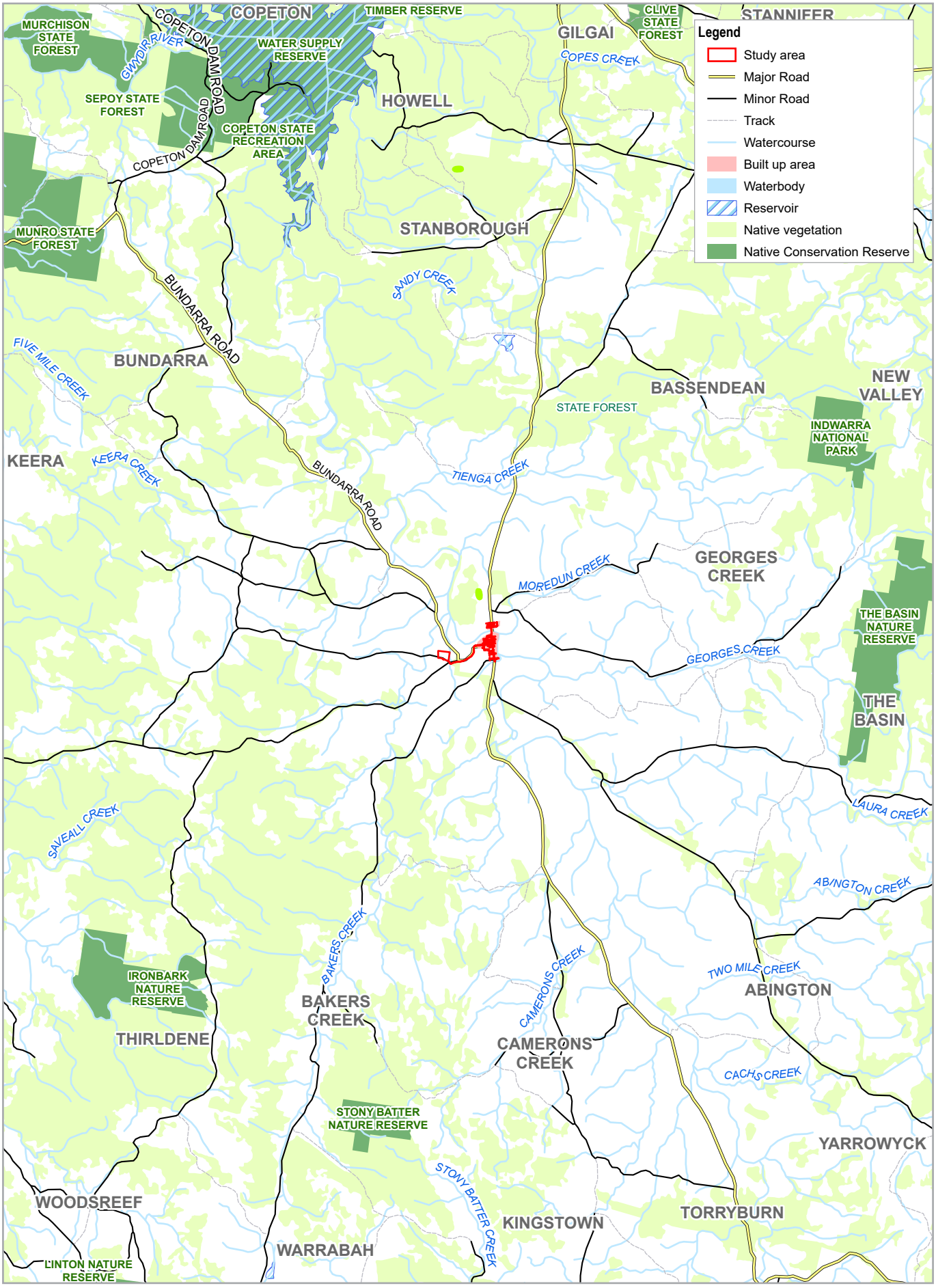
The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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 Sections 1.2 and 3.3.1). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Uralla Shire Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Site conditions may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



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Uralla Shire Council
Bundarra Sewerage Scheme
Ecological Assessment

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Locality

FIGURE 1

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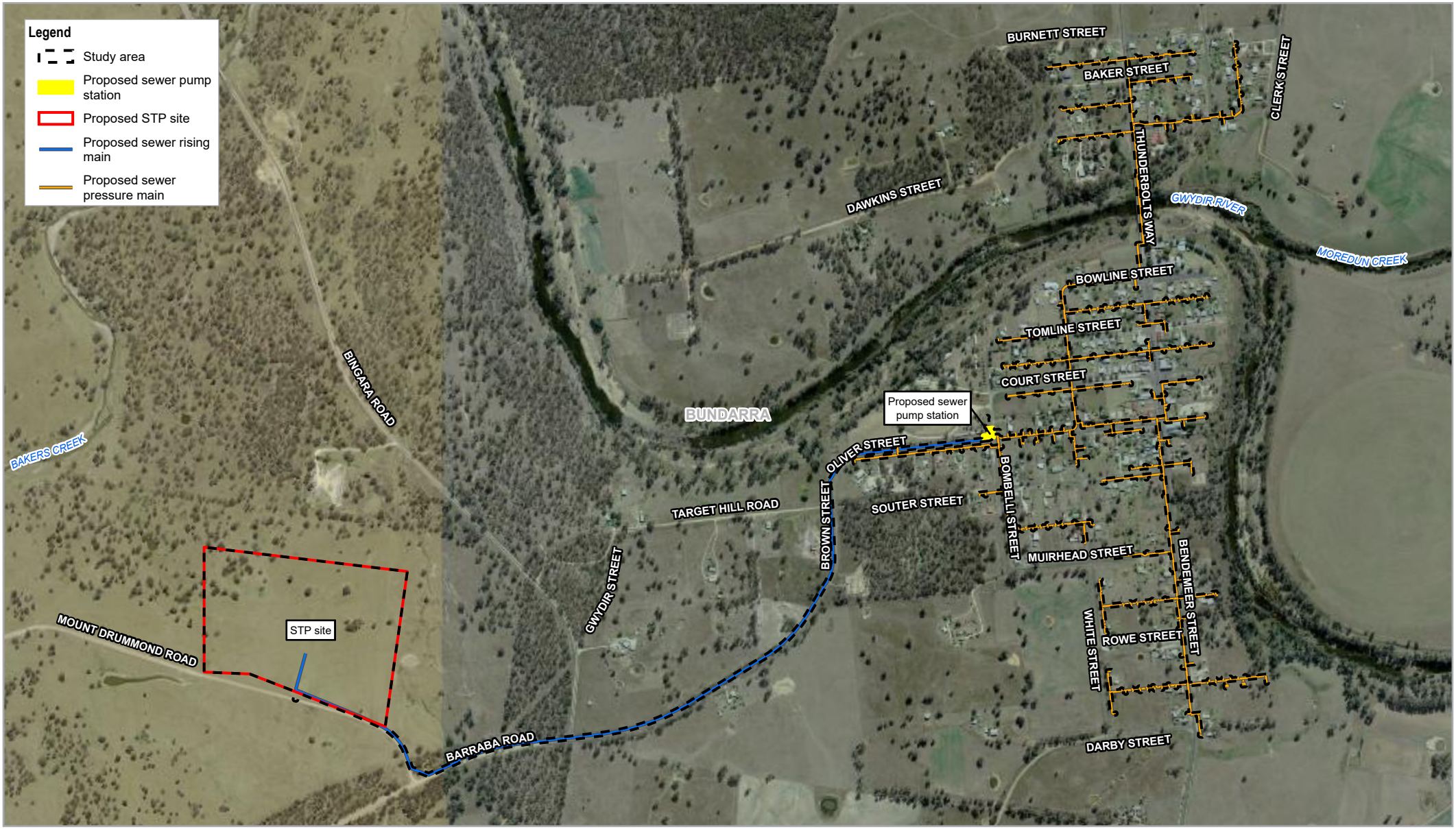

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Uralla Shire Council
Bundarra Sewerage Scheme
Ecological Assessment

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Study area

FIGURE 2

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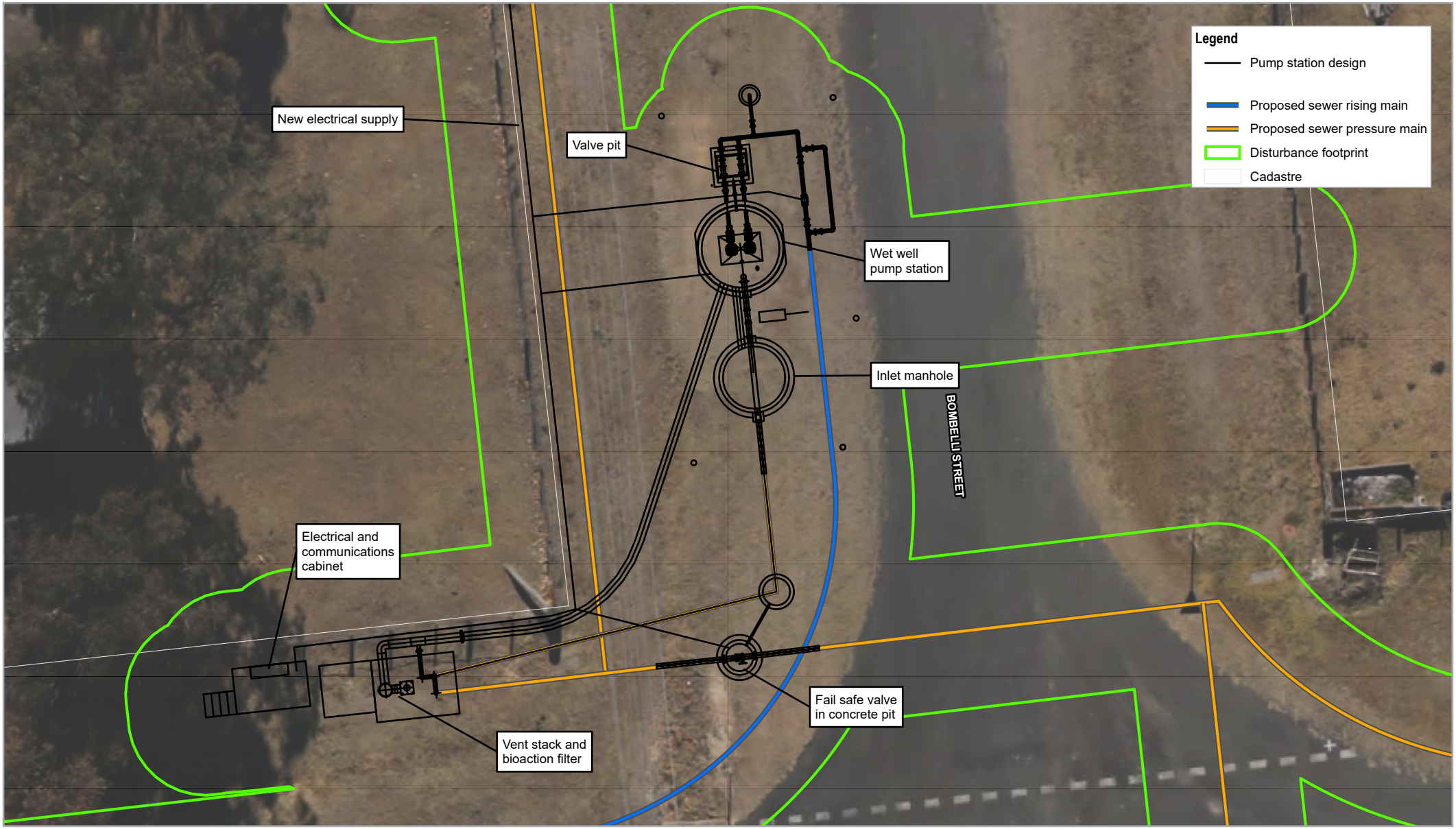

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Uralla Shire Council
Bundarra Sewerage Scheme
Ecological Assessment

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

Transfer pump station layout

FIGURE 3

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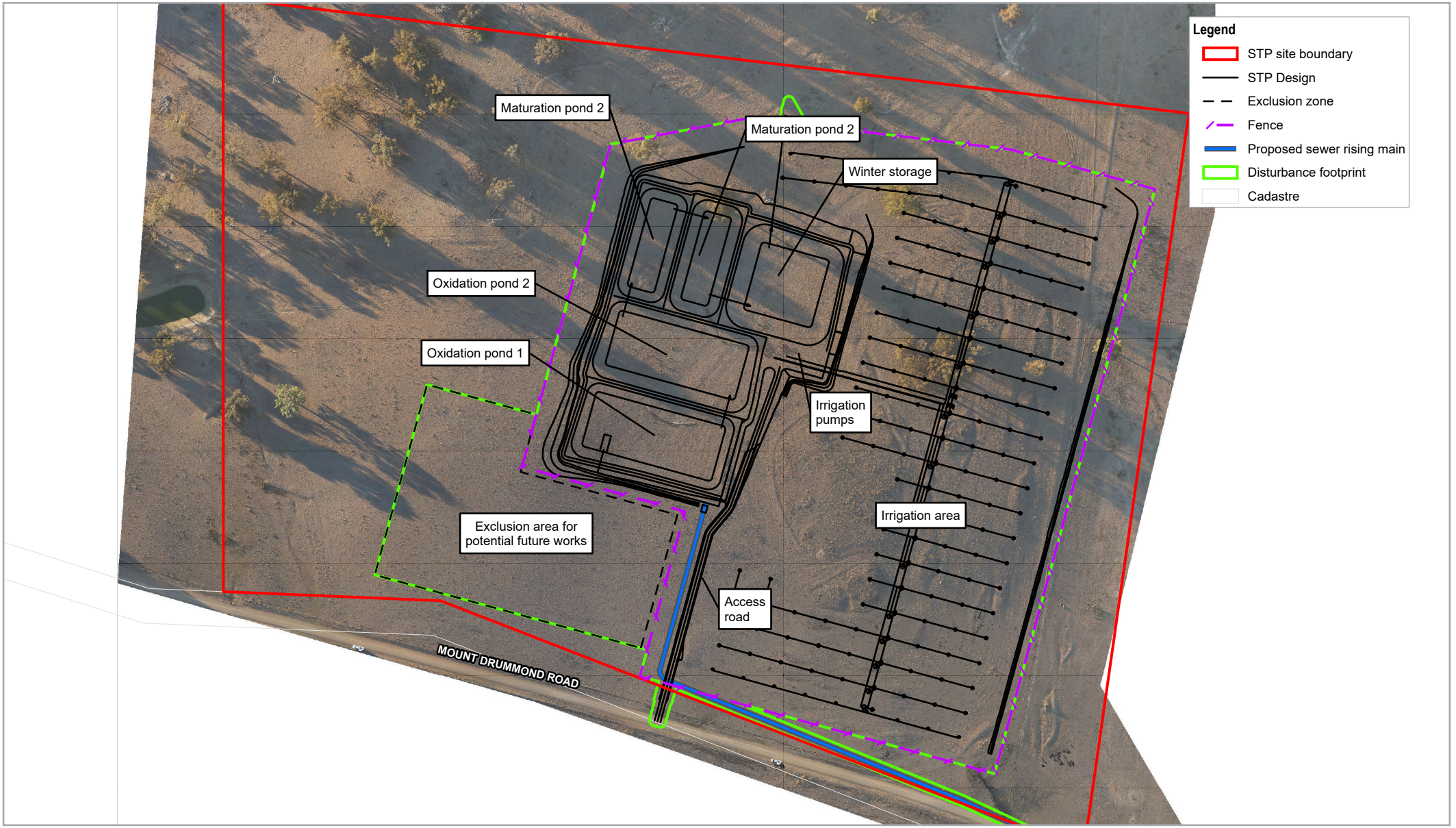

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Uralla Shire Council
Bundarra Sewerage Scheme
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Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

STP site layout

FIGURE 4

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2. Legislative context

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for project assessment and approval in NSW and aims to 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000.

The project is to be determined under Part 4 of the EP&A Act. Under section 5.5 of the EP&A Act, determining authorities must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. This report addresses the ecological components of the environment to assist the determining authorities to address the requirements of section 5.5 of the EP&A Act.

Section 1.7 of the EP&A Act states that the act is subject to provisions of Part 7 of the BC Act and Part 7A of the FM Act. Part 7.3 of the BC Act lists five factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the BC Act and the FM Act. The 'five part test' is used to assist in the determination of whether a project is 'likely' to impose 'a significant effect' on threatened biota and thus whether an SIS or BDAR is required. Five part tests have been prepared for threatened biota that would be impacted or are likely to be impacted by the project. These assessments are included in Appendix C.

2.1.2 Biodiversity Conservation Act 2017

The *Biodiversity Conservation Act 2016* (BC Act) provides legal status for biota of conservation significance in NSW. The BC Act aims to, amongst other things, 'maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development'. It provides for the listing of threatened species and communities, establishes a framework to avoid, minimise and offset the impacts of proposed development (the Biodiversity Offsets Scheme - BOS), and establishes a scientific method for assessing the likely impacts on biodiversity values and calculating measures to offset those impacts (the Biodiversity Assessment Method - BAM).

The BC Act came into effect on 25 August 2017 and repeals the *Threatened Species Conservation Act 1995*. Proponents can still assess the impacts of Part 5 developments on threatened biota listed under the BC Act via Section 5A of the EP&A Act, or they can voluntarily opt-in to the new Biodiversity Offsets Scheme. If a project is assessed under Section 5A of the EP&A Act, impacts on threatened biota are assessed by the new five part test (Section 7.3 of the BC Act, replacing the former seven part test). If the biodiversity impacts of the project are likely to be significant, a species impact statement would be required. If a project is assessed under the Biodiversity Offsets Scheme, biodiversity credits would be calculated for impacts on biodiversity values.

2.1.3 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 4, 'critically endangered' species and communities listed under Schedule 4A, and vulnerable species and communities listed under Schedule 5.
- The listing of 'Key Threatening Processes' (under Schedule 6).
- Diseases affecting fish and marine vegetation (under Schedule 6B).
- Noxious fish and noxious marine vegetation (under Schedule 6C).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements or otherwise for the preparation of a SIS.

One of the objectives of the FM Act is to 'conserve key fish habitats' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. The project requires works within a creek or waterway.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the project and hence may occur subject to the habitats present.
- Assessment of aquatic habitats during terrestrial field surveys.
- Assessment of impacts on aquatic habitats.
- Identification of suitable impact mitigation and environmental management measures to avoid or mitigate impacts on the aquatic environment.

Part of the proposal also crosses over a third order stream mapped as Key Fish Habitat. A permit under section 200 of the Act will be required in order to trench the pipeline into the bed of this creek.

2.1.4 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. 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.

2.2 State planning policies

2.2.1 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat (SEPP 44) 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. SEPP 44 applies to the LGAs listed in Schedule 1 of the policy.

Uralla Shire Council is listed in Schedule 1 of SEPP 44, therefore the policy applies to the locality.

There are 5 records of koalas within 25 km of the site, and the site contains one preferred Koala feed tree as listed under Schedule 2 of SEPP 44, *Eucalyptus albens* (White Box) in fairly high numbers. Koala habitat is discussed in Section 5.2.

2.3 Commonwealth legislation

2.3.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on Matters of National Environmental Significance (MNES) undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for the Environment (the 'Minister').

The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The great barrier reef marine park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

The significance of potential impacts on any MNES are determined via *Assessments of Significance* pursuant to the EPBC Act Significant Impact Guidelines (DotE, 2013). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Minister.

3. Methods

3.1 Desktop assessment

3.1.1 Threatened Biota Database Searches

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities listed under the BC Act and FM Act, and matters of national environmental significance (MNES) listed under the EPBC Act that may be affected by the proposal. Database records pertaining to the study area and locality were reviewed prior to field investigations. Due to the lack of ecological data for the locality in this area (a 10 km search produced very few results), the search was expanded from the usual 10 km radius to a 25 km radius. This included:

- The Commonwealth Department of Environment and Energy (DoEE) Protected Matters Search Tool (PMST), for MNES (threatened and migratory biota) known or predicted to occur in the locality of the project (DoEE, 2018a).
- DoEE online species profiles and threats database (DoEE, 2018b).
- OEH Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the BC Act that have been recorded within the locality of the project (OEH, 2018a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2018b). This resource was also used to identify the suite of threatened ecological communities (TECs) and threatened species that could potentially be affected by the project and to inform habitat assessments.
- OEH regional vegetation mapping for the Border Rivers, Gwydir and Namoi Region (2015) to identify previous vegetation mapping for the study area, as classified by OEH.
- The *NSW Vegetation Information System: Classification* (VIS) (OEH 2018c) to identify matching plant community types (PCTs) in the study area.
- Mapping and descriptions of the NSW Mitchell landscapes (DECC 2008a, 2008b).
- The Atlas of Groundwater Dependent Ecosystems (GDEs) (BOM 2018).
- Key fish habitat maps for Uralla local government areas (LGAs) (DPI 2018c).
- Aerial photographs and satellite imagery of the study area.
- Priority weed declarations for *Biosecurity Act 2015* (Biosecurity Act) listed species in the Uralla Shire Local Government areas (DPI 2017).

3.2 Field surveys

3.2.1 Overview

Field surveys were conducted by two GHD ecologists on 18 July 2018.

Survey methods included:

- Vegetation surveys and mapping.
- Threatened flora searches and habitat assessment.
- Fauna habitat assessment, including targeted searches for resources of relevance for threatened fauna species.

- Opportunistic fauna surveys.
- Rapid aquatic habitat assessment.

Survey techniques and effort were conducted with reference to DEC (2004) survey guidelines and as appropriate to the habitats present and landscape context. Further details on survey methodology are provided below.

3.2.2 Flora survey

The primary objectives of the flora survey were to:

- Verify, map and describe the distribution and condition of vegetation types occurring within the study area, including any Endangered Ecological Communities.
- Compile a flora list of those species occurring within the vegetation types, identifying any threatened species or potential habitat for threatened species.
- Assess the likely impacts of the project and provide recommendations to assist in minimising impacts on flora in the study area.

Surveys were conducted along the entirety of the study area.

Threatened flora habitat assessment

Surveys were undertaken for potential habitat for threatened flora species which could potentially occur within the study area given known distributions, previous records in the locality and habitat requirements for each species. An assessment of threatened flora species that are likely to occur is provided in Appendix A. Random meander surveys were conducted throughout suitable habitat within the overall study area, though surveys were conducted at a time when most species are not flowering. Therefore, the precautionary principle was applied and any suitable habitat is considered to potentially contain threatened species.

Consideration was given to previous threatened species records within the locality and within close proximity to the overall study area (e.g. OEH 2018a) when identifying areas of potentially suitable habitat (refer to Appendix A).

The majority of the project site is modified and disturbed and can be readily discounted as containing any threatened plant species.

Groundwater dependent ecosystems

The Australian Government Atlas of Groundwater Dependent Ecosystems (GDEs) (BOM, 2018) was used to identify any previously mapped groundwater dependent ecosystems (GDEs) that occur in or near the project site. This atlas identifies GDEs reliant on surface groundwater (rivers, springs and wetlands) and subsurface groundwater (vegetation).

3.2.3 Fauna survey

Fauna habitat assessment

An assessment of the quality of habitats present for native fauna was made across the study area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. Indicative habitat criteria for targeted threatened species (i.e. recorded in database searches) were identified prior to fieldwork. Criteria were based on information provided in BC Act species profiles, field notebooks and the knowledge and experience of GHD field ecologists. This technique is important in assisting in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the site, rather than relying solely on one off surveys that are subject to seasonal limitations and may only represent a snapshot of the species present.

The locations and quantitative descriptions of significant habitat features, such as hollow-bearing trees and wetlands, were captured with a handheld GPS unit and photographed where appropriate.

Habitat assessments included searches for and inspection of:

- Vegetation patch size, age, disturbance and structural diversity (important for many threatened birds and mammals).
- Quality of substrate for sheltering frogs and reptiles including rocks, logs, debris, peeling bark, leaf litter and native grassland.
- Presence of winter-flowering eucalypts, and feed trees of the Koala (*Phascolarctos cinereus*).
- Hollow-bearing trees and logs that may provide refuge, nest and den sites for a range of threatened fauna species.
- Stags and other roost sites for raptors and owls.
- Wetlands, moist grassland and other foraging habitat for waterbirds (including migratory birds) and frogs.
- Mammal scats at the base of trees or along tracks and runways.
- Tracks in soft substrate.
- Nest/den sites within logs, tree bases or tree trunks.
- Guano or moth remains at the base of hollow-bearing trees (diagnostic of the presence of tree-roosting bats).
- Scratches on tree trunks (diagnostic of koalas, gliders or goannas) and worn bark around tree hollows (diagnostic of active use of hollows).
- Owl pellets, whitewash or animal remains beneath trees (diagnostic of owl or raptor roosts).

Hollow-bearing tree assessments

Counts and assessments of hollow-bearing trees were undertaken throughout the study area. This information provides an indication of the density of hollow-bearing trees within each vegetation type. Additional information was collected on the tree species, and number, size and location of hollows for all hollow-bearing trees within the study area. Any hollow-bearing trees encountered during other surveys were also inspected for signs of use (e.g. visible chew marks, guano), and their location recorded using a handheld GPS.

Aquatic habitat assessment

A brief aquatic habitat assessment was undertaken along creeks within the study area. The presence of instream or riparian vegetation was recorded. Areas of potential fish refuge (snags, undercut banks) were noted. Key fish habitat maps for the area (DPI 2018c) were reviewed and key fish habitat was identified according to the following classifications as detailed in DPI (2013):

- Type 1 – highly sensitive fish habitat (includes freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or three metres in length, or native aquatic plants; known or expected protected or threatened fish habitat; and areas of critical habitat).
- Type 2 – moderately sensitive key fish habitat (freshwater habitats other than those defined in Type 1).

- Type 3 – minimally sensitive key fish habitat (ephemeral aquatic habitat not supporting native aquatic or wetland vegetation).
- Not key fish habitat (includes first and second order streams on gaining streams).

No fish trapping or electrofishing surveys were carried out.

Opportunistic observations

Opportunistic and incidental observations of fauna species were recorded at all times during the field survey. Survey effort was concentrated on suitable areas of habitat throughout the course of the survey, for instance burrows and diggings were noted, fallen timber or rocks were scanned and lifted to search for frogs and reptiles, and mature trees were scanned for roosting birds.

3.3 Assessment of likelihood of occurrence

Following collation of database records and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the overall study area. Identification of potential habitat for threatened and migratory species was based on information provided in the species profiles (DoEE 2018b, OEH 2018b), recovery plans, journal articles, and the field staffs' knowledge of species habitat requirements. The likelihood of occurrence assessment was further refined following field surveys. The likelihood of threatened and migratory biota occurring in the study area was assessed based on presence of records from the locality, species distribution and habitat preferences, and the suitability of potential habitat present. The results of this assessment are provided in Appendix A. Species considered likely to occur are discussed further in Section 4.

Table 3-1 provides a key to the likelihood of occurrence in the study area of threatened biota known or likely to occur in the locality.

Table 3-1 Key to likelihood of occurrence for threatened species

Scale	Description
Known	Species known to occur within the site (e.g. breeding and foraging habitat; foraging habitat; movement corridors). Detected on or immediately adjacent to the site.
High	Presence of high value suitable habitat (e.g. breeding and foraging habitat; important movement corridors). Not detected.
Moderate	Presence of medium value suitable habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors). Not detected.
Low/Unlikely	Presence of low value suitable habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors). Not detected.
None	No suitable habitat or corridors linking suitable habitat present. Not detected.

3.3.1 Survey limitations

Given the duration and timing of the field survey (winter) it is likely that some species that utilise the overall study area (permanently, seasonally or transiently) were not detected during the survey. Species not detected may include annual, ephemeral or cryptic flora species; fauna that are migratory and do not occur in the locality during winter, and mobile or transient fauna in general. To assess their likelihood of occurring within the study area the habitat assessment identified habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values and the potential for these species to occur in the study area. This information was used to predict potential impacts of the project on ecological values.

4. Existing environment

4.1 Site context

4.1.1 Location and land uses

The project is situated within the Northern Tablelands region of NSW, approximately 80 km north west of Uralla and Armidale. It is bound by Burnett Street in the north, Darby Street in the south, the Gwydir River to the east, and traverses along rural roads to the west, bound by agricultural farmland.

The study area is linear in nature and traverses various parcels of cleared, partially cleared, disturbed and developed land. The township itself forms the bulk of the study area, particularly in the eastern portion, before the alignment heads south- west into cleared and partially cleared lands to the proposed STP site. Along this route, the study area also traverses alongside a travelling stock route (TSR), which is crown land. Within the township, the proposed pipeline is largely along urban roadside verges, predominantly consisting of managed grasses. The STP site itself is heavily degraded from historical clearing and farming, and current cattle grazing.

The project is located within the Uralla Shire Council local government area. The area to be developed is zoned RU5 – Village, within the township itself, and RU1 – Primary Production, on the outskirts of town. The combined length of the study area (proposed pipeline from township to the STP) is approximately 12.7 km. The combined area of the study area is approximately 33.7 ha (Figure 2).

4.1.2 Climate

The Australian Government Bureau of Meteorology website provides long term climatic information for the study area, taken from the Barraba Post Office weather station (site number 054003), which is the closest station to the study area (32.6 km) with detailed long-term climate statistics. The mean annual rainfall for this area is 689.5 mm. Rainfall is typically highest in summer and lowest in early winter. Mean daily maximum temperatures range from 31.9° C in summer to 16.2° C in winter, with mean minimum temperatures ranging from 16.5° C in summer down to 0.3° C in winter (BOM, 2018).

4.1.3 Topography, soils and drainage

The entirety of the study area is situated on relatively flat land derived largely from basalt and granite soils, with alluvial soils along the floodplain of the Gwydir River. Within the study area there is little drainage, aside from a third- order stream that crosses underneath Barraba Road in the west of the study area. This stream is mapped as key fish habitat under the *Fisheries Management Act* 1994 and flows north into the Gwydir River. The study area also crosses the Gwydir River, which flows north west towards the Darling River; the project is not anticipated to have any direct impacts upon the flow of this river.

4.2 Flora and vegetation

4.2.1 Flora species

A total of 44 species of flora from 24 families were recorded within the study area during the field survey, including 32 native and 12 exotic species. The Poaceae family was the most diverse family recorded (13 species including 11 native and two exotic) followed by Asteraceae (3 native and 3 exotic species) and Myrtaceae (5 native species). One threatened flora species, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint), was detected immediately adjacent to the study area. This species is listed as vulnerable under both the BC and EPBC Acts. It is extremely likely that those specimens in the study area are planted street trees and are not naturally occurring. Appendix B provides a complete list of all flora species identified within the study area.

Flora species are discussed below in relation to the plant community types (PCTs) occurring within the study area. Priority weeds are discussed in Section 4.2.3.

4.2.2 Plant Community Types

The study area occurs in the New England Tableland Bioregion which is typified by Box Woodland vegetation types. These woodlands are dominated by a variety of *Eucalyptus* 'Box' species, and in the study area this consists of *Eucalyptus albens, E. moluccana* and *E. microcarpa.* The area has a history of agricultural uses which continues today, and includes large areas of native pasture within grazed paddocks. Being on the tablelands and at the foothills of the Nandewar Ranges, the area has a fairly high elevation, typically at 1000 m above sea level. The most intact areas of native vegetation in the area appear to be represented within Crown Land such as travelling stock routes and within National Parks.

The three species of 'Box' and their associated box communities are closely related and are very similar in terms of bark, habit and habitat features. These species are best identified through distinguishing characteristics of the buds and fruit. In order to effectively map the vegetation of the study area, the recently completed OEH vegetation mapping (2015) for the area was broadly ground-truthed and verified in a selection of points along the study area. Those areas mapped by OEH as being White Box grassy woodland were found to have *Eucalyptus albens* as generally dominant in the canopy, whereas those areas mapped as Grey Box grassy woodland by OEH were found to have *Eucalyptus moluccana* as generally dominant in the canopy. The ground-truthing surveys found the OEH vegetation mapping (2015) was reasonably representative of the vegetation in the study area.

Five vegetation types were identified within the study area including four native plant community types and one exotic/managed/planted vegetation type. Vegetation types within the study area include:

- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion (PCT 433) (0.05 ha). This community forms part of White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act and critically endangered under the EPBC Act.
- Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion (PCT 516) (2.99 ha).
- River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84) (0.08 ha).

- Derived Native Grassland, as a result of historical clearing and agricultural practices (17.72 ha).
- Managed/Planted Vegetation, largely within the township of Bundarra (12.36 ha).

Figure 5 shows the location and extent of plant community types within the study area. Appendix B provides a species list of flora recorded in the study area. Table 4-1 provides detailed descriptions of plant community types.

Paper Size ISO A4

0 100 200 300 400

Metres

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

N

GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Ecological Assessment

Vegetation communities within the study area

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

FIGURE 5

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\2219174_EA003_Vegetation_0
Print date: 30 Jul 2019 - 11:51

Data source: LPI: DTDB / DCDB 2017; public_NSW_Imagery: . Created by: fmackay

Table 4-1 Vegetation within the study area

Vegetation Community	White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion
PCT ID	PCT 433
Extent within study area (ha)	0.05
Location within study area	This vegetation type occurs along Barraba Road in the western portion of the study area. A small section also occurs to the south west of the town adjacent to Bombelli Street.
Floristic description	The community has an open woodland structure and the canopy is dominated by *Eucalyptus albens* (White Box), with *Eucalyptus blakelyi* (Blakely's Red Gum) and *Eucalyptus melliodora* (Yellow Box) also occurring. Grey boxes are also present within this community in the study area and could be either *Eucalyptus microcarpa* and/or *Eucalyptus moluccana*. Where these species overlap in range, such as in the study area, they are extremely difficult to tell apart in the absence of buds or flowers, and can hybridise with one another and also with *E. albens*. The shrub layer is sparse, with *Cassinia longifolia*, *Notelaea microcarpa* (Native Olive) and *Lissanthe strigosa* (Peach Heath) being common. The groundcover is dominated by a mixture of native and exotic grasses. Dominant native grasses include *Themeda triandra* (Kangaroo Grass), *Cymbopogon refractus* (Barbed- wire Grass), *Austrostipa scabra* (Speargrass) and *Aristida ramosa* (Purple Wiregrass). Introduced grasses common within this community include *Eragrostis curvula* (African Lovegrass) and *Hyparrhenia hirta* (Coolatai Grass), both occurring in dense patches. Native groundcovers include *Cheilanthes sieberi* (Poison Rock Fern), *Einadia nutans* (Climbing Saltbush), *Calotis lappulacea* (Yellow Burr-daisy), *Chrysocephalum apiculatum* (Common Everlasting), *Dichondra repens* (Kidney Weed), *Eremophila debilis* (Winter Apple) and *Geranium solanderi*.
Condition	The community is in moderate to good condition, though it is largely subject to edge effects, given its extremely close proximity to roads. The occurrence of *Eragrostis curvula* (African Lovegrass) and *Hyparrhenia hirta* (Coolatai Grass) in this community is typical of roadside environments.
Conservation significance	**EPBC Act:** critically endangered (woodland form) **BC Act:** endangered (woodland and grassland forms) Forms a part of White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act and critically endangered under the EPBC Act. The final determination (under the BC Act, NSW Scientific Committee, 2011) and listing advice (under the EPBC Act) for this threatened ecological community (TEC) includes Derived Native Grassland. Within the study area, some areas of Derived Native Grassland meet the final determination for the TEC under the BC Act but not under the EPBC Act (on the basis of condition criteria). As a precaution, all areas of derived native grassland that occur between patches of White Box Grassy Woodland have been mapped as conforming to this TEC under the BC Act. The woodland areas of this community within the study area meets the criteria for listing under the BC Act and EPBC Act, whilst the Derived Native Grassland within the study area conform to the BC Act listing only (discussed further in Section 5.3).

Vegetation Community	White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion
Photograph	

Vegetation Community	Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion
PCT ID	516
Extent within study area (ha)	2.99
Location within study area	This community within the study area occurs along Barraba Road and within the north west corner of the STP Site.
Floristic description	This community is dominated by *Eucalyptus moluccana* (Grey Box), with *E. melliodora* (Yellow Box), *E. blakelyi* (Blakely's Red Gum) and *Angophora floribunda* (Rough- barked Apple) also occurring as occasional canopy species. *E. albens* is also present in this community, though not as a dominant species and largely occurs as an intergrade where this community adjoins the White Box Grassy Woodland. Within the study area, the midstorey of this community is largely absent, with occasional *Notelaea microcarpa* (Native Olive) and *Cassinia longifolia* occurring. The ground cover in this community largely consists of native and exotic grasses, including *Bothriochloa decipiens* (Pitted Bluegrass), *Austrostipa scabra* (Speargrass) and *Aristida ramosa* (Purple Wiregrass), and the exotic species *Hyparrhenia hirta* (Coolatai Grass).Other native groundcovers such as *Carex inversa, Chrysocephalum apiculatum* (Common Everlasting) and *Dichondra repens* (Kidney Weed) are common.
Condition	Along Barraba Road the community is in a moderate condition, with a fairly intact groundcover in places, while in the STP site the community is poor as a result of historical clearing and current grazing practices.
Conservation significance	**EPBC Act:** critically endangered (woodland form) **BC Act:** not listed The listing advice for White Box – Yellow Box – Blakely's Red Gum Woodland under the EPBC Act includes areas dominated or co-dominated by *Eucalyptus moluccana* or *E. microcarpa* in the Nandewar bioregion. Therefore, the patches of this community within the study area conform to White Box – Yellow Box – Blakely's Red Gum Woodland under the EPBC Act.

Vegetation Community	Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion
	The Derived Native Grassland associated with this community do not conform to the White Box – Yellow Box – Blakely's Red Gum Woodland TEC under the EPBC Act on the basis of condition criteria (discussed further in Section 5.3). This community is not listed under the BC Act, as the final determination does not include representatives in the Nandewar bioregion that are dominated by *Eucalyptus moluccana* or *E. microcarpa*.
Photograph	

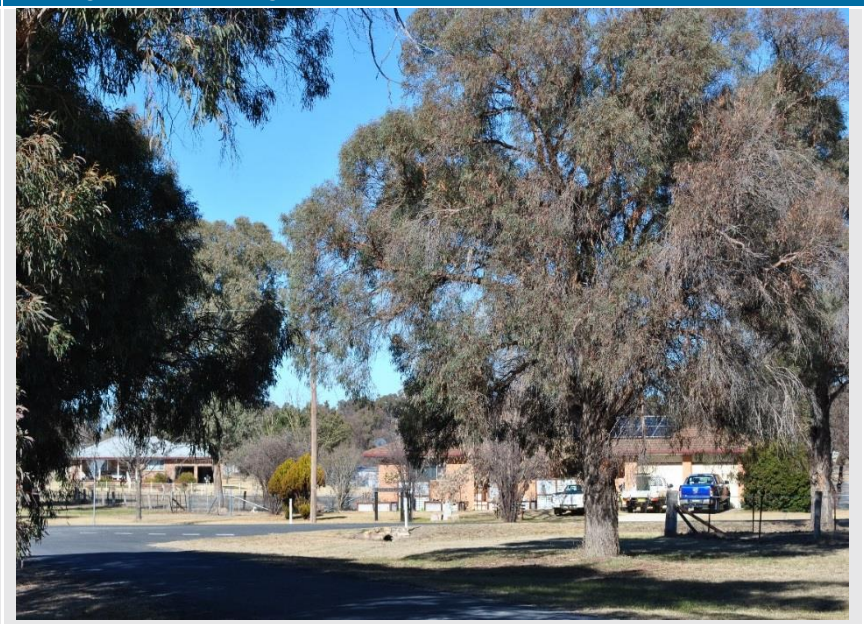
Vegetation Community	River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
PCT ID	84
Extent within study area (ha)	0.08
Location within study area	This vegetation occurs in a very minor portion of the study area, where the proposed pipeline crosses the Gwydir River.
Floristic description	The canopy is dominated by *Casuarina cunninghamiana* (River Oak) and *Angophora floribunda* (Rough- barked Apple).
Condition	This community was not surveyed in great detail within the study area, given the very minor portion occurring. It appears to be in moderate condition. It is also highly unlikely that this community will be directly impacted by the proposal, as the proposed pipeline will traverse across the bridge, rather than through the vegetation alongside the river, down below.
Conservation significance	Not listed

Vegetation Community	River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
Photograph	

Vegetation Community	Derived Native Grassland
PCT ID	NA
Extent within study area (ha)	17.72
Location within study area	This vegetation community occurs along Barraba Road, within the STP site and in the south east portion of the township of Bundarra.
Floristic description	This community is derived from the historic clearing of native canopy and midstorey of box communities, and now consists of native grasslands dominated by *Themeda triandra* (Kangaroo Grass), *Cymbopogon refractus* (Barbed- wire Grass), *Austrostipa scabra* (Speargrass), *Chloris ventricosa* (Windmill Grass) and *Aristida ramosa* (Purple Wiregrass). Introduced grasses common within this community include *Eragrostis curvula* (African Lovegrass) and *Hyparrhenia hirta* (Coolatai Grass), particularly along the roadside. Within the STP site, *Carex inversa* and *Juncus usitatus* are common native groundcovers.
Condition	This community is in a moderate to good condition. The condition within the STP site has been degraded by dry conditions and heavy grazing (see photograph below) with the better examples located along the Barraba Road reserve.
Conservation significance	Some areas of derived native grassland conform to the White Box Grassy Woodland TEC under the BC Act (NSW Scientific Committee, 2011). Therefore, those patches of derived native grassland occurring between patches of the TEC have also been mapped as such under the BC Act. The derived native grassland does not meet the definition for this community under the EPBC Act (discussed further in Section 5.3).

Vegetation Community	Derived Native Grassland
Photograph	

Vegetation Community	Managed/Planted Vegetation
PCT ID	NA
Extent within study area (ha)	12.36
Location within study area	This community occurs within the township of Bundarra and consists largely of planted trees with either native or exotic grasses underneath.
Floristic description	In very small areas, remnant native trees exist as isolated street trees, with *Eucalyptus blakelyi* (Blakely's Red Gum) being most common. Planted trees include Liquidambar (*Liquidambar styraciflua*), *Quercus* sp. (Oak) and *Eucalyptus nicholii* (Narrow- leaved Black Peppermint), with the latter being a threatened species under both the BC Act and the EPBC Act. In some parts of this community, the vegetation is not planted trees but rather managed exotic grasses that are mown, particularly along roadsides.
Condition	NA
Conservation significance	Not listed

Vegetation Community	Managed/Planted Vegetation
Photograph	

4.2.3 Priority Weeds

The *Biosecurity Act 2015* provides for the declaration of priority weeds in local government areas. Plant species identified as priority weeds for the Uralla region and recorded in the study area are listed in Table 4-2.

Table 4-2 Priority weeds recorded during the field survey

Scientific Name	Common Name	Duty
Senecio madagascariensis	Fireweed	Prohibition on dealings Must not be imported into the State or sold
Opuntia aurantiaca	Tiger pear	Prohibition on dealings Must not be imported into the State or sold
Rubus fruticosus species aggregate	Blackberry	Prohibition on dealings Must not be imported into the State or sold

4.3 Fauna and habitat

4.3.1 Fauna habitat

Habitat in the study area is predominantly in a disturbed condition due to historical agricultural activities, particularly grazing by livestock, and development such as residential housing and roads. There are narrow areas however, particularly along Barraba Road, which provide a moderate level of fauna habitat, due to the presence of an intact midstorey and ground layer, and the presence of fallen logs and tree hollows.

Fauna habitat types identified within the study area are detailed in the following sections. The availability of habitat resources for threatened fauna is further discussed in Section 5.

Grassy Woodland Habitats

While these communities largely occur immediately adjacent to the roadside, they are still likely to provide important habitat resources for native fauna. The communities are of course subject to edge effects from the road such as increased noise, dust and weed invasion, however they do occur in a fairly good condition throughout.

The grassy woodland habitats within the study area are likely to provide habitat for a range of bird species, including potentially threatened bird species, and a variety of more common reptiles. Hollows within these communities are typically small and in low numbers, and therefore habitat for hollow- dependent mammals is largely absent. Microchiropteran bat species are likely to be present and can roost under tree bark and in very small hollows and fissures in trees. Five hollow- bearing trees containing five small and two medium hollows were detected within the study area, and two dead stags.

When in flower, the Eucalypt species within the study area are likely to be an important nectar resource for a range of native bird and insect species. Common honeyeater species such as White- plumed Honeyeater (*Lichenostomus penicillatus*), Yellow- faced Honeyeater (*Lichenostomus chrysops*) and White- eared Honeyeater (*Lichenostomus leucotis*), as well as threatened species such as Regent Honeyeater (*Anthochaera Phrygia*) would potentially be found feeding in these trees. Similarly, both common and threatened species of parrot may utilise this nectar resource when available, such as Musk Lorikeet (*Glossopsitta concinna*) and Eastern Rosella (*Platycercus eximius*), and threatened species Little Lorikeet (*Glossopsitta pusilla*) and Swift Parrot (*Lathamus discolor*).

Fallen timber in a variety of sizes from large fallen trees to small hollow logs is fairly common within these communities in the study area (see Photograph 1). Groundcover and woody debris such as fallen logs and bark provide suitable foraging and sheltering substrate for a range of native birds, mammals, reptiles and frogs.

Photograph 1 A fallen log in the grassy woodland

Derived Native Grassland

The derived native grassland is typically lacking in habitat features for local fauna, given its disturbed state, and is predominantly subject to either mowing or cattle grazing. However, common ground- foraging bird species such Australian Magpie (*Cracticus tibicen*), Magpie- lark (*Grallina cyanoleuca*) and Masked Lapwing (*Vanellus miles*) are likely to forage within these grasslands. Birds of prey may also hunt over these grasslands as they could be housing prey species such as introduced rabbits and mice. Birds of prey that may potentially utilise these grasslands include Wedge- tailed Eagle (*Aquila audax*), Brown Falcon (*Falco berigora*), Nankeen Kestrel (*Falco cenchroides*) and Black- shouldered Kite (*Elanus axillaris*).

The grasslands are unlikely to provide foraging habitat for many mammal species, though Eastern Grey Kangaroos (*Macropus giganteus*) may feed here and Microchiropteran bat species may forage aerially above these grasslands for insects.

4.3.2 Aquatic Habitats

The unnamed creek which crosses under Barraba Road is a third- order stream and is mapped as Key Fish Habitat (see Figure 6) under the *Fisheries Management Act* 1994. Within the study area, this creek contains some wetland vegetation that would provide suitable habitat for a range of frog and insect species. It is a relatively small drainage with fringing wetland vegetation and pools of water, rather than continuous flow. No in-stream vegetation was present at the time of survey and there was no obvious riparian corridor along its length. During the survey the water was turbid and rubbish such as tyres were present in the channel. When flowing, it is possible that fish species may be present within this creek, given that it flows into the Gwydir River. At the time of the site inspection, this section of the creek contained pools of water (see Photograph 2).

However, once the creek enters the paddock to the east of the STP site, it is extremely degraded and the banks have been eroded away, with no associated woodland vegetation or riparian zone. The land surrounding this section of the creek also lacks tussock grasses or fringing vegetation due to current grazing practices (see Photograph 3). The creek was very dry at the time of survey with no noticeable moisture on the ground. It is likely that this section of the creek is largely characterised by very infrequent overland flows, as there is no clearly defined channel (particularly downstream of a farm dam). The dam that is present in the paddock here would also have to fill and overflow in order for water to continue travelling in the direction of the Gwydir River. Therefore, it is unlikely that fish could travel either to or from the Gwydir River. This dam is likely to provide habitat for common species of frog such as *Limnodynastes tasmaniensis* (Spotted Marsh Frog) and waterbird such as *Egretta novaehollandiae* (White-faced Heron) and *Threskiornis spinicollis* (Straw- necked Ibis).

The study area passes over the Gwydir River. This river typically has year- round flow and is likely to provide an important water resource to a variety of native birds, mammals and reptiles and is an important area for fish breeding (MDBA, 2018). The river has potential to be breeding habitat for amphibians and wetland birds and may represent foraging habitat for terrestrial birds and mammals, including threatened species.

The *Policy and guidelines for fish habitat conservation and management* (DPI 2013) was reviewed with respect to classification of waterways for fish passage. This stream is likely to be moderate key fish habitat (Type 2) at the road crossing. A permit under section 200 of the Act will be required to trench the pipeline into the bed of this creek. The stream is like to be minimally sensitive key fish habitat (Type 3) downstream in the paddock where it represents ephemeral aquatic habitat not supporting native aquatic or wetland vegetation.

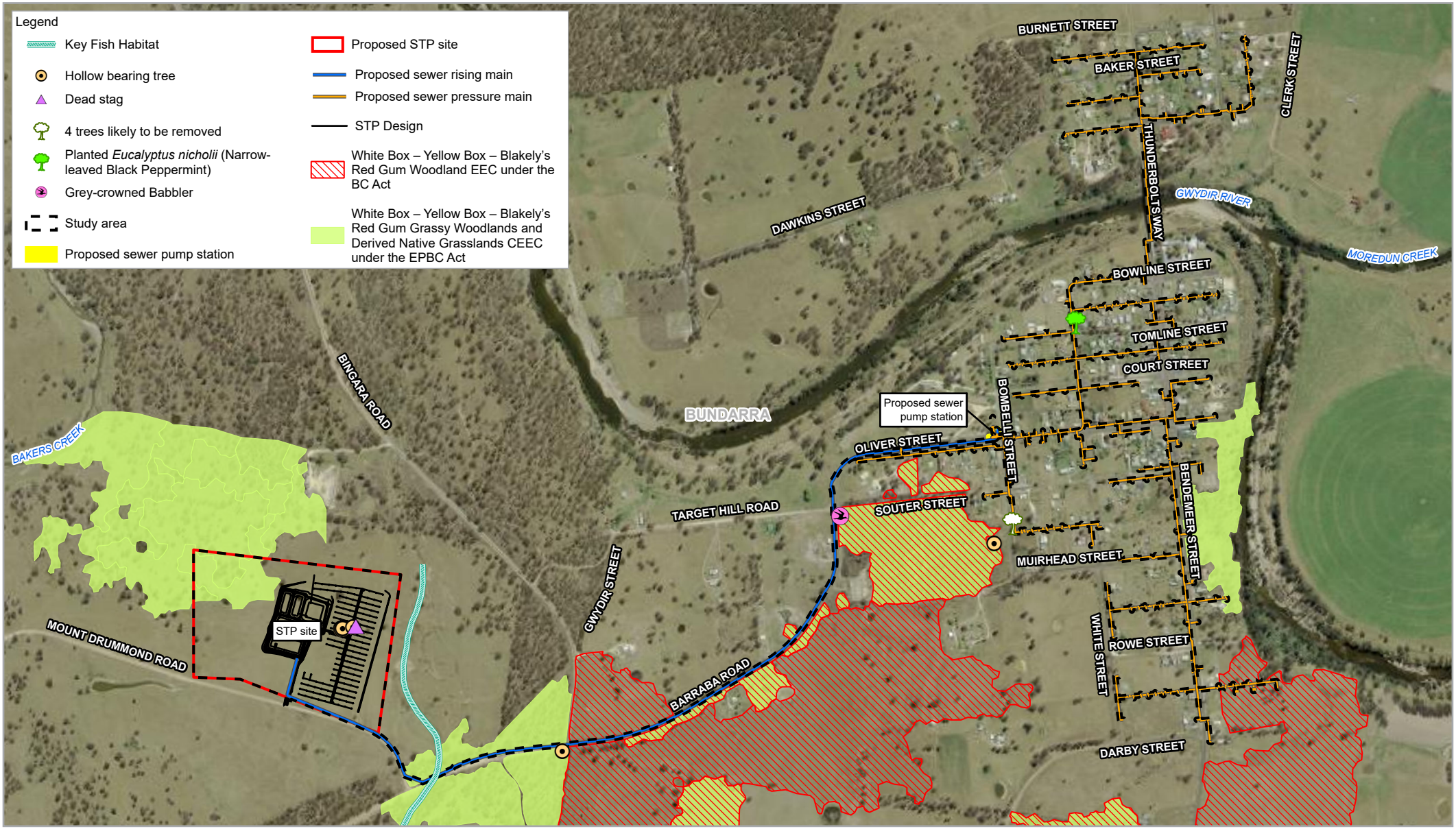
Photograph 2 Key Fish Habitat within the study area

Photograph 3 Section of creek beyond the dam, with no discernible channel

4.4 Connectivity

Connectivity within the study area is very poor, with the vast majority of the study area occurring within cleared or disturbed land. Where the study area crosses the Gwydir River, connectivity is created via the riparian corridor along the river. The study area traverses one more linear patch of native vegetation as the corridor leaves town and heads north west. This vegetation is a Travelling Stock Route (TSR) and is connected to the north, west and south east via similar vegetation corridors, but these are linear in nature and fairly narrow. Habitat value within these corridors is moderate to low.

The project itself is linear in nature and follows existing roads until it reaches the proposed STP site, which is predominantly cleared. The project is therefore unlikely to significantly impact upon connectivity within the study area or the greater locality.



Paper Size ISO A4

0 100 200 300 400

Metres

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

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GHD

Uralla Shire Council
Bundarra Sewerage Scheme
Ecological Assessment

Threatened Ecological Communities, Habitat Features, Key Fish Habitat and Threatened Species within the study area

Project No. **22-19174**
Revision No. **0**
Date **30/07/2019**

FIGURE 6

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\2219174_EA004_ThreatenedSpecies_0
Print date: 30 Jul 2019 - 11:51

Data source: LPI: DTDB / DCDB 2017; sixmaps/LPI_Imagery_Best: © Department of Finance, Services & Innovation 2017. Created by: fmackay

5. Conservation significance

5.1 Database searches

Based on the desktop assessment the following threatened biota and MNES are known or predicted to occur in the locality:

- Three threatened ecological communities (TECs).
- 18 threatened flora species.
- 40 threatened fauna species, comprising one frog, 23 birds, 13 mammals, one fish and two reptiles.
- Seven migratory species.

This list does not include marine threatened and migratory species or shorebirds which were highlighted by the database searches, because the locality does not contain any marine habitats.

The occurrence and potential occurrence of these threatened biota within the site is discussed in the following sections.

5.2 Threatened biota listed under the BC Act

5.2.1 Threatened ecological communities

Two plant community types within the study area comprise a TEC listed under the BC Act:

- White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub- region, BBS Bioregion (PCT 433). This community forms a part of White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act. This was determined based upon the dominant canopy species present, species assemblage, soil type and location in the landscape, in accordance with the Final Determination for this Community published by the NSW Scientific Committee (2011).
- Some patches of the Derived Native Grassland have also been mapped as conforming to White Box – Yellow Box – Blakely's Red Gum Woodland under the BC Act. The Final Determination (NSW Scientific Committee, 2011) for this community lists patches of derived native grassland where the former canopy of *Eucalyptus albens* and other species typical of this community, have been removed. Therefore, as a precaution, those patches of Derived Native Grassland which occur between patches of existing White Box – Yellow Box – Blakely's Red Gum Woodland EEC, along Barraba Road and in the south east portion of the township, have been mapped as such, because it is likely that they previously contained these canopy species, prior to clearing and grazing practices.

There are minor areas of this EEC in the study area, though disturbance will largely occur along the roadside were they vegetation is already fragmented and disturbed, as shown on Figure 6. Approximately 0.36 ha of this EEC occurs within the study area, with approximately 0.18 ha to be directly impacted.

Furthermore, the Final Determination (NSW Scientific Committee, 2011) for this community does not mention *Eucalyptus moluccana* as occurring within this EEC. Therefore, under the BC Act, the patches of Grey Box Grassy Woodland do not conform to the EEC.

5.2.2 Threatened flora species

One threatened flora species, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint), was detected immediately adjacent to the study area, as shown on Figure 6. This species is listed as vulnerable under both the BC and EPBC Acts. It is extremely likely that the five specimens are planted street trees and are not naturally occurring. It is also unlikely that any of these planted specimens will require removal as part of the proposal.

Based on the assessment of habitats, soil types and vegetation occurring within the site, there is potential habitat for nine other threatened flora species to occur within the study area. The majority of these species have suitable habitat within the woodland communities only, and these are *Callistemon pungens, Eucalyptus caleyi* subsp. *ovendenii, Eucalyptus magnificata, Eucalyptus mckieana, Euphrasia arguta* and *Homopholis belsonii.* Two of the species, *Prasophyllum Wybong* and *Thesium australe* have suitable habitat in both the woodlands and the derived native grasslands, and finally *Dichanthium setosum* has suitable habitat in the derived native grasslands only.

A complete list of all flora species recorded previously within the locality and an assessment of their likelihood of occurrence is presented in Appendix A. An Assessment of significance has been prepared to determine impacts of the project on the potential habitat for these species (Appendix C).

5.2.3 Threatened Fauna Species

Two Grey- crowned Babblers (*Pomatostomus temporalis temporalis*), listed as vulnerable under the BC Act, were observed immediately adjacent to the study area (see Figure 6). A further 14 bird species (Regent Honeyeater, Brown Treecreeper, Varied Sittella, Painted Honeyeater, Little Lorikeet, Swift Parrot, Square- tailed Kite, Hooded Robin, Black- chinned Honeyeater, Turquoise Parrot, Scarlet Robin, Diamond Firetail, Spotted Harrier and Barking Owl) and five mammals (Koala, Eastern False Pipistrelle, Eastern Bentwing- bat, Corben's Long- eared Bat and Yellow- bellied Sheathtail- bat) are considered to have a moderate likelihood of occurrence in the study area. Assessments of Significance have been applied to these threatened fauna species which may be potentially impacted by the proposal, and are presented in Appendix C.

5.3 EPBC Act MNES

5.3.1 Threatened ecological communities

White Box – Yellow Box – Blakely's Red Gum grassy woodland is listed as a critically endangered ecological community (CEEC) under the EPBC Act. The patches of White Box Grassy Woodland within the study area meet the criteria for EPBC listing as specified by the EPBC Policy Guidelines (DEH 2006). The listing specifies that each patch:

- Must be larger than 0.1 ha, and
- Must have dominant species that are commensurate with the community, and
- Each 0.1 ha patch of the community must contain 12 native, non- grass species in the groundcover, or
- Must be larger than 2 ha, and
- Contain 20 or more mature trees per hectare (trees are considered 'mature' if they are at least 125 cm circumference at breast height), or
- Contain mature trees and natural regeneration.

Within the study area, the patches of White Box Grassy Woodland that are greater than 0.1 ha and also contain mature trees and regeneration have been mapped as conforming to this CEEC under the EPBC Act. These patches are shown on Figure 6.

Additionally, the EPBC policy guidelines for White Box – Yellow Box – Blakely's Red Gum grassy woodland specifies that *Eucalyptus moluccana* can also occur within this community. Therefore, the patches of Grey Box grassy woodland which contain mature trees and regeneration have also been mapped as conforming to White Box – Yellow Box – Blakely's Red Gum grassy woodland CEEC under the EPBC Act. These patches occur along Barraba Road and in the south east portion of the township.

The occurrence of Grey Box grassy woodland in the north western corner of the STP site does not contain regeneration (being heavily grazed) and does not contain 20 or more mature trees per hectare; however, it needs to be considered as part of the larger patch, which extends outside of the study area. The offsite extents of the patch around the STP site were not ground-truthed during the site visit for access reasons. On a precautionary basis, it is assumed that the offsite extents contain sufficient mature trees and regeneration to meet the EPBC Act criteria for White Box – Yellow Box – Blakely's Red Gum grassy woodland CEEC.

Approximately 3.04 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland CEEC occurs within the study area, with 0.24 ha to be directly impacted. Figure 6 shows the greater extent of this CEEC in the wider area, with 0.24 ha being a relatively minimal area.

5.3.2 Threatened flora

Five *Eucalyptus nicholii* (Narrow- leaved Black Peppermint) were detected immediately adjacent to the study area, which is listed as vulnerable under the EPBC Act (refer to Section 2.3.1).

All of the previously discussed (see Section 5.2.2) threatened flora species considered likely to occur are also listed under the EPBC Act, with the exception of *Eucalyptus magnificata*. Therefore, eight other flora species listed as threatened under the EPBC Act were assessed as having the potential to occur.

5.3.3 Threatened fauna

No threatened fauna species listed under the EPBC Act have been recorded at the site. Based on the habitats present, a total of five threatened fauna species (Regent Honeyeater, Swift Parrot, Grey- headed Flying-fox) listed under the EPBC Act may occur in the site and/or be affected by the proposal. These are comprised of three bird and two mammal species.

Migratory fauna

Terrestrial migratory species for which habitat was identified within the study area include the following:

- *Apus pacificus* (Fork- tailed Swift).
- *Hirundapus caudacutus* (White-throated Needletail).
- *Merops ornatus* (Rainbow Bee- eater).

The Fork- tailed Swift and White- throated Needletail may forage and fly over the study area but would be unlikely to land or to be dependent on the habitats present within the study area. Impacts are therefore likely to be indirect and minimal in regards to these species, which do not breed in Australia.

The Rainbow Bee- eater may forage within the study area but no breeding habitat is available.

6. Impact assessment

The project is likely to require vegetation clearing, comprising temporary disturbance of native groundcover, tree trimming activities and removal of some trees within the construction footprint. This is detailed in the following sections.

Measures to mitigate the potential impacts of the project are discussed in Section 7.

6.1 Direct impacts

6.1.1 Vegetation Clearing

The project is estimated to disturb approximately 19.26 ha of remnant and derived native vegetation, and managed/planted vegetation (see Table 6-1), of which 11.68 ha is represented by native vegetation.

Table 6-1 Vegetation clearing within the study area

Vegetation Type	BC Act Status	EPBC Act Status	Area within study area (ha)	Area to be directly impacted (ha)
White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	EEC	CEEC	0.05	0.02
Grey Box grassy woodland or open forest of the Nandewar Bioregion and New England Tableland Bioregion	-	CEEC (in part, see Section 5.3.1)	2.99	0.23
River Oak – Rough- barked Apple – Red Gum – Box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	-	-	0.08	*0.05**
Derived Native Grassland	EEC (in part, see Section 5.2.1)	-	17.72	11.39
Managed/Planted Vegetation	-	-	12.36	7.58
Total			**33.2**	**19.3**

Note: EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

**Where the project crosses the Gwydir River, the pipeline is proposed to be attached to the existing bridge. Therefore, while the figures portray the disturbance areas as traversing through the River Oak – Rough-barked Apple – Red Gum – Box riparian tall woodland, none of this community will actually require removal as it is situated under the bridge.*

Clearing of vegetation of conservation significance

The project is likely to disturb an estimated 0.17 ha of derived native grassland and 0.02 ha of woodland that is listed under the BC Act as EEC, located predominantly in the Barraba Road reserve. The project is also likely to impact (mostly through tree trimming and removal of saplings) an estimated 0.24 ha of EPBC Act-listed CEEC, of which 0.02 ha also represents the EEC woodland listed under the BC Act.

Tree and habitat tree removal

The majority of the project footprint is within already cleared or managed areas immediately adjacent to the roadside (i.e. pipeline network within Bundarra town), or within derived native grassland (i.e. along rising main route and within the STP site). As such, tree removal is expected to be minimal, with the majority of vegetation disturbance comprising temporary disturbance to native grassy understorey of varying conditions, removal of a limited number of tree saplings along Barraba Road and some tree trimming.

Notwithstanding the above, removal of a small number of mature trees and stags could potentially be required. This includes:

- Approximately eight trees within the STP site, which includes six hollow-bearing trees or stags, noting that the waste treatment infrastructure is largely placed within areas of derived native grassland to avoid as many mature trees as possible.
- Four roadside trees at the southern end of Bombelli Street (three *Eucalyptus blakelyi* and one *E. melliodora*). These trees are not located within the project footprint but are located just outside of the estimated footprint within the mapped study area. These trees have been assessed on a precautionary basis due to their proximity to the project footprint.

A number of mitigation measures are provided in Section 7 to minimise the potential for impacts to retained native vegetation adjacent to the study area. Additionally, impacts are predominantly temporary and short term because once the pipeline has been installed, the soil will be returned and vegetation can regenerate. The only area where impacts are permanent are within the STP site, where the STP is a permanent above- ground structure.

6.1.2 Aquatic impacts

It is anticipated that impacts to aquatic habitats are to be minimal. The water quality of the Gwydir River is unlikely to be impacted, given that the pipeline will traverse above the river attached to the existing bridge.

It is proposed to discharge water from the STP into the unnamed creek to the south of the STP site in times of high rainfall. Given that the creek does not appear to have any channel or banks in this area (observed during the field surveys) as a result of cattle grazing, it is unlikely that this discharge would cause significant impacts to any local fauna. It is also considered likely that the discharged water would sit within the paddock, rather than in the creek itself, given that there are no banks to hold it in place. Therefore, the expected impacts to aquatic fauna such as fish are considered to be very low, given the absence of a creek channel.

The introduction of pollutants from the project into the surrounding environment, if uncontrolled, could potentially impact on water quality. The potential for water quality impacts are considered to be low to moderate. Potential water quality impacts would be managed through the implementation of mitigation measures, including best practise sediment and erosion controls. There could also be temporary water quality impacts during construction due to runoff from areas stripped of vegetation or runoff from soil stockpiles.

6.1.3 Fragmentation and barrier effects

The land in the study area has been previously fragmented due to land use including agricultural grazing. There would be minimal impacts to connectivity as the vegetation to be removed occurs either along the existing roadways, or within already cleared and fragmented areas. The project would increase distances between vegetation by 6 metres, which is not considered a significant barrier to flora and fauna dispersal or movements.

6.1.4 Injury and mortality of native fauna

The project may cause displacement or in some cases possible mortality of fauna that are present at the time of vegetation clearing activities, due to vehicle strike by increasing the rate of vehicle visitation to the site. Less mobile terrestrial fauna, such as common species of frogs and reptiles present within groundcover are most at risk of mortality as a result of vegetation clearing. Other species of fauna are unlikely to remain within the disturbance area during construction activities.

Displaced individuals of nocturnal species including microbats would be vulnerable to predation if they are disturbed in daylight hours and would experience energy costs, increased risk of predation and increased competition for resources. This may result in impacts beyond the study area by favouring aggressive or generalist species.

There is a risk that fauna species that are breeding in the vicinity of the study area may have their breeding disrupted if the construction phase was to coincide with the breeding season. Mitigation measures including pre-clearing surveys and clearing only while in the presence of a qualified ecologist are detailed in Section 7.2.4.

6.1.5 Loss and/or disturbance of fauna habitat

The vegetation that would be removed for the project is not considered to be important habitat for local populations of native fauna species given that it is already largely disturbed and predominantly occurs along roadsides.

Fauna habitat resources that would be removed include the following:

- Myrtaceous species, including suitable feed trees for woodland bird species.
- Fallen logs and woody debris, which would provide shelter and foraging habitat for native insects, reptiles and amphibians.
- Habitat trees bearing decorticating bark and small fissures.

6.2 Indirect impacts

Potential indirect impacts associated with the project are listed below. Mitigation measures to reduce these impacts are presented in Section 7.

6.2.1 Edge effects and Weeds

The term ‘Edge effects’ refers to factors including increased weed invasion, noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of introduced plant species, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects are likely to result from construction activities. Construction may increase the degree of weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of native vegetation via erosion (wind and water) and via workers shoes and clothing and through construction vehicles.

The study area and immediate surroundings are already disturbed due to vegetation clearing that was conducted for agricultural purposes and the existing roads. There is also evidence of weed infestation and exotic perennial grasses throughout the study area and adjoining areas. The project facilitate the introduction or spread of weed species, light and dust into adjacent areas of vegetation.

Vegetation management measures are recommended for the project to avoid direct and indirect impacts on native vegetation. Given these mitigation measures and the current condition of the study area, the project would result in only a minor increase in impacts arising from weed infestation and other edge effects.

6.2.2 Introduction of pathogens

The project has the potential to introduce or spread pathogens such as *Phytophthora cinnamomi* (Phytophthora). Rainfall is one key factor influencing the distribution of *Phytophthora cinnamomi*; consequently, disease caused by the pathogen is generally restricted to moister regions (Summerell et al. 2005). Where present, Phytophthora may result in the dieback or modification of native vegetation and damage to fauna habitats.

Spread of *Batrachochytrium dendrobatidis* (Chytrid fungus) is also possible, given the presence of aquatic habitat within the study area. Chytrid fungus affects both tadpoles and adult frogs and can result in the mortality of entire populations once introduced into an area.

There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Mitigation measures are included in Section 7.2 to minimise the potential for any impacts such as pathogen introduction as a result of the proposal.

6.2.3 Soil and water pollution during the construction phase

The project has the potential to result in pollution and contaminated runoff within the works area and adjoining areas through soil disturbance during the construction phase. Potential sources of soil and water pollution include:

- Soil disturbance during vegetation clearing activities.
- Inappropriate management of soil and material stockpiles.
- Hydrocarbon leaks or spills from vehicles or equipment used in construction or vegetation clearance activities.
- Increased runoff.
- Increased sediment transfer and erosion potential in areas cleared of vegetation.

The topography of the study area and nature of the project means that there is potential for soil and water pollution as a result of the project if appropriate controls are not adopted during the construction phase, vegetation clearing and soil disturbance activities.

It is anticipated that any water released into the environment as a result of the project would be of a similar quality to present conditions. Mitigation measures to reduce the potential for such matters are described in Section 7.

6.2.4 Noise and vibration

Noise and vibration impacts are expected during the various stages of construction as a result of vegetation clearing, vehicle movement and operation of plant for construction. Raised levels of noise and vibration may deter native fauna from using the study area during construction. This may potentially interrupt dispersal of fauna within the locality if species are unwilling to travel through the study area while increased levels of noise or vibration are detectable. Species may also abandon the study area in search of quieter areas. It is however likely that fauna species which occur within the vicinity of the study area are somewhat habituated to noises and vibration resulting from the proximity to residential areas and roads, and that species which are sensitive to increased noise levels have already moved away from these areas. In any case, an increase in noise and vibration within the study area will be temporary and short- term.

Measures relevant to reducing impacts on native fauna have been summarised in Section 7.2.2.

6.3 Key threatening processes

A key threatening process (KTP) is defined in the BC Act as an action, activity or project that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 KTPs listed under the BC Act, eight listed under the FM Act and 20 listed under the EPBC Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this project are discussed in Table 6-2. Mitigation measures to limit the impacts of these KTPs are discussed in Section 7.

Table 6-2 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	BC Act; EPBC Act	Clearing of native vegetation has occurred historically around and throughout the study area. The project would result in the clearing of approximately 11.68 ha of native vegetation from the study area.
Removal of dead wood and dead trees	BC Act	Some dead wood was identified within the study area.
Invasion of plant communities by perennial exotic grasses	BC Act	Parts of the study area have been subject to historical disturbance activities including agricultural grazing, and as a result, there are exotic weed species in most of the study area. Vehicles and plant could further spread exotic grass species, as could soil disturbance and vegetation clearing.
Infection of native plants by *Phytophthora cinnamomi*	BC Act; EPBC Act	Construction activities have the potential to introduce the root-rot fungus *Phytophthora cinnamomi* to the study area, which could lead to dieback of vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act; EPBC Act	Construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. Specific measures to reduce the potential for the introduction chytrid fungus is recommended to limit impacts on fauna and their habitats.
Anthropogenic climate change	BC Act FM Act EPBC Act	Combustion of fuels associated with construction of the project would contribute to anthropogenic emissions of greenhouse gases. The increase in greenhouse gases over time could impact average temperatures, rainfall patterns and bushfires, which can impact vegetation and habitats for flora and fauna. The direct impact on the local environment is likely to be negligible, however the project will add to cumulative increases in greenhouse gases in the locality.

6.4 Impacts on state-listed biota

6.4.1 Threatened ecological communities

One EEC was identified within the study area: White Box – Yellow Box – Blakely's Red Gum Woodland listed as endangered under the BC Act. The project is likely to disturb approximately 0.18 ha of EEC comprising:

- 0.17 ha of the EEC retained as Derived Native Grassland.
- 0.02 ha of the EEC retained as woodland.

An *Assessment of Significance* in accordance with Section 1.7 of the EP&A Act has been undertaken for potential impacts to this TEC and is presented in Appendix C. The conclusion of the assessment is that the project is unlikely to have a significant impact due to the following:

- Direct impacts to TEC vegetation are minimal within the study area.
- The TEC vegetation to be affected is mainly in a state of low to moderate condition due to its situation adjacent to roadways.
- This TEC exists elsewhere within the locality that would not be impacted by the proposal.
- The project would result in minimal fragmentation as the vegetation is already fragmented by roads.

6.4.2 Threatened flora species

One flora species listed under the BC Act, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint) was recorded within the study area, though these are highly likely to be planted specimens and not naturally occurring. Suitable habitat is present for nine other threatened flora species (refer to Appendix A). Assessments of significance in accordance with Section 1.7 of the EP&A Act have been undertaken for these species and are presented in Appendix C. The general conclusion of these assessments is that the project is unlikely to have a significant impact on these species for the following reasons:

- The habitat that would be removed as a result of the project is already fragmented and predominantly occurs adjacent to roadsides.
- The habitat to be removed comprises a small proportion of better quality habitat in the locality.

6.4.3 Threatened fauna species

One threatened fauna species, Grey- crowned Babbler (*Pomatostomus temporalis temporalis*), was recorded immediately adjacent to the study area during field surveys.

The site also contains potential habitat for a large range of fauna species as described in Section 6.4.3. Assessments of significance in accordance with Section 1.7 of the EP&A Act have been undertaken for these species and are presented in Appendix C. The general conclusion of these assessments is that the project is unlikely to have a significant impact on these species for the following reasons:

- The habitat that would be removed as a result of the project is already fragmented and predominantly occurs adjacent to roadsides.
- The habitat to be removed comprises a small proportion of better quality habitat in the locality.

6.5 Impacts on MNES

6.5.1 Threatened ecological communities

One TEC was identified within the study area: White Box – Yellow Box – Blakely's Red Gum Woodland listed as critically endangered under the EPBC Act. The project is likely to disturb approximately 0.24 ha of the CEEC comprising woodland. No Derived Native Grassland listed as CEEC under the EPBC Act will be impacted by the project.

Impacts to this community are considered unlikely to be significant, especially given that the majority of this community occurs within the STP site and is not anticipated to be removed.

6.5.2 Threatened flora species

One flora species listed as vulnerable under the EPBC Act, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint) was recorded within the study area, though these are highly likely to be planted specimens and not naturally occurring. Suitable habitat is present for nine other threatened flora species listed under the EPBC Act.

Impacts to these species are unlikely to be significant, considering the very minor area of habitat to be removed, which is already fragmented and disturbed.

6.5.3 Threatened fauna species

Potential habitat for five threatened fauna species listed under the EPBC Act exists within the study area, comprising three birds and two mammals. Potential impacts have been discussed in Section 6.4.3. Factors listed in the EPBC Act significant impact guidelines (DotE 2013) were considered in conjunction with the *Assessments of Significance* included in Appendix C with respect to these species. It was concluded that the project would not lead to a significant impact on these species.

6.5.4 Migratory species

No migratory species were identified in the study area during surveys, though potential habitat for three migratory species was identified. Impacts to these species have been assessed in accordance with the *Significant Impact Guidelines* (DotE, 2013) for migratory species and are considered unlikely to be significant to the long term survival of these migratory species in the locality. This is because the project is:

- Unlikely to substantially modify, destroy or isolate an area of important habitat for a migratory species.
- Unlikely to result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.
- Unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

No further assessment for migratory species is considered necessary.

7. Mitigation

7.1 Avoidance of impacts

The majority of the impact area avoids areas of ecological significance and falls within land that has been previously cleared in association with roadways and already cleared areas.

The project would result in some unavoidable residual adverse impacts, including the removal of small areas of native vegetation and EEC, and indirect impacts such as noise, sedimentation, runoff or edge effects outside the study area. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, or threatened species which occur in the study area or in adjoining habitats. Specific mitigation measures are recommended to minimise such impacts on ecological values.

It is highly recommended that wherever possible, the path of the pipeline should be designed so that removal of trees is avoided. Within the township of Bundarra, it is considered likely that the majority of trees within the study area can be avoided by design. This will be more difficult within the vegetation along Barraba Road, however this principle should be adopted wherever possible, including with the placement of the pump station.

Likewise, it is highly recommended that the STP is placed in the area of already cleared and open derived native grassland. This will avoid any necessity to clear the trees located within this paddock, particularly the patch of hollow- bearing trees (see Figure 4).

All hollow logs situated within the project area should be shifted into areas of habitat that are to be retained, so that they can continue to provide fauna habitat in the immediate vicinity of the proposal.

Delineating a vegetation buffer with a high visibility barrier would also help to prevent accidental clearing or disturbance of adjacent vegetation or aquatic habitat.

These measures aim to guide the vegetation clearing process by encouraging the contractor to avoid unnecessary clearing of vegetation, and limiting vegetation clearing required for the proposal. Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas so as to avoid any additional impacts outside the study area.

7.2 Environment Management Plan

The project should include the preparation of an Environment Management Plan (EMP), which will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the environmental impact mitigation measures outlined below.

7.2.1 Worker induction

Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the study area and measures to be implemented to protect biodiversity.

7.2.2 Managing impacts to Flora and Fauna

The following recommendations are required to reduce potential impacts on local fauna and their habitats within the study area:

- Soil that is removed for the trenching of the pipeline should be infilled the same way that it came out i.e. topsoil containing a native seedbank will be placed in last, allowing the area to regenerate naturally.

- Topsoil should be properly stockpiled and stored to avoid contamination by weed species.
- Clearing of potential habitat trees (hollow bearing trees) should be minimised, and these trees should be searched prior to clearing (i.e. under decorticating bark).
- Artificial construction lighting should only be active during day time only to prevent adverse impacts to foraging microbats at night.
- A suitably qualified fauna-spotter-catcher should be present during vegetation clearing activities. Suitable release methods should be used such as nest boxes for 'soft release'.
- Restricting vehicle movements to operational (daylight) hours.
- Implementing and enforcing appropriate speed limits for vehicles traversing the site.
- Establishment of 'no-go' areas, which are demarcated with high visibility barrier tape to prevent accidental impacts to vegetation and other biota adjacent to the study area.

7.2.3 Management of weeds and edge effects

Measures that should be adopted to avoid dispersal of weeds and their reproductive material are:

- Dispose of weeds correctly by pulling out all of the plant and covering loads when transporting to a disposal facility licensed to accept green waste.
- Separate declared weed species from remaining vegetation and do not mulch or re-use weed material on-site. Declared weed species must be disposed of in accordance with Department of Primary Industries' guidelines for the classification of weed.
- Prior to entering the construction corridor, inspect vehicle exterior and remove all plant propagules (such as seeds) from vehicle tyres, undercarriages, grills, floors and trays.
- Ensure that construction plant and equipment that has previously operated in or travelled from areas known to be contaminated with listed priority weeds are washed down prior to entering the site.
- In the event of the presence of any declared priority weeds, manage them in accordance with the requirements of the Biosecurity Act 2015.
- Remove weeds immediately and dispose of without stockpiling.
- Avoid stockpiling of materials adjacent to native vegetation wherever possible.
- Avoid stockpiling of fill in areas of remnant vegetation. This should preferably be stored in already cleared areas.
- Areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation.

7.2.4 Pre-clearance surveys

Pre-clearing surveys for threatened flora species, particularly Orchid species likely to be present, or sedentary fauna species (i.e. nesting birds, or fauna utilising hollows) should be carried out by a qualified ecologist prior to the commencement of works, or the felling of any hollow- bearing trees. If any species of concern are identified, construction should be delayed until suitable avoidance measures can be implemented. Displaced fauna species may require relocation into suitable adjacent habitat by a fauna-spotter-catcher.

7.2.5 Phytophthora management

Hygiene measures in accordance with the Department of Environment and Heritage national best practice guidelines for Phytophthora (2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the project should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the study area and when traversing between areas of vegetation within the study area.

These measures relate to the vegetation clearing and construction stages of the project only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area.

7.2.6 Chytrid fungus management

The machinery used for vegetation clearing activities has the potential to introduce amphibian chytrid fungus to the study area, which could lead to death of local frogs. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing should be incorporated into the FFMP and include decontamination of plant equipment working within 40 m of waterways and wetland habitat.

These measures relate to the vegetation clearing and construction stages of the project only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area.

7.3 Remediation

Following completion of construction works, cleared areas should be rehabilitated in an ecologically appropriate manner using soil stabilisation measures and planting of local and endemic species characteristic of the vegetation types identified within the study area.

8. Conclusion

The Uralla Shire Council is proposing to construct a low- pressure sewerage system and an oxidation pond STP with effluent re- use by irrigation within the township of Bundarra. The proposed pipeline will traverse approximately 12.5 km through the town and link up to the proposed STP.

The project will require the removal of up to 19.3 ha of both native and planted/managed vegetation within the study area, approximately 11.7 ha of which is comprised of native vegetation communities. One threatened ecological community, White Box – Yellow Box – Blakely's Red Gum Woodland is listed as endangered under the BC Act and critically endangered under the EPBC Act. This threatened ecological community will be impacted through a combination of tree trimming, sapling removal and understorey disturbance, and includes disturbance of:

- 0.17 ha derived native grassland (listed under BC Act only).
- 0.02 ha of remnant woodland (listed under both BC Act and EPBC Act).
- An additional 0.22 ha of remnant woodland (listed under the EPBC Act only).

An *Assessment of Significance* was prepared for the community and concluded that the project is unlikely to significantly impact upon this community in the locality, given the very minor area to be removed and the availability of this community in the locality.

Removal of a small number of mature trees and stags could potentially be required. This includes:

- Approximately eight trees within the STP site, which includes six hollow-bearing trees or stags, noting that the waste treatment infrastructure is largely placed within areas of derived native grassland to avoid as many mature trees as possible.
- Four roadside trees at the southern end of Bombelli Street (three *Eucalyptus blakelyi* and one *E. melliodora*). These trees are not located within the project footprint but are located just outside of the estimated footprint within the mapped study area. These trees have been assessed on a precautionary basis due to their proximity to the project footprint.

There are minor infestations of priority weeds in the project area. These are *Senecio madagascariensis* (Fireweed), *Opuntia aurantiaca* (Tiger Pear) and *Rubus fruticosus species aggregate* (Blackberry).

A number of avoidance and mitigation measures have been presented to reduce the potential for impacts to ecological values within the study area. In particular, the removal of trees should be avoided by design wherever possible, especially in choosing the location for the proposed STP site. Retention of hollow- bearing trees is recommended wherever possible.

One threatened fauna species was identified adjacent the study area, Grey- crowned Babbler (*Pomatostomus temporalis temporalis).* This species occurred near Barraba Road, where two birds were identified foraging in the adjacent woodland. There is potential for this species to forage in the study area, and an Assessment of Significance has been prepared and concluded that the project would not result in any significant impacts to the species. Additionally, one threatened flora species was identified immediately adjacent to the study area, *Eucalyptus nicholii* (Narrow- leaved Black Peppermint), within the township of Bundarra. While these are highly likely to be planted specimens, the species is threatened nonetheless and avoidance of removal of these trees is highly recommended.

Potential habitat for a further nine threatened flora and 18 fauna species exists within the study area. *Assessments of Significance* determined that the project is unlikely to result in a significant impact to these species due to the following:

- The very minor area of native vegetation to be removed, which is already situated adjacent to the roadside.
- Habitat within the study area is in a modified nature of low to moderate species diversity due to previous land use. This habitat is therefore unlikely to be significant to the long-term survival of threatened species within the locality.
- Clearing would not fragment habitat such that habitat in retained areas of vegetation would be impacted.

Based on the findings of this biodiversity assessment report, the project is not likely to have a significant effect on threatened species or ecological communities listed under the BC Act or FM Act, pursuant to section 1.7 of the EP&A Act. As such, a Species Impact Statement is not required.

Recommended mitigation measures are included in this report in order to minimise the impact of the project on native flora, fauna and ecological processes within the study area and adjacent land during the construction phase. These measures should be incorporated into an Environmental Management Plan for the proposal, and should include:

- Pre-clearing surveys to minimise risk of damage to resident fauna and threatened flora species, minimise clearing of native vegetation and prevent encroachment of weeds into retained adjoining habitats.
- Standard environmental management measures to minimise the risk of indirect impacts on adjoining habitats through contaminated runoff, sedimentation and erosion.
- Infilling of soil in the same order to which it was removed, so that topsoil is put back in place at the top.

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Appendices

Appendix A – Likelihood of occurrence table

Threatened Biota Habitat Table

Databases Searched

- Office of Environment and Heritage (OEH) (2018a) Threatened species profiles- threatened ecological communities known or predicted to occur within the Hunter CMA subregion.
- Department of the Environment and Energy (DoEE) (2018a) EPBC PMST Online Search including a 25 km buffer.
- NSW Department of Primary Industries (DPI) (2018) 'Fish communities and threatened species distributions of NSW'.
- Office of Environment and Heritage (OEH) (2018b) NSW Wildlife Atlas Search - threatened species results within a 10 km buffer.
- Note: Marine species which are restricted to marine environments only (such as whales, dolphins, sharks and seabirds) are excluded from the Likelihood of Occurrence Table as there is no marine habitat in the project site.

Likelihood of Occurrence

Matters considered in determining the likelihood of occurrence include:

- Known natural distributions including prior records (database searches) and site survey results.
- Geological/ soil preferences.
- Specific habitat requirements (e.g. aquatic environs, seasonal nectar resources, tree hollows etc).
- Climatic considerations (e.g. wet summers; snow fall).
- Home range size and habitat dependence.
- Topographical preferences (e.g. coastal headlands, ridgetops, midslopes, gilgai, wetlands).

The likelihood of occurrence scale is defined in the following table.

Likelihood of occurrence scale

Scale	Description
Known	Species known to occur within the site (e.g. breeding and foraging habitat; foraging habitat; movement corridors). Detected on or immediately adjacent to the site.
High	Presence of high value suitable habitat (e.g. breeding and foraging habitat; important movement corridors). Not detected.
Moderate	Presence of medium value suitable habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors). Not detected.
Low/Unlikely	Presence of low value suitable habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors). Not detected.
None	No suitable habitat or corridors linking suitable habitat present. Not detected.

Table A1 Threatened species known or predicted from the locality, habitat association and likelihood of occurring at the site

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
FLORA						
Acacia pubifolia	Velvet Wattle	E	V	Velvet Wattle occurs in NSW and Qld. In NSW it is known from two main populations, one north of Emmaville and the other near Warrabah National Park. Velvet Wattle generally grows in dry shrubby woodland on granite and metasediment soils.	12 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Low – species unlikely to be present within the study area due to a lack of habitat.
Boronia granitica	Granite Boronia	V	E	Granite Boronia occurs in scattered localities on the New England Tablelands and North West Slopes north from the Armidale area to the Stanthorpe district in southern Queensland. Grows on granitic soils amongst rock outcrops, often in rock crevices, and in forests and woodlands on granite scree and shallow soils. Important site characteristics include low precipitation and high levels of solar radiation. This semi-arid soil environment will have selected the more xerophytic species from the available regional assemblage of rainforest species.	Predicted within 10 km (DoEE 2018).	Low – species unlikely to be present within the study area due to lack of habitat, and species not known from the locality.
Boronia ruppii	Rupp's Boronia	E		Rupp's Boronia grows in dry eucalypt woodland on soils derived from serpentinite rock. Recent extensive surveys indicate over a dozen small subpopulations remain scattered across the local site, but the species does not extend to other regional serpentine areas.	8 records within 25 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat.
Cadellia pentastylis	Ooline	V	V	Appears to flower spasmodically, during a general flowering period of October to January. Dispersal of fruit and seed is probably by "passive fall" or by birds. Seeds showed a high rate of infertility at all sites, although they have been successfully germinated and established after heat application. Forms a closed or open canopy mixing with eucalypt and cypress pine species.	1 record within 25 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Callistemon pungens			V	In NSW the species occurs from near Inverell to the eastern escarpment in New England National Park. It also occurs in the northern tablelands of south-eastern Queensland. Habitats range from riparian areas dominated by *Casuarina cunninghamiana* subsp. *cunninghamiana* to woodland and rocky shrubland. Often in rocky watercourses, usually with sandy granite (occasionally basalt) creek beds.	23 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate –** suitable habitat for this species exists within the study area.
Dichanthium setosum	Bluegrass	V	V	Species exists in inland Queensland and NSW. Occurs in moderately disturbed areas like cleared woodland, grassy roadside remnants and pasture. Often found with White Box *Eucalyptus albens*, Silver-leaved Ironbark *Eucalyptus melanophloia*, Yellow-Box *Eucalyptus melliodora*, Ribbon Gum *Eucalyptus viminalis*, Winter Apple *Eremophila dibilus* and Kangaroo Grass *Themeda triandra*. Associated with heavy basaltic black soils and red-brown loams with clay subsoil.	3 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate –** suitable habitat for this species exists within the study area.
Diuris pedunculata	Small Snake Orchid	E	E	Confined to north east NSW and mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor. The Small Snake Orchid grows on grassy slopes or flats. Often on peaty soils in moist areas. Also on shale and trap soils, on fine granite, and among boulders. It flowers during August-October.	Known from the region (Copeland, 2005)	Low – species unlikely to be present within the study area due to a lack of habitat and suitable soil types.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Eucalyptus caleyi subsp. *ovendenii*	Ovenden's Ironbark	V	V	*Eucalyptus caleyi* subsp. *ovendenii* occurs from west of Guyra to west of Tenterfield on the New England Tablelands of NSW. Grows in grassy woodland on dry, shallow soils of moderate fertility. Preferred altitudes are 610 to 820 m, on granitic substrates. Ovenden's Ironbark occupies a higher geographical range than that of subspecies caleyi, occurring on the crests of broad high ridges and replacing subspecies caleyi inhabiting the lower slopes in the same general area. Associated species include *Eucalyptus melliodora, Eucalyptus dealbata, Eucalyptus albens, Eucalyptus melanophloia* and *Geijera parviflora*. Flowering occurs from July to September, with fruits having a distinctly square cross-section.	Predicted within 10 km (DoEE 2018).	**Moderate –** suitable habitat for this species exists within the study area.
Eucalyptus magnificata	Northern Blue Box	E		Known in NSW from only a few widely separate populations on the New England Tablelands, around Hillgrove east of Armidale and in the Glen Innes and Tenterfield region. Grassy open forest or woodland on shallow, sandy or loamy soils. Occurs on moderately hilly sites and at the edge of gorges, usually at altitudes from 900 - 1050 m.	Known from the region (pers. Comm.)	**Moderate –** suitable habitat for this species exists within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Eucalyptus mckieana	Mckie's Stringybark	V	V	Confined to the drier western side of the New England Tablelands of NSW, from Torrington to Bendemeer. Flowers are white, with a flowering period of March to May. The species is remarkable for its very narrow and numerous sucker leaves, the narrowest of all the stringybarks and which persist to a height of 2 to 4 metres. Eucalyptus mckieana is found in grassy open forest or woodland on poor sandy loams, most commonly on gently sloping or flat sites. Associated species at Northern Tablelands sites include *Angophora floribunda, Eucalyptus amplifolia, Eucalyptus andrewsii, Eucalyptus bridgesiana, Eucalyptus youmanii, Eucalyptus nicholii, Eucalyptus blakelyi* and *Eucalyptus conica*, and at North Western Slopes sites *Eucalyptus andrewsii, Eucalyptus stannicola, Eucalyptus prava* and *Angophora floribunda.*	26 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate –** suitable habitat for this species exists within the study area.
Eucalyptus nicholii	Narrow- leaved Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire.	1 record within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Known –** planted specimens (street trees) detected within the study area.
Eucalyptus rubida subsp. *barbigerorum*	Blackbutt Candlebark	V	V	Known from scattered populations on the New England Tablelands from Guyra to the Tenterfield area. Grassy woodland on medium or high fertility soils. Often on cold flats.	Known from the region (pers. Comm.)	Low – species unlikely to be present within the study area due to a lack of habitat and suitable soil types.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Eucalyptus scoparia	Wallangarra White Gum	E	V	In NSW it is known from only three locations near Tenterfield. Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. At lower elevations can occur in less rocky soils in damp situations.	Known from the region (pers. Comm.)	Low – species unlikely to be present within the study area due to a lack of habitat and suitable soil types.
Euphrasia arguta		CE	CE	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	1 record within 25 km (OEH 2018a).	**Moderate –** suitable habitat for this species exists within the study area.
Homopholis belsonii	Belson's Panic	E	V	Grows in dry woodland (e.g. Belah) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils. Habitat and ecology appear to be poorly known.	1 record within 25 km (OEH 2018a).	**Moderate –** suitable habitat for this species exists within the study area.
Homoranthus prolixus	Granite Homoranthus	V	V	Flowers from October to November. Homoranthus prolixus grows in heath patches, in skeletal soil among crevices of granite outcrops. Likely to be highly fire-sensitive and intolerant to frequent fire disturbance. *Homoranthus prolixus* has a localised distribution and may be the dominant shrub at some sites. Its abundance in populations ranges from frequent or common, to very locally abundant.	31 records within 25 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat and suitable soil types.
Macrozamia humilis	Inverell Cycad	V		Known only from a single locality near Inverell, on the North West Slopes of NSW. The single known population occurs in low dry woodland on sandy soil on an outcrop of laterite-capped granite.	8 records within 10 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat and suitable soil types. No *Macrozamia* sp. detected during field surveys.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Polygala linariifolia	Native Milkwort	E		Sandy soils in dry eucalypt forest and woodland with a sparse understorey. The species has been recorded from the Inverell and Torrington districts growing in dark sandy loam on granite in shrubby forest of *Eucalyptus caleyi, Eucalyptus dealbata* and *Callitris*, and in yellow podsolic soil on granite in layered open forest. In the Pilliga area, this species has been recorded in Fuzzy Box woodland, White Cypress Pine-Bulloak - Ironbark woodland, Rough-barked Apple riparian forb-grass open forest, and Ironbark - Brown Bloodwood shrubby woodland. Other associated species include *Eucalyptus trachyphloia, Eucalyptus sphaerocarpa, Angophora floribunda, Angophora leiocarpa, Tristania suaveolens, Allocasuarina torulosa* and *Wahlenbergia* species in the understorey.	10 records within 25 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat and suitable overstorey species.
Prasophyllum sp. Wybong (C.Phelps ORG 5269)			CE	Distributed within the Border Rivers (Gwydir, Namoi, Hunter), Central Rivers and Central West Natural Resource Management Regions. The species is known to occur in open eucalypt woodland and grassland. The species can be found in the EPBC listed threatened ecological community White-box Yellow-box Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	1 record within 25 km (OEH 2018a).	**Moderate –** suitable habitat for this species exists within the study area.
Swainsona sericea	Silky Swainson-pea	V		Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Sometimes found in association with cypress-pines Callitris spp.	1 record within 25 km (OEH 2018a).	Low – species unlikely to be present within the study area due to a lack of habitat.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Thesium australe	Austral Toadflax	V	V	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland. Found in association with Kangaroo Grass *Themeda australis*. Flowers in spring and summer.	4 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate –** suitable habitat for this species exists within the study area.
Tylophora linearis		V	E	Majority of records occur in the central western region, and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii.* Also grows in association with *Acacia hakeoides, Acacia lineata, Melaleuca uncinata*, *Myoporum* species and *Casuarina species*. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later.	Predicted within 10 km (DoEE 2018).	Low – marginal habitat available for this species within the study area.
Vegetation Communities						
New England Peppermint (*Eucalyptus nova- anglica*) Grassy Woodlands		CE	CE	In NSW all sites are within the New England Tablelands. The community occurs primarily in valley flats subject to cold air drainage. The valley flats are composed of basaltic soils, fine-grained sedimentary and acid volcanic substrates with poorly drained loam-clay soils. This woodland community is dominated by trees of New England Peppermint *Eucalyptus nova-anglica* and occasionally Mountain Gum *E. dalrympleana* subsp. *heptantha*, and is usually 8-20 metres tall. The woodland has a predominantly grassy understorey with few shrubs.	Predicted within 10 km (DoEE 2018).	None – no suitable habitat present.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Weeping Myall Woodlands		E	E	This ecological community is scattered across the eastern parts of the alluvial plains of the Murray-Darling river system. Typically, it occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The tree layer grows up to a height of about 10 metres and invariably includes *Acacia pendula* (Weeping Myall or Boree) as one of the dominant species or the only tree species present. The understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs. The structure and composition of the community varies, particularly with latitude, as chenopod shrubs are more prominent south of the Lachlan River district, while other woody species and summer grasses are more common further north.	Predicted within 10 km (DoEE 2018).	None – no suitable habitat present.
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland		E	CE	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and Blakely's Red Gum *E. blakelyi*. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs.	Predicted within 10 km (DoEE 2018).	**Present** – detected within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
FAUNA						
Birds						
Anthochaera phrygia	Regent Honeyeater	CE	CE	Distribution extends from south-east Queensland to central Victoria. Preferred habitat is dry open forests and woodlands, particularly box-ironbark eucalypt woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes. Also uses remnant patches including travelling stock routes and roadside reserves when moving between habitat and areas of flowering eucalypt. Feeds on invertebrates and nectar from mistletoe and eucalypts. Breeding corresponds with flowering eucalypts. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Nest is an open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.	123 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – species known to occur in the area particularly during flowering periods of local Eucalypt species.
Artamus cyanopterus	Dusky Woodswallow	V		Distributed across mainland Australia, ranging from Queensland to South Australia and Tasmania. Preferred habitat is open eucalypt forests and woodlands. Associated with Eucalypt saplings and Acacia species, and a ground cover of sedges and woody debris. Feeds on insects and occasionally nectar, fruit and seed. Breeding and nesting occurs in shrubs or low trees, living or dead in branch forks, hollows or behind loose bark.	25 records within 25 km (OEH 2018a).	Low **-** Marginal quality foraging and nesting habitat.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Chthonicola sagittata	Speckled Warbler	V		The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees.	92 records within 25 km (OEH 2018a).	Low **-** Marginal quality foraging and nesting habitat.
Circus assimilis	Spotted Harrier	V		Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months.	3 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging habitat within the study area. Lack of breeding habitat within the study area given the general lack of large, old trees.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses.	187 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.
Daphoenositta chrysoptera	Varied Sittella	V		Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years	23 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.
Erythrotriorchis radiatus	Red Goshawk	CE	V	The Red Goshawk is endemic to Australia, ranging from the western Kimberley region to north-eastern NSW (Marchant and Higgins, 1993). Occurs in coastal and sub-coastal areas in forest and woodland of tropical and warm-temperate Australia. Preferred vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins.	Predicted within 10 km (DoEE 2018).	Low – outside the typical range of this species.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Grantiella picta	Painted Honeyeater	V	V	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	3 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – suitable foraging and breeding habitat within the study area.
Glossopsitta pusilla	Little Lorikeet	V		Wide distribution across coastal and Great Divide regions of eastern Australia, from South Australia to Cape York. Forages in the canopy of open eucalypt forest and woodlands. Sometimes found foraging in Angophora, Melaleuca and other tree species. Riparian habitats used for high soil fertility.	147 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V		Distributed along the Australian coastline and well inland along rivers and wetlands, it is widespread in eastern NSW. Foraging habitat consists of coastal seas, rivers, fresh and saline lakes, lagoons, reservoirs and terrestrial habitats such as grasslands. Diet consists of waterbirds, turtles and fish. Resident pairs are territorial and occupy nesting territories of hundreds of hectares. Breeding habitat consists of large trees within mature open forest, gallery forest or woodland and reported that they avoid nesting near urban areas. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.	4 records within 25 km (OEH 2018a).	Low **–** species unlikely to occur within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Hieraaetus morphnoides	Little Eagle	V		Distribution throughout New South Wales is in the densely forested part of the Dividing Range. Occupies open eucalypt forest, woodland or open woodland. Acacia, Sheoak and riparian woodlands are favourable. Feeds on birds, reptiles and mammals. Nests in tall trees in remnant patches in winter and lays eggs in spring.	34 records within 25 km (OEH 2018a).	Low **-** marginal quality foraging and nesting habitat within the study area.
Lathamus discolor	Swift Parrot	E	CE	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta*, *Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat.	2 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – species known to occur in the area particularly during flowering periods of local Eucalypt species.
Lophoictinia isura	Square-tailed Kite	V		Distribution is along coastal and subcoastal areas from Queensland to Victoria. Found in timbered habitats including dry woodlands, timbered watercourses and open forests with ground cover of grasses and acacia scrub. Feeds on passerines like honeyeaters. Breeds from July to February and nests are located near watercourses in tree forks.	7 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging habitat within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Melanodryas cucullata cucullata	Hooded Robin (south- eastern form)	V		Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season.	22 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.
Melithreptus gularis gularis	Black- chinned Honeyeater (eastern subspecies)	V		Occupies mostly in upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. A gregarious species usually seen in pairs and small groups of up to 12 birds.	63 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging habitat within the study area.
Neophema pulchella	Turquoise Parrot	V		Occurs from southern Queensland to northern Victoria, along the western side of the Great Dividing Range. The species lives on the edges of eucalypt woodland and clearings nearby, timbered ridges and creeks on farmland.	89 record within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Ninox connivens	Barking Owl	V		Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance.	10 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging habitat within the study area.
Ninox strenua	Powerful Owl	V		Endemic to eastern and south-eastern Australia, from Mackay to south-western Victoria. Resides in a wide range of vegetation types, from woodland and open sclerophyll forest, to tall open wet forest and rainforest. Solitary and sedentary species. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Roosts in species like Turpentine, Black Sheoak, Blackwood, Rough-barked Apple and Cherry Ballart. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas. Very large territory.	1 record within 25 km (OEH 2018a).	Low **-** Marginal quality foraging habitat within the study area but a general lack of breeding habitat within the wider region due to a lack of large hollows.
Pandion cristatus	Eastern Osprey	V		Found around the Australian coastline, except Victoria and Tasmania. They are common around the northern coast, especially on rocky shores. Favour areas along the coast like river mouths, lagoons and lakes. Feed on fish in clear, open water. Nests in crowns of dead trees a kilometre from the ocean.	1 record within 25 km (OEH 2018a).	Nil **–** species unlikely to occur away from coast.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Petroica boodang	Scarlet Robin	V		Found from south-east Queensland to South Australia, from the coast to the inland slopes. They live in dry eucalypt forests and woodlands, with an open and grassy ground cover with little scattered shrubs. Lives in mature and regrowth vegetation.	22 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V		In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW (OEH 2012). It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (OEH 2012).	12 records within 25 km (OEH 2018a).	**Known** – species detected immediately adjacent to the study area during field surveys.
Rostratula australis	Australian Painted Snipe	E	E	In NSW many records are from the Murray-Darling Basin, including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Predicted within 10 km (DoEE 2018).	Nil **–** no suitable habitat for this species.
Stagonopleura guttata	Diamond Firetail	V		Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	127 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and breeding habitat within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Queensland south to the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (20-40 females) from November through to January in roof domes in sandstone caves and overhangs. Found in well-timbered areas containing gullies. Feeds on insects in the forest canopy or over water. Breeding occurs in winter or spring. Likely to hibernate through the coolest months.	482 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Low - Marginal quality foraging habitat and no suitable breeding habitat present within the study area.
Chalinolobus picatus	Little Pied Bat	V		Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Can tolerate high temperatures and dryness but need access to nearby open water.	10 records within 25 km (OEH 2018a).	Low - Marginal quality foraging habitat and no suitable breeding habitat present within the study area.
Dasyurus maculatus	Spotted-tail Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal health and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along immensely vegetated creek lines.	1 record within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Low - Marginal quality foraging habitat and no suitable breeding habitat present within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Occurs on the south east coast of Australia, from southern QLD to Tasmania. Prefers moist habitats with trees taller than 20m. Roosts in eucalypt hollows, and hunts small flying insects like moths and beetles just below the tree canopy.	1 record within 25 km (OEH 2018a).	Low **-** Marginal quality foraging and breeding habitat.
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat	V		Occurs along the east coast and north-west coast of Australia. Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony. Hunts in forested areas for insects like moths and flying insects.	231 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and roosting habitat within the study area.
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	5 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – suitable foraging and roosting habitat within the study area.
Petauroides volans	Greater Glider		V	The species is restricted to eastern Australia, from north QLD to central Victoria. This nocturnal marsupial lives in a variety of eucalypt-dominated habitats, ranging from low open forests on the coast to tall forests in the ranges and low woodland westwards of the Dividing Range. It feeds on eucalypt leaves and flowers. It uses large tree hollows in old, large trees.	Predicted within 10 km (DoEE 2018).	Nil **–** no suitable habitat for this species.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares. Breeds from August to February.	5 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – suitable habitat within the travelling stock route and proposed STP site due to presence of preferred feed trees (*E. albens*) and connectivity of habitat.
Petaurus norfolcensis	Squirrel Glider	V		Species widely distributed throughout Australia, from Queensland to western Victoria. Occurs in mature Box-Ironbark woodland, and River Red Gum in areas west of the great dividing range, and in Blackbutt-Bloodwood first with heathy understorey in coastal regions. Prefers mixed species forest composition, with an Acacia midstorey. Requires abundant tree hollows for refuge and nest sites. Diet includes Acacia gum, eucalypt sap, nectar and manna, as well as invertebrates and pollen.	22 records within 25 km (OEH 2018a).	Low **-** Marginal quality foraging and breeding habitat present within the study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby & Law, 2008). Will also forage in urban gardens and cultivated fruit crops.	3 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Low **-** Marginal quality foraging habitat within the study area.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Found throughout northern and eastern Australia. Habitat type ranges from eucalypt forests to open areas. It roosts in groups of up to six in tree hollows and buildings. Will forage for insects in open and closed forests, in a wide range of habitat types. Breeding occurs from December to mid-march.	7 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging and roosting habitat within the study area.
Scoteanax rueppelli	Greater Broad-nosed Bat	V		Occurs in gully and river systems that drain into the great dividing range. Found throughout NSW but not in altitudes over 500 m. Utilises a variety of habitat from woodland to moist and dry eucalypt forest, but mostly inhabits tall wet forest. Roosts in tree hollows and buildings. Open woodland and dry open forest is used for foraging for beetles and flying insects.	1 record within 25 km (OEH 2018a).	Low **-** Marginal quality foraging habitat within the study area.
Vespadelus troughtoni	Eastern Cave Bat	V		The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	1 record within 25 km (OEH 2018a).	Low **–** no suitable roosting habitat for this species within the study area, therefore it is unlikely to occur nearby.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Fish						
Maccullochella peelii	Murray Cod		V	Murray Cod were once abundant throughout the Murray-Darling river system, but overfishing and environmental changes have drastically reduced its numbers. Murray Cod generally prefer slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs. Small numbers are still present in the Nepean River and Yarra River.	Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.
Reptiles						
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Occurs at sites ranging from 500 to 1100 m elevation. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey. This species often occurs on steep rocky or scree slopes, especially granite.	21 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Low – no suitable habitat within the study area due to a lack of boulders and rocks.
Wollumbinia belli	Bell's Turtle	E	V	In NSW, currently found in four disjunct populations in the upper reaches of the Namoi, Gwydir and Border Rivers systems, on the escarpment of the North West Slopes. Shallow to deep pools in upper reaches or small tributaries of major rivers in granite country. Occupied pools are most commonly less than 3 m deep with rocky or sandy bottoms and patches of vegetation. Most typically uses narrow stretches of rivers 30 - 40 m wide. Most surrounding habitat has been converted to grazing land.	377 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Frogs						
Litoria booroolongensis	Booroolong Frog	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.
Migratory Species						
Apus pacificus	Fork-tailed Swift		M	Recorded in all regions of NSW. Non- breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	2 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – suitable aerial foraging habitat above the study area.
Hirundapus caudacutus	White-throated Needletail		M	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas (Higgins, 1999).	8 records within 25 km (OEH 2018a). Predicted within 10 km (DoEE 2018).	**Moderate** – suitable aerial foraging habitat above the study area.
Hydroprogne caspia	Caspian Tern		M	Widespread around virtually the entire Australian coastline, and also occur inland along major rivers, especially in the Murray–Darling and Lake Eyre drainage basins, preferring wetlands with clear water so they can detect their prey.	4 records within 25 km (OEH 2018a).	Nil – no suitable habitat for this species.
Merops ornatus	Rainbow Bee-eater		M	Bee-Eaters are a familiar sight in many lightly-timbered parts of mainland Australia, where they often perch on fence-posts or overhead wires, then launch after flying insects, flying swiftly, sometimes with rapid twists and turns, before snapping the insect in its bill, and returning to the perch to eat it. Breeds in tunnels excavated in creek banks.	43 records within 25 km (OEH 2018a).	**Moderate** – suitable foraging habitat within the study area. No suitable breeding habitat present.

Scientific name	Common name	BC Act	EPBC Act	Habitat association	Nature of record	Likelihood of occurrence in the study area
Motacilla flava	Yellow Wagtail		M	Occurs in damp or wet habitats with low vegetation, from pastures, to marshes, wetlands and estuaries.	Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.
Myiagra cyanoleuca	Satin Flycatcher		M	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests. Prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksia. Where they breed at elevations of more than 600 m above sea level in south-eastern Australia, they breed from November to early January (Frith 1969).	Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.
Rhipidura rufifrons	Rufous Fantail		M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (BA, 2017). Forages mainly in the low to middle strata of forests, sometimes in or below the canopy or on the ground; insectivorous. Breeds from about September to February. A small cup-shaped nest made from grass, roots, fine strips of bark, plant-fibre, decayed wood, moss and spider web is placed in a tree, shrub or vine, between 0.34–6.0 m above the ground, the average height being 1.6 m (Higgins et al. 2006).	Predicted within 10 km (DoEE 2018).	Nil – no suitable habitat for this species.

All information in this table is taken from NSW OEH and Commonwealth Department of the Environment Threatened Species profiles (OEH 2015a, DotE 2015a) unless otherwise stated. The codes used in this table are: M – migratory, V- vulnerable, E- endangered, CE-critically endangered, Ex- presumed extinct.

Appendix B – Flora Species Recorded in Study Area

Family	Scientific name	Common name	Weed Status	BC Act	EPBC Act
Asteraceae	*Bidens pilosa**	Cobbler's Pegs			
Asteraceae	*Calotis lappulacea*	Yellow Burr- daisy			
Asteraceae	*Carthamus lanatus**	Saffron Thistle			
Asteraceae	*Cassinia quinquefaria*				
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting			
Asteraceae	*Senecio madagascariensis**	Fireweed	WONS		
Cactaceae	*Opuntia aurantiaca**	Tiger Pear	WONS		
Caryophyllaceae	*Paronychia brasiliana**	Brazilian Whitlow			
Casuarinaceae	*Casuarina cunninghamiana*	River Oak			
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush			
Chenopodiaceae	*Maireana microphylla*	Small- leaf Bluebush			
Convolvulaceae	*Dichondra repens*	Kidney Weed			
Cyperaceae	*Carex inversa*				
Dilleniaceae	*Hibbertia obtusifolia*	Hoary Guinea Flower			
Ericaceae - Epacridoideae	*Lissanthe strigosa*	Peach Heath			
Fabaceae (Faboideae)	*Glycine sp.*				
Geraniaceae	*Geranium solanderi*	Native Geranium			
Juncaceae	*Juncus usitatus*				
Lomandraceae	*Lomandra multiflora*	Many- flowered Mat-rush			
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush			
Malvaceae	*Brachychiton populneus*	Kurrajong			
Malvaceae	*Sida spinosa**				
Myrtaceae	*Angophora floribunda*	Rough- barked Apple			
Myrtaceae	*Eucalyptus albens*	White Box			
Myrtaceae	*Eucalyptus blakelyi*	Blakely's Red Gum			
Myrtaceae	*Eucalyptus nicholii*	Narrow- leaved Black Peppermint		V	V
Myrtaceae	*Eucalyptus melliodora*	Yellow Box			
Myrtaceae	*Eucalyptus microcarpa*	Grey Box			
Myrtaceae	*Eucalyptus moluccana*	Grey Box			
Oleaceae	*Notelaea microcarpa*	Native Olive			
Oleaceae	*Olea europaea subsp. cuspidata**	African Olive			
Phormiaceae	*Dianella revoluta*	Blueberry Lily			
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues			
Poaceae	*Aristida ramosa*	Purple Wiregrass			
Poaceae	*Austrostipa scabra*	Speargrass			
Poaceae	*Bothriochloa macra*	Redleg Grass			

Family	Scientific name	Common name	Weed Status	BC Act	EPBC Act
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass			
Poaceae	*Echinopogon caespitosus*	Hedgehog Grass			
Poaceae	*Eragrostis brownii*	Brown's Lovegrass			
Poaceae	*Eragrostis curvula**	African Lovegrass			
Poaceae	*Chloris ventricosa*	Windmill Grass			
Poaceae	*Hyparrhenia hirta**	Coolatai Grass			
Poaceae	*Microlaena stipoides*	Weeping Meadow Grass			
Poaceae	*Rytidosperma sp.*	A Wallaby Grass			
Poaceae	*Themeda triandra*	Kangaroo Grass			
Poaceae	*Sporobolus creber*	Western Rat- tail Grass			
Pteridiaceae	*Cheilanthes sieberi*	Poison Rock Fern			
Polygonaceae	*Rumex crispus**	Curled Dock			
Rosaceae	*Rubus fruticosus**	Blackberry	WONS		
Rubiaceae	*Opercularia sp.*	A Stinkweed			
Scrophulariaceae	*Eremophila debilis*	Winter Apple			

*denotes an introduced species, V = Vulnerable

Appendix C – EPBC and BC Act Assessments of Significance

White Box – Yellow Box – Blakely's Red Gum Woodland CEEC under the EPBC Act

Assessment of Significance for White Box – Yellow Box – Blakely's Red Gum CEEC
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:
Reduce the extent of an ecological community
3.04 ha of this community occurs within the study area, though the majority of this area is not anticipated to be directly impacted. The area expected to be impacted is 0.24 ha. The area to be cleared is therefore relatively minimal, in comparison to the area of this community that will remain in the locality. Furthermore, the area to be removed is already fragmented and occurs along roadsides. This vegetation removal will be temporary and short- term. It is highly unlikely that the portion of this CEEC within the STP site will be directly impacted.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
The activity will increase existing fragmentation within this community by a maximum of six metres, and this is within areas that are already fragmented and disturbed by the road.
Adversely affect habitat critical to the survival of an ecological community
Being along the roadside, the area of this CEEC to be directly impacted is not considered to be habitat critical to the survival of the community. The portion of this community which occurs in the STP site is not anticipated to be directly impacted by the activity.
Modify or destroy abiotic (non- living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
Abiotic factors are not expected to be modified or destroyed by the proposed activity. The trench to be dug is proposed to be a maximum of two metres in depth and is therefore unlikely to significantly impact upon groundwater levels. While the activity is proposed to cross a stream within this community, it is not considered to present a significant modification to this community within the study area.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
A substantial change in species composition is not anticipated to occur within this CEEC as a result of the proposed activity. No functionally important species are expected to be lost. The area of this community to be directly impacted is relatively minor and is roadside vegetation, which is unlikely to be vitally important to the survival of the community.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: - assisting invasive species, that are harmful to the listed ecological community to be established, or - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
It is considered highly unlikely that any invasive species will be assisted by the proposed activity. Similarly, it is considered highly unlikely that regular mobilisation of fertilisers, herbicides or other chemicals harmful to the community will be regularly mobilised. While the activity may increase fragmentation adjacent to the roadside, meaning that car fumes and dust may penetrate further into the community, this is considered highly unlikely to cause a further decline of this community within the study area.
Interfere with the recovery of an ecological community
The proposed activity is not anticipated to interfere with the recovery of the ecological community. While 3.04 ha occurs within the study area, the area to be directly disturbed is a relatively minor area (0.24 ha) and is not anticipated to be significant to the survival of the community in the locality.

White Box – Yellow Box – Blakely's Red Gum Woodland EEC under the BC Act

Assessment of Significance for White Box – Yellow Box – Blakely's Red Gum EEC
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to this threatened ecological community.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
The project would result in impacts on approximately 0.18 ha of this EEC. This represents a very small proportion of this community in the locality, given that the area to be cleared is proposed to be no more than 6m wide, and the community also exists outside the study area. Therefore, the extent to be removed is minimal and the community can remain viable in the locality. Furthermore, the impacts are expected to be temporary and short- term, and the community can regenerate once the pipeline has been installed and topsoil replaced.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Within the project site and surrounding areas, this ecological community has been degraded through historic and ongoing disturbances. Vegetation is currently subject to infestation by exotic species and has been modified through past land clearing and is subject to edge effects from the roadside. In this context, impacts to a small area of this historically modified community would be unlikely to further alter the composition of the community such that the local occurrence of this community would be placed at risk of extinction. Furthermore, given that the impacts are expected to be temporary and short- term, the community can regenerate once impacts have ceased.
c) In relation to the habitat of a threatened species, population or ecological community: (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and
Given the very small area (0.18 ha) of this EEC proposed to be removed and the already degraded nature of this vegetation immediately adjacent to the roadside, the impacts to a small area of this community are unlikely to affect the long-term survival of the community within the locality. This community will persist immediately adjacent to the study area, and the community disturbed within the study area can regenerate once construction has ceased.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the development or activity, and
The proposed clearing would occur on the edge of Barraba Road. The community to be removed is therefore already fragmented, and the project would increase fragmentation by no more than 6 m. Once the pipeline has been installed and soil returned, the community can regenerate and reduce this fragmentation. Pollination and seed dispersal agents, including birds, insects and wind would likely continue to operate across this gap.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
The study area contains a very minor proportion of the local occurrence of the ecological community and of the habitat resources available to local populations of constituent species. The project will impact 0.18 ha of this EEC. Within the project site, this vegetation is already modified and degraded, and is situated adjacent to the roadside. Any changes to the floristic assemblage are unlikely to result in any significant further negative impacts to the community within the project site or surrounds. The area of modified and degraded vegetation within the project site that may be impacted is not considered to be important to the long-term survival of the community in the locality. It can also regenerate upon cessation of the activity.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No the project would not result in impacts to any declared areas of outstanding biodiversity values (either directly or indirectly)

Assessment of Significance for White Box – Yellow Box – Blakely's Red Gum EEC
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to increase the impact of, a key threatening process
The project will contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to this EEC: • Clearing of native vegetation • Removal of dead wood and dead trees The project may also contribute to the operation of the following KTPs of relevance to this EEC: • Anthropogenic climate change • Bushrock removal • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Loss of hollow- bearing trees • Infection of native plants by *Phytophthora cinnamomi*.
Conclusion of Assessment of Significance
Based on consideration of the above factors it is concluded that the proposed activity is unlikely to have a significant impact on this EEC. A Species Impact Statement is not likely to be required for this community.

Woodland Flora and Fauna Species

Given the minor area and linear nature of woodland habitat to be removed, woodland- inhabiting flora and fauna have been assessed together.

Flora species:

- *Callistemon pungens*
- *Eucalyptus caleyi* subsp *ovendenii* (Ovenden's Ironbark)
- *Eucalyptus magnificata* (Northern Blue Box)
- *Eucalyptus mckieana* (Mckie's Stringybark)
- *Euphrasia arguta*
- *Homopholis belsonii* (Belson's Panic)

Fauna species:

- *Anthochaera phrygia* (Regent Honeyeater)
- *Climacteris picumnus victoriae* (Brown Treecreeper)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Grantiella picta* (Painted Honeyeater)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Lathamus discolour* (Swift Parrot)
- *Lophoictinia isura* (Square- tailed Kite)
- *Melanodryas cucullata cucullata* (Hooded Robin)
- *Melithreptus gularis gularis* (Black- chinned Honeyeater)
- *Neophema pulchella* (Turquoise Parrot)
- *Petroica boodang* (Scarlet Robin)
- *Pomatostomus temporalis temporalis* (Diamond Firetail)
- *Phascolarctos cinereus* (Koala)

These species all typically occur in woodland and forest habitats, and for fauna species, both foraging and breeding habitat is present within these vegetation types.

Assessment of Significance for Woodland- dependent Flora and Fauna species
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The project will have a relatively minor direct impact upon these woodland- dependent flora and fauna species. A total of 0.02 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland, and 0.23 ha of Grey Box grassy woodland would be removed as part of the proposal, totalling 0.25 ha of habitat. Given that the habitat to be removed occurs immediately adjacent to the roadside, it is highly unlikely that lifecycles of any of these threatened species would be impacted, such that local populations would be placed at risk of extinction. Fauna species can actively avoid the area during construction, and impacts are expected to be temporary and short term. For flora species, while there will be soil disturbance, this soil will be replaced and therefore, any viable seed of any of these threatened species within the soil can potentially germinate. As impacts are temporary, these species can establish in the area upon completion of the proposal. There is potential for indirect impacts on the above fauna species during the construction phase such as increase in, noise, visitation of people and vehicle movements during daylight hours, which could potentially impact on these species' lifecycles, such that they would actively avoid the area during construction. However, upon completion of the works, these species can utilise the area once more. Given the minor and temporary nature of these impacts, it is unlikely the project would have an adverse effect on the life cycle of these species such that a viable local population would be placed at risk of extinction.

Assessment of Significance for Woodland- dependent Flora and Fauna species
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable to these threatened species.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to these threatened species.
c) In relation to the habitat of a threatened species, population or ecological community:
(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and
The project will modify 0.25 ha of suitable habitat for these species. Given that the habitat to be modified occurs largely adjacent to the roadside and is already fragmented and disturbed, it is unlikely that this temporary modification would result in the permanent extinction of any of these threatened species.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the development or activity, and
The habitat to be modified is already fragmented by the roadway, and the project will increase fragmentation by no more than 6 m. This is unlikely to cause significant detrimental impacts to any local species of flora and fauna dependent on this habitat. Furthermore, impacts are expected to be short- term and temporary, and the 6 m of fragmentation is likely to be recovered once topsoil is returned and the vegetation can regenerate.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
The 0.25 ha of woodland habitat to be modified is not considered to be important to any of these flora or fauna species, given that it predominantly occurs immediately adjacent to the roadside and is already fragmented and subject to edge effects. Its modification is unlikely to significantly impact upon the long- term survival of these species, especially given that the activity is expected to be short- term.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No critical habitat has been listed for any of these species.
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to increase the impact of, a key threatening process
The project will contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to these species: • Clearing of native vegetation • Removal of dead wood and dead trees The project may also contribute to the operation of the following KTPs of relevance to these species: • Anthropogenic climate change • Bushrock removal • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Loss of hollow- bearing trees • Infection of native plants by Phytophthora cinnamomi.
Conclusion of *Assessment of Significance*
The project is unlikely to have a significant impact on these woodland species, pursuant to section 1.7 of the EP&A Act, given the relatively minor area (0.25 ha) of already fragmented roadside vegetation to be removed. Furthermore, impacts are expected to be short- term and temporary.

Flora and Fauna Species which utilise both Woodland and Grassland Habitat

The following flora species are known to inhabit both grassy woodland and derived native grassland of the northern tableland area:

- *Prasophyllum Wybong*
- *Thesium australe (Austral Toadflax)*

The following fauna species typically roost, forage and breed within woodland habitats, but may also forage over open grassland areas.

Fauna species:

- *Circus assimilis* (Spotted Harrier)
- *Ninox connivens* (Barking Owl)
- *Stagonopleura guttata* (Diamond Firetail)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing- bat)
- *Nyctophilus corbeni* (Corben's Long- eared Bat)
- *Saccolaimus flaviventris* (Yellow- bellied Sheathtail- bat)

Assessment of Significance for Woodland and Grassland- dependent Flora and Fauna species
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The project will have a relatively minor direct impact upon these woodland- dependent flora and fauna species. A total of 0.02 ha of White Box – Yellow Box – Blakely's Red Gum grassy woodland, 0.23 ha of Grey Box grassy woodland and 11.39 ha of Derived Native Grassland would be removed as part of the proposal. For fauna, this represents 11.64 ha of foraging habitat, and 0.24 ha of breeding habitat. All impacts to woodland habitat are expected to be short- term and temporary. The STP site is the only permanent impact, representing approximately 11 ha of permanent disturbance within the grassland area. Given that much of the habitat to be removed occurs immediately adjacent to the roadside, or in areas of highly disturbed grazing land, it is highly unlikely that lifecycles of any of these threatened species would be impacted, such that local populations would be placed at risk of extinction. Fauna species can actively avoid the area during construction, and impacts are expected to be temporary and short term. As impacts are temporary, these species can establish in the area upon completion of the proposal. For flora species, the only permanent impacts are expected to be approximately 11 ha within the derived native grassland. There is potential for indirect impacts on the above fauna species during the construction phase such as increase in, noise, visitation of people and vehicle movements during daylight hours, which could potentially impact on these species' lifecycles, such that they would actively avoid the area during construction. However, upon completion of the works, these species can utilise the areas once more, aside from the approximately 11 ha of permanent disturbance in the STP site. Microbat species are likely to still forage above this STP site for insects, upon its completion. Given the minor and predominantly temporary nature of these impacts, it is unlikely the project would have an adverse effect on the life cycle of these species such that a viable local population would be placed at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable to these threatened species.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to these threatened species.

Assessment of Significance for Woodland and Grassland- dependent Flora and Fauna species
c) In relation to the habitat of a threatened species, population or ecological community:
(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and
The project will modify 10.4 ha of suitable habitat for these species. Given that the habitat to be modified predominantly occurs either adjacent to the roadside or within a paddock currently being grazed, and the habitat is already fragmented and disturbed, it is unlikely that this mostly temporary modification would result in the permanent extinction of any of these threatened species. The only permanent removal of habitat will occur within the STP site, consisting of approximately 11 ha of derived native grassland in a disturbed and grazed state.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the development or activity, and
The habitat to be modified or removed is already fragmented by the roadway or by farmland, and the project will increase fragmentation by no more than 6 m along the roadside. Approximately 11 ha of grassland habitat will be removed, though this is unlikely to cause significant detrimental impacts to any local species dependent on this habitat, given its already disturbed and open nature, and it is currently subject to cattle grazing. Furthermore, impacts are largely expected to be short-term and temporary, and the 6m of fragmentation within woodland habitat is likely to be recovered once topsoil is returned and the vegetation can regenerate.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
The 10.4 ha of woodland and grassland habitat to be modified is not considered to be important to any of these species, given that it occurs immediately adjacent to the roadside and is already fragmented and subject to edge effects. Its modification is unlikely to significantly impact upon the long- term survival of these species, especially given that the activity is expected to be short- term. The approximately 11 ha of grassland habitat to be permanently removed is also not considered to be important to the survival of these species in the locality, given that the area is already highly disturbed and is currently grazed by cattle.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No critical habitat has been listed for any of these species.
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to increase the impact of, a key threatening process
The project will contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to these species: • Clearing of native vegetation • Removal of dead wood and dead trees The project may also contribute to the operation of the following KTPs of relevance to these species: • Anthropogenic climate change • Bushrock removal • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Loss of hollow- bearing trees • Infection of native plants by Phytophthora cinnamomi.
Conclusion of *Assessment of Significance*
The project is unlikely to have a significant impact on these species, pursuant to section 1.7 of the EP&A Act, given the relatively minor area (11 ha) of already fragmented, disturbed vegetation to be removed, and 10.4 ha of habitat to be modified only. Furthermore, impacts are largely expected to be short- term and temporary, apart from the approximately 11 ha of already disturbed, grazed habitat to be permanently removed.

Dichanthium setosum (Bluegrass)

Assessment of Significance for Woodland- dependent Flora and Fauna species
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The project will have a relatively minor direct impact upon this flora species, with 11.39 ha of grassland habitat to be directly impacted. The STP site is the only area of permanent impact, representing approximately 11 ha of habitat for this species. This area of permanent disturbance however contains only marginal habitat, given its current state of grazing and historical disturbance. More suitable habitat for this species exists within the Derived Native Grassland along the roadside, where disturbance will be short- term and temporary. Given the minor and predominantly temporary nature of these impacts, it is unlikely the project would have an adverse effect on the life cycle of this species such that a viable local population would be placed at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable to these threatened species.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to these threatened species.
c) In relation to the habitat of a threatened species, population or ecological community:
(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and
The project will modify 11.39 ha of suitable habitat for this species, and permanently remove approximately 11 ha. Given that the habitat to be disturbed predominantly occurs either adjacent to the roadside or within a paddock currently being grazed, and the habitat is already fragmented and disturbed, it is unlikely that this mostly temporary modification would result in the permanent extinction of this threatened species.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the development or activity, and
The habitat to be modified or removed is already fragmented by the roadway or by farmland, and the project will increase fragmentation by no more than 6 m along the roadside. Approximately 11 ha of habitat will be permanently removed, though this is unlikely to cause significant detrimental impacts to this species, given its already disturbed and heavily grazed nature. Furthermore, impacts are largely expected to be short- term and temporary, and the 6 m of fragmentation within roadside habitat is likely to be recovered once topsoil is returned and the vegetation can regenerate.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
The 11.39 ha of grassland habitat to be modified is not considered to be important to this species, given that it occurs immediately adjacent to the roadside and is already fragmented and subject to edge effects. Its modification is unlikely to significantly impact upon the long- term survival of this species, especially given that the activity is expected to be short- term. The approximately 11 ha of habitat to be permanently removed is also not considered to be important to the survival of this species in the locality, given that the area is already highly disturbed and is currently grazed by cattle.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No critical habitat has been listed for any of these species.

Assessment of Significance for Woodland- dependent Flora and Fauna species
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to increase the impact of, a key threatening process
The project will contribute to the operation of the following Key Threatening Process (KTP) of relevance to this species: • Clearing of native vegetation The project may also contribute to the operation of the following KTPs of relevance to this species: • Anthropogenic climate change • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by Phytophthora cinnamomi.
Conclusion of *Assessment of Significance*
The project is unlikely to have a significant impact on this species, pursuant to section 1.7 of the EP&A Act, given the relatively minor area (approximately 11 ha) of already fragmented, disturbed vegetation to be removed, and 11.39 ha of habitat to be modified. Furthermore, impacts are largely expected to be short- term and temporary, apart from the approximately 11 ha of heavily grazed habitat to be permanently removed.

Eucalyptus nicholii (Narrow- leaved Black Peppermint)

Assessment of Significance for Woodland- dependent Flora and Fauna species
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Five planted *Eucalyptus nicholii* were detected immediately adjacent to the study area within the township of Bundarra. It is highly unlikely that these trees would require removal as part of the project and are likely to be subject to indirect impacts only. Trimming of these trees may be required. Also, this species was not detected within any native vegetation type such as woodland or grassland. Therefore, the project is very unlikely to place any local population of this species at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable to these threatened species.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to these threatened species.
c) In relation to the habitat of a threatened species, population or ecological community:
(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity and
The project is unlikely to modify any habitat for this species. These trees are likely to be subject to indirect impacts only, with no habitat to be removed. This species was not detected within any naturally occurring vegetation type in the study area.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the development or activity, and
No habitat for this species will become fragmented or isolated. No individuals are expected to be directly impacted.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
No habitat for this species is expected to be removed, modified, fragmented or isolated.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No critical habitat has been listed for any of these species.
e) Whether the proposed development or activity constitutes or is part of a key threatening process or is likely to increase the impact of, a key threatening process
The project will contribute to the operation of the following Key Threatening Process (KTP) of relevance to this species: • Clearing of native vegetation The project may also contribute to the operation of the following KTPs of relevance to this species: • Anthropogenic climate change • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by Phytophthora cinnamomi.
Conclusion of *Assessment of Significance*
The project is unlikely to have a significant impact on this species, pursuant to section 1.7 of the EP&A Act, given that no individuals are expected to be removed, and the species does not occur within the native vegetation types subject to modification or removal.

GHD

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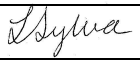
GHDDocId/https://projects.ghd.com/OC/Newcastle/bundarraseweragеopti/Delivery/Documents/2219174-REP-EcologicalImpactAssessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P. Fagan	C. Phu		L. Sylva		08/08/2019

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Appendix D – Agency consultation

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC18/378426
Your Ref: E-mail 31 May 2018

GHD
230 Harbour Drive
COFFS HARBOUR NSW 2450

Attention: Mr Ben Luffman

Dear Mr Luffman

Re: Bundarra Waste Water Treatment Scheme Options Report

Thank you for your email dated 31 May 2018 about the Bundarra sewerage scheme options report seeking comments from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide input and apologise for the delay in responding.

We understand the proposal is to build a reticulated low-pressure sewer system and Wastewater Treatment Plant (WWTP) to service existing houses that are currently serviced by septic systems at Bundarra, which is adjacent to the Gwydir River.

The OEH has statutory responsibilities relating to biodiversity (including threatened species, populations, ecological communities, or their habitats), Aboriginal and historic heritage, National Parks and Wildlife Service estate and flooding.

We have reviewed the GHD Options Report (May 2018) and associated maps and undertaken a selective site option inspection focused by your verbal advice. Whilst there are no apparent issues with respect to National Parks and Wildlife Service estate, we provide the following comments and recommendations.

We acknowledge that the options report is an overview document that considers the potential risks and constraints of the various site options and has a focus on cost minimisation in the formulation of the preferred option. However, there needs to be a clear and consistent justification for the preferred option(s) recommended within the conclusion section of the report accompanied by the relevant detailed mapping for at least those options that are still being considered.

Biodiversity
The desk top review has provided an indication of the biodiversity values of the locality and the likelihood of each option to impact on some of these values. It highlights those site options with an obvious native vegetation coverage as likely to harbor threatened flora or provide habitat for threatened fauna. The OEH generally agrees with this approach however, the feeder main required for each of the WWTP options does not appear to have been considered in the overall analysis.

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ABN 30 841 387 271
www.environment.nsw.gov.au

If option 1 is the only scenario now being seriously considered, then this needs to be clearly stated in the conclusion section of the report. If other WWTP options are still being considered, then the feeder main routes of the other options, still being considered, also need to be provided in the detailed mapping appendices. Feeder main impacts should be assessed as part of the overall option analysis.

Different WWTP options will result in differing impacts as some of the options are likely to result in impacts to well vegetated road reserves and/or possibly traverse a well vegetated travelling stock route (TSR). Some options will likely have a greater length of impact on road reserve vegetation and, in this locality, would potentially result in impact on Endangered Ecological Communities (EECs) and habitat for threatened species (TS). Conversely, some options may have minimal to no impact on native vegetation for some WWTP options and where the relevant road reserve route of its feeder main would traverse already cleared areas. These scenarios are uncertain from the options report mapping.

The biodiversity impacts of the potentially impacted road reserve vegetation should be considered as a factor in the option analysis as some of this vegetation not only forms TS habitat and comprises EEC but it also forms important connectivity corridor linkages. The nearby/adjacent TSR, various road reserves and other vegetation patches are strategically mapped as a regional connectivity corridor in the NSW NPWS Key Habitat and Corridors mapping in Scotts, D. (2003) Key habitats and corridors for forest fauna: a landscape framework for conservation in north-east New South Wales. *Occasional Paper 32: NSW National Parks and Wildlife Service*.

Observations made during our site options inspection on 20 June 2018 revealed the dominant plant community type generally present in the locality and occurring across or adjacent to several site options. Road reserves and the readily viewable parts of the TSR would appear to be *White Box, Yellow Box, Red Gum Woodland* EEC, also known as Box-Gum Woodland. Some of the WWTP options may also consist of derived grassland that might also align with this EEC, and this needs to be a subject of an appropriate higher level environmental assessment of the preferred design. It will need to assess the full extent of all biodiversity impacts of the preferred WWTP option within the REF/EIS.

Aboriginal cultural heritage

The OEH has also reviewed the overview document from the perspective of Aboriginal Cultural Heritage. We note that an Aboriginal Heritage Information Management System (AHIMS) search and a search of the Australian Heritage Database was carried out to inform the proposal. We further note that the GHD Options Report notes that only a single isolated Aboriginal object was revealed within the project area from the AHIMS search.

We take this opportunity to advise that the AHIMS register identifies an Aboriginal scar tree (AHIMS 20-3-0074) in the southeast part of the Bundarra township and notify you that the OEH AHIMS register only represents Aboriginal sites and objects that have been previously recorded and identified to OEH. Furthermore, our records indicate that Bundarra and the surrounding area, like much of the New England and Northern Tablelands, has not been subject to intensive archaeological survey and therefore it is highly likely that the AHIMS register is not an accurate representation of the presence of Aboriginal objects within the project area.

Moreover, we note that the AHIMS register generally only identifies tangible objects and does not identify locations that may have intangible Aboriginal cultural values which may form constraints to any proposed works.

Flooding

The township of Bundarra sits adjacent to the Gwydir River, however the proposed location for the WWTP (Option 1 from the Options report) is some 20m higher in elevation than the river. The report states that the site is not impacted by flooding from the Gwydir based on flood information provided by the local council and the local topography supports this.

A small drainage feature exists on the site, however this will not present flood issues due to the small catchment that it services. OEH has no further comment on flooding matters for this proposal.

OEH Recommendations

The OEH recommends that prior to finalising any plans for this project, the proponent should:

1. engage with the local Aboriginal community and undertake archaeological surveys over the areas proposed for ground disturbing works. Specific surveys for the entire impact zone of the preferred option should be undertaken to ensure that all identifiable Aboriginal objects and intangible cultural constraints are accounted for prior to finalising the plans for this project.
2. include an unexpected finds protocol in the proposal to deal with incidental discovery of suspected Aboriginal objects during future construction. This should include a procedure for cessation of works and seeking further advice if discovery of Aboriginal objects occurs. OEH recommends that local Aboriginal knowledge holders and the OEH are contacted in such an event and that the local NPWS Office would likely be the most useful initial point of contact.
3. consider the extent of likely biodiversity impacts from installation of the different feeder mains to the various WWTP options.
4. ensure the preferred option assessment considers all the impacts on biodiversity for the selected preferred feeder main routes option.
5. note that a high potential exists for impact to EEC vegetation along some of the road reserves in the locality and that the proposal should be designed to minimise such impacts.

The OEH would appreciate the opportunity to provide further advice to the Uralla Shire Council and GHD once the preferred site for the proposed WWTP has been selected, the development plans for the selected sewerage system site option has been finalised and the more detailed environmental assessment requirements for the full extent of the project have been undertaken.

If you have any further questions about this issue, Mr Ross Wellington, Senior Conservation Planning Officer, Regional Operations, OEH, can be contacted on 6640 2514 or at ross.wellington@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 29 June 2018

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Regional Operations

Contact officer: ROSS WELLINGTON
6640 2514

From: kirstyn.goulding@crownland.nsw.gov.au
To: Ben Luffman
Subject: Re: Bundarra Sewerage Scheme
Date: Friday, 19 October 2018 1:42:20 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image004.png

Hi Ben

DoI Crown Lands provides the following comments for this proposal:-

Crown lands note that the proposed sewerage system will traverse several Crown roads, largely former night soil lanes, in the township of Bundarra. The locations of all Crown roads within Bundarra have been mapped in Attachment A. To authorise the use of these roads, it is recommended that the management of the affected roads be transferred to Uralla Shire Council prior to construction of the sewerage system. This will require the agreement of Council.

Further, Crown lands note that the proposed sewerage system will provide property connection points to both vacant and occupied lots. This includes several Crown lots. Crown lands have no objections to this but request further information regarding potential impacts on Crown land.

Finally, Crown lands also note that the proposed rising main connecting the pressure sewer to the sewage treatment plant will traverse Lot 7301 DP 1149103 between Barraba Road and Mount Drummond Road. This lot forms part of Reserve 24842 for travelling stock. Crown lands have no objections to this however these works may require an easement and/or road opening to authorise this route. Further investigations will be required.

Thanks
Kirstyn

Lands Ministerial Unit
NSW Department of Industry - Crown Lands
Level 4, 437 Hunter Street, NEWCASTLE NSW 2300
E: lands.ministerials@industry.nsw.gov.au W: www.industry.nsw.gov.au

Please contact Kirstyn Goulding on (02) 4920 5058 for any inquiries

On Fri, Oct 5, 2018 at 3:09 PM Ben Luffman <Ben.Luffman@ghd.com> wrote:

> Hi,
>
> We are designing the Sewerage Scheme for Bundarra. As part of the design/approval process, we invite Crown Lands to review the Concept Design Report at the link below:
>
> https://ghd.sendthisfile.com/8zvGQdDvevMrkMEUDgUcXaM9
>
> If you have any questions or comments, please contact us by 19 October 2018.
>
> Regards
>
> **Ben Luffman | A GHD Associate**
> B App Sc (Hons) | Grad Dip Urban and Regional Planning
> **Senior Environmental Consultant**
>
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From: David Ward
To: Ben Luffman
Subject: Re: Bundarra Sewerage Scheme Options Report
Date: Wednesday, 1 August 2018 1:59:09 PM
Attachments: image001.png
image004.png
image003.png
image005.png
image002.png

Hi Ben,

DPI Fisheries only regulates the construction/excavation works within the creek system, so the potential proposed release of low strength effluent into the waterway is not an issue that I can comment on. Presumably it is the EPA or council that should be providing comment.

Cheers
David

On 27 July 2018 at 15:42, Ben Luffman <Ben.Luffman@ghd.com> wrote:

> Hi David,
>
> We have progressed with the design for Bundarra STP but before going too far, we would like to know if DPI has any concerns with the proposed approach?
>
> We have designed the system to accommodate the 50th percentile flows, as per the *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004). This means there would be overflow of low strength effluent every 2 years or so. The overflow would enter an unnamed tributary (3rd order stream/key fish habitat) of the Gwydir River.
>
> Below is a summary of the system.
>
> **Sewage collection system**
>
> - Low pressure sewer system from the township of Bundarra
> - Each property has a grinded pump unit which discharge into a fully pressurised sewer system
> - No stormwater or other foreign solids are entering the system.
>
> **Proposed Sewage Treatment System**
>
> - Inlet works receiving sewage from the pressure sewer system
> - Two oxidation ponds operating in series, designed for a total average dry weather flow of 100 ML/day and a total detention time of 80 days

- Two maturation ponds operating in series, designed for a total average dry weather flow of 100 ML/day and a total detention time of 20 days

- A 3.9ML winter storage pond to store effluent up to the 50th percentile during wet periods or periods of low demand eg winter

Projected effluent quality based on average temperature of 16 oC:

Parameter	Performance
Biochemical oxygen demand (BOD)	1.8 mg/L
Suspended solids	2.0 mg/L
Total nitrogen (TN)	24.0 mg/L
Total phosphorus (TP)	5.0 mg/L
Faecal coliforms	183 cfu/100mL
pH	6.5-8.5

Reuse scheme

- Spray irrigation system of a 3 hectare area designed to accept the 50th percentile event

The proposed effluent management offers the significant benefit that most of the effluent is reused or recycled back to the environment and hence minimising the need to release effluent to the local waterways. The scheme is designed for 50th percentile reuse with zero runoff. The effluent reuse demand should be high during dry weather thus minimising need to discharge to the receiving waters during dry weather. However, there would be some overflows of low strength effluent to the receiving environment during extended wet weather periods when there is minimal or no effluent reuse demand (for an event greater to the 50th percentile).

This is considered sustainable because during wet weather, the assimilative capacity of the receiving waters should be high due to dilution effect. The concept is also based on provision of a low pressure sewage collection system that typically has significantly lower inflow and infiltration potential than a conventional gravity reticulation system. This should further assist in minimising wet weather overflows to the receiving waters.

Let me know if you need anything else

Regards

Ben Luffman | A GHD Associate

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From: David Ward <david.ward@dpi.nsw.gov.au>
Sent: Friday, 1 June 2018 12:39 PM
To: Ben Luffman <Ben.Luffman@ghd.com>
Cc: Andres Munoz Senda <Andres.Munoz@ghd.com>
Subject: Re: Bundarra Sewerage Scheme Options Report

Hi Ben,

Thanks for that information. You will see from the attachment that there is a 3rd order stream crossing Barraba Road, along the route of the sewer main. This creek is considered *Key Fish Habitat* and will require a permit for any dredging/reclamation works (under s.200 of the *Fisheries Management Act* 1994) to trench the pipe into the bed of the creek. However, it should be the only location that is KFH.

Cheers

David

On 1 June 2018 at 11:52, Ben Luffman <Ben.Luffman@ghd.com> wrote:

> Hi David,

As mentioned, we are designing the Sewerage Scheme for Bundarra which will involve some works at creeks. As part of the design/approval process, we invite you to review the Options Report at the link below:

https://ghd.sendthisfile.com/sX5g8wZT2g6vOyaN4UUUeb2I

If you have any questions or comments, please contact us by 15 June 2018.

Regards

Ben Luffman | A GHD Associate
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David Ward | Fisheries Manager

DPI Fisheries - Aquatic Environment

Our reference: : EF13/5596; DOC18/385856-01
Contact: : Ingrid Carruthers – 02 6773 7000 – armidale@epa.nsw.gov.au
Date : 19 June 2018

GHD
230 Harbour Drive
COFFS HARBOUR NSW 2450

Email: ben.luffman@ghd.com **BY EMAIL**

Attention: Mr Ben Luffman

Dear Mr Luffman,

RE: Uralla Shire Council – Bundarra Sewerage Scheme – Options Report

I refer to the *Uralla Shire Council, Bundarra Sewerage Scheme, Options Report* (May 2018) prepared by GHD and provided to the Environment Protection Authority ("EPA") on 31 May 2018 ("the Options Report").

The EPA supports the preferred conceptual option of a low-pressure sewerage system, and an oxidation pond wastewater treatment plant ("WWTP") with effluent re-use by irrigation to service the town of Bundarra. The EPA acknowledges it will provide significant environmental improvements compared with the existing sewerage services within the town.

Based on the information provided in the Options Report, an Environment Protection Licence ("EPL") for the proposed sewerage system will not be required under Schedule 1 of the *Protection of the Environment Operations Act 1997* ("the Act"). This is because the proposed sewerage system will not exceed the processing capacity of 2,500 equivalent persons or 750 kilolitres per day and will not involve a direct discharge to waters.

The EPA will remain the Appropriate Regulatory Authority for the Bundarra sewerage system in accordance with section 6 of the Act as it will still be an activity that is carried on by a public authority at a premises occupied by a local authority.

The EPA would appreciate the opportunity to provide further advice to Uralla Shire Council and GHD once a site for the proposed WWTP has been selected and the proposed development plans for the sewerage system have been finalised.

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Please contact Ingrid Carruthers on (02) 6773 7000 or by email to armidale@epa.nsw.gov.au to discuss this matter further.

Yours sincerely

REBECCA SCRIVENER
Acting Head Regional Operations Unit
Environment Protection Authority

cc: Uralla Shire Council (council@uralla.nsw.gov.au)

Andres Munoz Senda

From: MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Sent: Friday, 1 February 2019 11:50 AM
To: Andres Munoz Senda
Cc: LABROSSE Alexander
Subject: RE: Bundarra Bridge crossing - Proposed DN63 sewer crossing
Attachments: Licence Agreement.pdf

Hi Andres,

Roads and Maritime Services concurs with the proposed works subject to the conditions below being met.

- Should the proposed works vary in any way you must advise Roads and Maritime.
- The attached licence agreement be completed and signed before work commences.

Thanks,
Peter G McRae
A/Bridge Maintenance Planner
Northern Region Asset Management | Regional & Freight
T 02 6640 1062 **M** 04 2717 5147
www.rms.nsw.gov.au

Every journey matters

Roads and Maritime Services
Level 3 76 Victoria St Grafton NSW 2460

From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Friday, 1 February 2019 10:15 AM
To: LABROSSE Alexander; MCRAE Peter G (Grafton)
Subject: RE: Bundarra Bridge crossing - Proposed DN63 sewer crossing

Alex/Peter

Please find attached the Heritage assessment report as part of the REF. The proposed alignment across the bridge was accepted.

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: Andres Munoz Senda
Sent: Thursday, 31 January 2019 3:58 PM
To: 'LABROSSE Alexander' <Alexander.LABROSSE@rms.nsw.gov.au>
Cc: MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Subject: RE: Bundarra Bridge crossing - Proposed DN63 sewer crossing

Hi Alex

We have revised our design to address your comments and future upgrade of the footpath. Please find them attached for your review.
Could you pls confirm the approval process and timeframe?. We are a bit stress with the program.

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: LABROSSE Alexander <Alexander.LABROSSE@rms.nsw.gov.au>
Sent: Tuesday, 13 November 2018 8:54 AM
To: Andres Munoz Senda <Andres.Munoz@ghd.com>
Cc: Steven Todkill <Steven.Todkill@ghd.com>; MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Subject: RE: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Andres,

We are just in the preliminary stages of design currently, therefore won't have designs for review for a few months yet.

Please see attached a design for a similar walkway replacement completed previously. Note that this design called for new steel support beams, therefore they could be fabricated with holes for the u-bolt pipe hangers. Note that the walkway replacement parts will all be connected to the top flange of the support beams, so if your pipe is hung below, they will not clash.

So it is not necessary to drill hundreds of holes into the existing beams, I'd suggest that a quicker and more efficient method for hanging the pipe would be to use lindapter girder clamp bolts or similar. I'll leave this up to you for consideration.

The walkway will need to be closed during works, with pedestrians detoured across the bridge under traffic control. We will have complete access below the bridge using EWPs on the land and/or on a barge in the river.

Regards
Alexander Labrosse
Project Engineer | Bridge Works Northern

P 02 6642 9926 **M** 0407 494 288
www.rms.nsw.gov.au
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Roads and Maritime Services
RMD Bridges Northern
34 Heber St, South Grafton, 2460

Postal Address
P. O. Box 576
Grafton, NSW, 2460

From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Friday, 9 November 2018 8:09 AM
To: MCRAE Peter G (Grafton)
Cc: LABROSSE Alexander; Steven Todkill
Subject: RE: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Hi Peter/Alex

Thanks for your inputs.

Is it possible to receive the walkway upgrade design drawings, so we are sure we will not clash with the upgraded footpath?

In order to understand the constraints that the contractor will have during construction, in particular the section under the river, it would be great if you can send me any constraints imposed to this footpath, ie, if transit need to be allowed at all times or can be closed for some hours of the day, or any others?

For sure we will be able to work out some good outcome for both projects.

Much appreciated.

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Sent: Thursday, 8 November 2018 3:24 PM
To: Andres Munoz Senda <Andres.Munoz@ghd.com>
Cc: LABROSSE Alexander <Alexander.LABROSSE@rms.nsw.gov.au>
Subject: FW: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Andres,

We are intending to use the space between the bridge and walkway, so I assume the next best location is to hang it below.
We will be able to assist with the added difficulty of hanging the sewer main while we are installing the walkway next FY.

Depending on the method you use to hang the pipe, you will need to check with Alex to make sure it won't clash with the walkway.

Thanks,
Peter G McRae
A/Bridge Maintenance Engineer
Northern Region Asset Management | Regional & Freight
T 02 6640 1062 **M** 04 2717 5147
www.rms.nsw.gov.au

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Roads and Maritime Services
Level 3 76 Victoria St Grafton NSW 2460

From: LABROSSE Alexander
Sent: Thursday, 8 November 2018 8:56 AM
To: MCRAE Peter G (Grafton)
Subject: Re: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Peter,

Apologies for the delay.

I have reviewed the proposal.

We have already commenced looking at widening the walkway on the existing support beams, therefore it would be our preference if the pipe was designed to be hung beneath the walkway instead of on top. If the pipe installation is scheduled the same FY as our works, we can assist with installing the pipe as we will have all the necessary access.

Yet to be confirmed - the capacity of the existing beams and whether they are appropriate for the upgraded walkway.

Thanks
Alex

Sent from my iPad

On 7 Nov 2018, at 3:27 pm, MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au> wrote:

> Alex,
>
> Have you had a chance to have a look at the Bundarra Walkway?
>
> Thanks, Peter
>
> ---
>
> **From:** Andres Munoz Senda [mailto:]
> **Sent:** Wednesday, 7 November 2018 3:10 PM

To: MCRAE Peter G (Grafton)
Subject: RE: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Hi Peter

Just a quick follow up on this design and preliminary comments from RMS. Do you have any feedback?

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: Andres Munoz Senda
Sent: Friday, 26 October 2018 11:07 AM
To: 'JOHNSTON Ian W' <Ian.JOHNSTON@rms.nsw.gov.au>; MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Cc: 'Stephen Hansen' <steve.hansen@finance.nsw.gov.au>; 'HISLOP David G' <David.HISLOP@rms.nsw.gov.au>
Subject: Bundarra Bridge crossing - Proposed DN90 sewer crossing

Hi Ian/Peter

Please find attached our proposed low pressure sewer main DN90 - Bundarra Bridge crossing for RMS review/approval.
I'll advise Council's rep shortly. In the meantime, I'm cc Steve from PWA who is representing the Uralla Shire Council as contract manager for this project.

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: JOHNSTON Ian W <Ian.JOHNSTON@rms.nsw.gov.au>
Sent: Wednesday, 17 October 2018 11:27 AM
To: Andres Munoz Senda <Andres.Munoz@ghd.com>
Cc: MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>
Subject: RE: WAE - Bundarra Bridge crossing

Andres,

These agreements are between RMS and Council so it would be best if RMS deal direct with the council rep.

I'll pass this onto Peter McRae to deal with from here.

Regards,

Ian Johnston
A/ Contract/Project Manager
Regional Maintenance Delivery Northern | Regional and Freight
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Roads and Maritime Services
Level 3, 76 Victoria St Grafton NSW 2460

From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Wednesday, 17 October 2018 11:22 AM
To: JOHNSTON Ian W
Subject: RE: WAE - Bundarra Bridge crossing

Hi Ian

Can I pass the attached form to my client to fill it in? or do you have a revised form?

Regards

Andres Munoz
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Senior Civil Engineer – Water

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From: JOHNSTON Ian W <Ian.JOHNSTON@rms.nsw.gov.au>
Sent: Tuesday, 16 October 2018 4:35 PM
To: Andres Munoz Senda <Andres.Munoz@ghd.com>
Subject: RE: WAE - Bundarra Bridge crossing

ok

From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Tuesday, 16 October 2018 4:32 PM

To: JOHNSTON Ian W
Subject: RE: WAE - Bundarra Bridge crossing

Thanks Ian

I have discussed a couple of minor changes with David, I'll update the drawings and resubmit for review. I'll also advise the contact details for Uralla Shire Council

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: JOHNSTON Ian W <Ian.JOHNSTON@rms.nsw.gov.au>
Sent: Tuesday, 16 October 2018 2:39 PM
To: MCRAE Peter G (Grafton) <Peter.MCRAE@rms.nsw.gov.au>; Andres Munoz Senda <Andres.Munoz@ghd.com>
Cc: HISLOP David G <David.HISLOP@rms.nsw.gov.au>
Subject: FW: WAE - Bundarra Bridge crossing

Peter,

RE: Bundarra proposed water pipe utility design for review

I had a brief look at this and it appears that it will not clash with proposed future walkway redecking, might need to run this by whoever will be doing Bundarra over at RMD.

Andres,
Who is the council contact for this proposed project? We will need to liaise with then for dates and provide them with the standard utility agreement.

Regards,

Ian Johnston
A/ Contract/Project Manager
Regional Maintenance Delivery Northern | Regional and Freight
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From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Tuesday, 16 October 2018 2:16 PM

To: JOHNSTON Ian W
Subject: RE: WAE - Bundarra Bridge crossing

Hi Ian

Please find attached the proposed sewer main DN90 - Bundarra Bridge crossing for your preliminary review and advise on the approval process. I'll give you a call shortly

Regards

Andres Munoz
BE (CivHydEnv) (Hons)
Senior Civil Engineer – Water

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From: JOHNSTON Ian W <Ian.JOHNSTON@rms.nsw.gov.au>
Sent: Wednesday, 22 August 2018 9:49 AM
To: Andres Munoz Senda <Andres.Munoz@ghd.com>
Subject: RE: WAE - Bundarra Bridge crossing

Hi Andres,

Drawing set attached.

Regards
Ian

From: Andres Munoz Senda [mailto:Andres.Munoz@ghd.com]
Sent: Wednesday, 22 August 2018 8:35 AM
To: JOHNSTON Ian W
Subject: WAE - Bundarra Bridge crossing

Hi Ian

I'm progressing with the design for the Bundarra bridge sewer main crossing. This design will be sent to RMS for review/approval.
Is it possible to get WAE drawings of the bridge? I'm in particular interested on the eastern side of the bridge (walkway).

Thanks in advance

Regards

Andres Munoz
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Appendix E – Odour Assessment

Uralla Shire Council

Bundarra Sewerage Scheme
Odour Assessment

August 2019

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Table index

Figure index

1. Introduction

1.1 Overview

The village of Bundarra, located approximately 73 km to the north-west of Uralla NSW, is currently served by on-site sewer systems (mainly septic tanks). These systems dispose of household effluent into absorption trenches or on-site irrigation, which introduces environmental and health issues to the community and the Gwydir River catchment. The current wastewater service levels in Bundarra village differ from the rest of Uralla Shire Council area, which Council propose to address by establishing a sewer reticulation and a wastewater treatment system.

This report presents the Odour Assessment which has been prepared by GHD Pty Ltd (GHD) in support of the project Review of Environmental Factors (REF).

The assessment focusses on the proposed STP which is the main source of odour. There is also one pumping station with a vent stack and a total of 18 double acting air valves required within the accompanying sewerage scheme system. These valves are proposed to have a compact, carbon filled vessel to mitigate any potential odour issues.

1.2 Scope and limitations

This odour assessment assessed the operational odour impact associated with the sewerage scheme and proposed STP. The following tasks were completed in this assessment:

- A desktop review of site plans, aerial photographs and topographic maps to gain an understanding of the existing environment in terms of local terrain, existing/proposed operations and sensitive receptors within the study area was undertaken.
- Applicable air quality criteria with consideration of the *NSW Approved Methods for the modelling and Assessment of Air Pollutants in New South Wales (2016)* (the Approved Methods) was outlined.
- Meteorological modelling was conducted for the site using to gain an understanding of the local wind climate and use as model input for conducting atmospheric dispersion modelling.
- An odour emission inventory was derived for the proposed operations with which to identify significant sources of odour emissions and estimate the emission rates. GHD used odour data from similar STPs in Australia.
- Odour modelling was undertaken using the regulatory approved atmospheric dispersion model Calpuff based on proposed operations at the site. Model predictions were presented as contours of predicted ground level odour concentrations, which were overlaid upon an aerial photograph or cadastral image. These results can also be used to determine the extent of the predicted impact on the surrounding residences.
- In principle mitigation and management measures to reduce odour impact were recommended.

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GHD otherwise disclaims responsibility to any person other than Uralla Shire 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 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Uralla Shire Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of odours) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.3 Assumptions

This air quality assessment relied upon the following assumptions:

- Odour emission rates were based on similar STP's in Australia.
- STP operating conditions are based on experience with other sites and may be changed in the future during design and operation.

2. Existing environment

2.1 Location

The site is located in the village of Bundarra approximately 2 kilometres southwest from the town centre. It resides within the Uralla Shire Council area and the Gwydir River borders the village on its northern and eastern sides. The surrounding environment is primarily composed of open grass and agricultural lands.

2.2 Existing air quality (odour)

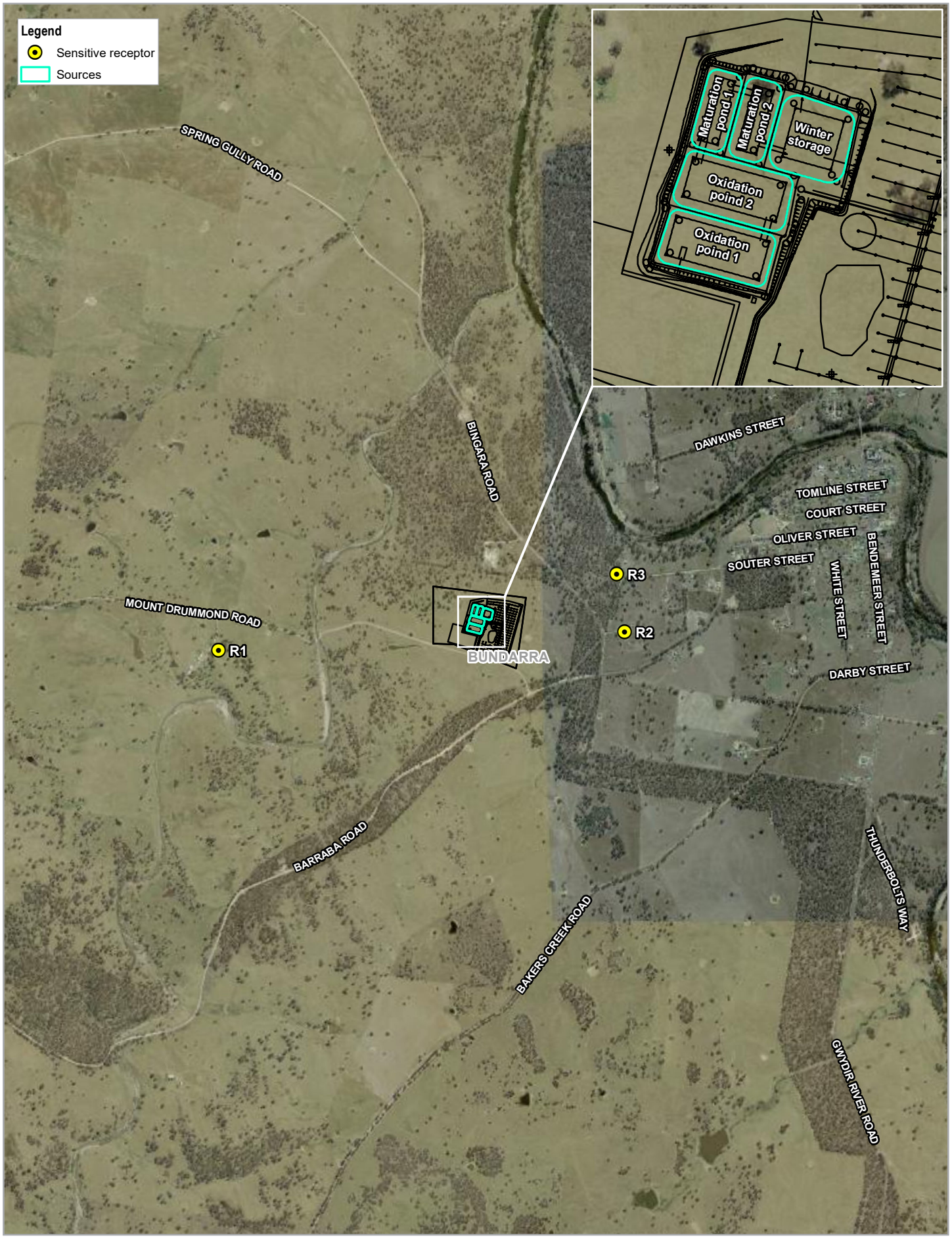
No significant industrial odour sources exist in Bundarra village and the surrounding area. The current system of on-site sewer systems (mainly septic tanks) are sources of odour. Once the proposal has been installed, these local on-site sewer systems will be decommissioned.

2.3 Sensitive receptors

The location of the nearest identified sensitive receptors to the site are presented in Table 2-1 along with the nearest road and receptor type. A figure showing the location of the site with surrounding receptors is supplied in Figure 2-1.

Table 2-1 Sensitive receptors locations

ID	X Coordinate (m)	Y Coordinate (m)	Nearest Rd	Description
R1	310792	6659882	Mount Drummond Rd	Residential
R2	313244	6659992	Bingara Rd	Residential
R3	313195	6660342	Target Hill Rd	Residential



Paper Size ISO A4

0 250 500 750 1,000

Metres

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

N

GHD

Uralla Shire Council
Bundarra Sewerage Scheme

Site and sensitive receptor location

Project No. **22-19174**
Revision No. **1**
Date **29/07/2019**

Figure 2-1

G:\22\19174\GIS\Maps\Deliverables\2219174_006_Air_Location_1.mxd
Print date: 29 Jul 2019 - 15:01

Data source: LPI: DTDB / DCDB /Aerial Imagery, 2017. Created by: mking, gmcdiarmid

3. Regulatory requirements

3.1 Guidelines

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (EPA, 2016) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

The draft *NSW Best Practice Odour Guideline Sewerage systems including sewage treatment plants, water recycling facilities, sewage reticulation systems and sewer mining* (the 'draft Best Practice Guidelines') (DoP 2010) provides recommended odour design criteria for new, existing and expanding sewage treatment plants.

3.2 Odour assessment criteria

3.2.1 Approved Methods

The Approved Methods defines odour assessment criteria and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are the:

- **F**requency of the exposure
- **I**ntensity of the odour
- **D**uration of the odour episodes
- **O**ffensiveness of the odour
- **L**ocation of the source

These factors are often referred to as the FIDOL factors.

The odour assessment criteria is defined to take account of two of these factors (**F** is set at 99th percentile; **I** is set at from 2 to 7 odour units (OU)). The choice of assessment criteria has also been made to be dependent on the population of the affected area, and to some extent it could be said that population is a surrogate for location – so that the **L** factor has also been considered. The relationship between the criteria odour level **C** to affected population **P** is given below:

$$C = [\log P\text{-}4.5] \div \text{-}0.6 \qquad \text{equation 1}$$

Table 3-1 lists the values of C for various values of affected populations as obtained using equation 1.

Table 3-1 Odour criteria for the assessment of odour (DEC, 2005)

Population of affected community	Odour performance criteria (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 receivers can be minimised.

The criteria assumes that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be encountered. The criteria of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally 1 second. The choice of the short averaging time recognises that the human nose has a response time of less than 1 second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the Calpuff dispersion model (used in this assessment) cannot predict concentrations for a 1 second average, a ratio between the 1 second peak concentration and 60 minute average concentration has been applied. This is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (that is, near or far-field), and values are tabulated in the Approved Methods.

3.3 Proposal specific odour assessment criteria

Project specific odour assessment criteria was justified based on receptor type, location and the affected population. The surrounding Bundarra community consists primarily of residential tenancies. The Uralla Shire Council has advised that there are 450 people in Bundarra occupying 171 tenements. A corresponding odour performance criteria of 3 OU was selected as the proposal specific odour assessment criteria.

4. Odour emissions

4.1 Overview

This section discusses and quantifies the likely odour sources associated with the STP.

Significant odour generation typically occurs at areas of wastewater turbulence due to increased mixing and aeration, which leads to high odour emissions. This would generally occur at the inlet works of the STP. However as inlet works are not proposed as part of the design plans, odour emissions from wastewater turbulence has been accounted for in wastewater discharge into first oxidation odour emissions.

The project description identifies the following potential significant sources:

- Wastewater discharge into first oxidation pond
- Two oxidation ponds
- Two maturation ponds
- Winter storage (treated effluent)
- Irrigation area (treated effluent)

Treated effluent is not anticipated to be odorous however and has not been included in odour modelling.

4.2 Odour emission source characteristics

Where an odour release is from an extended liquid surface (such as the oxidation ponds) the source is modelled as an area source, and the odour emission rate (OER) is specified as the specific odour emission rate (SOER, or OER/m^2) multiplied by the source area.

Odour can be elevated at the location wastewater is discharged into the first oxidation pond where turbulence from the discharging wastewater causes odour to be released.

The de-sludging data has been calculated using odour measurements down-wind and up-wind of the biosolids holding tank during mixing at the Picton WRP, with similar odour levels expected at Bundarra STP. At a site like this, sludge may be removed by long arm excavators into a truck for transfer to a drying area.

Sludge drying has not been assessed as exact details are not known at this stage and would not likely occur for 10 years.

It is possible at times that cool night air temperatures lead to destratification of the ponds. As the surface layer cools down to less than the temperature of the layers beneath, there is the potential for thermal eddies within the water column to promote migration of odorous components from deeper levels to the surface which would increase odour generation rates and offensiveness. The effect is likely to be more pronounced during night time when the top layer is also oxygen depleted due to algal respiration. The steady cool breeze may also exacerbate the odour. The odour levels have been assumed to be double the normal level during a pond inversion.

Treated effluent irrigation is not expected to be a significant source of odour given the level of treatment indicated for the effluent and the size of the buffer. Management measures have been provided for this area however this has not been included as a source in the odour model.

Odour emission rates are presented in Table 4-1.

Table 4-1 Odour emission rate data used for the Bundarra STP

Odour source	Data source	Height (m)	Area (m^2)	SOER OU ($m^3/s/m^2$)	OER OU (m^3/s)
Wastewater discharge location at the oxidation pond	West Camden	1	150	5.00	750
Oxidation pond 1	Leanyer	1	3784	0.12	470
Oxidation pond 2	Leanyer	1	3943	0.09	355
Maturation pond 1	Leanyer	1	1774	0.05	89
Maturation pond 2	Leanyer	1	1886	0.05	88
Desludging of pond	Picton	1	99	46.00	4545

4.3 Scenarios assessed

Three operational scenarios were modelled. The configuration of each model is shown in Table 4-2. An 'x' denotes that the odour source is active and emitting odour in the scenario.

Table 4-2 Scenario configurations

Odour source	Scenario		
	Normal operations	Normal operations with pond inversion	Normal operations with desludging
Wastewater discharge location at the oxidation pond	x	x	x
Oxidation pond 1	x	x	x
Oxidation pond 2	x	x	x
Maturation pond 1	x	x	x
Maturation pond 2	x	x	x
Pond inversion (odour rates x 2)		x	
Desludging of pond			x

The location of modelled odour sources is shown on Figure 4-1.

Figure 4-1 Modelled odour source location

5. Assessment methodology

5.1 Overview

GHD have chosen to utilise the advanced dispersion model, CALPUFF for dispersion modelling purposes. CALPUFF requires that a 3D meteorological grid be developed to allow for the 3D computation of dispersion of pollutants in the atmosphere. The characterisation of local wind patterns generally requires accurate site-representative hourly recordings of wind direction and speed over a period of at least a year.

To produce a representative site-specific meteorological data set the following methodology was adopted:

- Production of a 3D gridded dataset with the TAPM prognostic model TAPM
- Utilising the TAPM 3D gridded dataset as an initial guess field for the CALMET meteorological model

5.2 Meteorological modelling

The TAPM prognostic model was run to obtain a coarse meteorological 3D gridded dataset for the site for the selected year. This dataset is based on synoptic observations, local terrain and land use information with a resolution of 1000 m. The TAPM model parameters are summarised in Table 5-1. Five years of TAPM were run for the site.

Table 5-1 Selected TAPM model settings

Parameter	Value
Modelled year	January 2013 to December 2017 (5 years)
Domain centre	Latitude = S -30 deg 10.5 min Longitude = E 151 deg 3 min
Site location	3122319 m E; 6660216 m N Zone 56
Number of vertical levels	25
Number of easting grid points	50
Number of northing grid points	50
Outer grid spacing Number of grids (nests)	30,000 m x 30,000 m 4
Grid resolution	Level 1 – 30,000 m Level 2 – 10,000 m Level 3 – 3,000 m Level 4 – 1,000 m

GHD has found from previous studies that TAPM does not predict light wind conditions as well as CALMET. It is these meteorological conditions which give rise to the upper percentile impacts, (i.e. top 0.1 per cent) when poor dispersion can occur.

Upon completion of the broad scale TAPM modelling runs, a CALMET simulation was set up to run for the modelled year, combining the three dimensional gridded data output from the TAPM model and using the CALTAPM conversion utility available with CALMET. This approach is consistent with NSW OEH (2011) guidance documentation.

5.2.1 CALMET diagnostic meteorological pre-processor

The US EPA approved version of CALMET (Version 5.8) was used to resolve the wind field around the project area to a 500 m spatial resolution. The application of CALMET is an approved modelling approach in Approved Methods, with model guidance documentation provided (OEH, 2011).

All model settings were selected based on the OEH (2012) guidance and as per the CALPUFF modelling guidelines (OEH, 2011, p. 5). CALMET was run using the Hybrid mode with the TAPM data provided as an initial guess field.

All CALMET settings were selected as per the CALPUFF guidance document OEH (2011).

The terrain of the site is shown in Figure 5-1. Lakes Calpuff View was used to generate the geo file containing topography and land use data to the resolution required for the CALMET run. This file was modified manually to produce the results with the site location in the centre. The meteorology of the region is also influenced by the local terrain, landuse and vegetation.

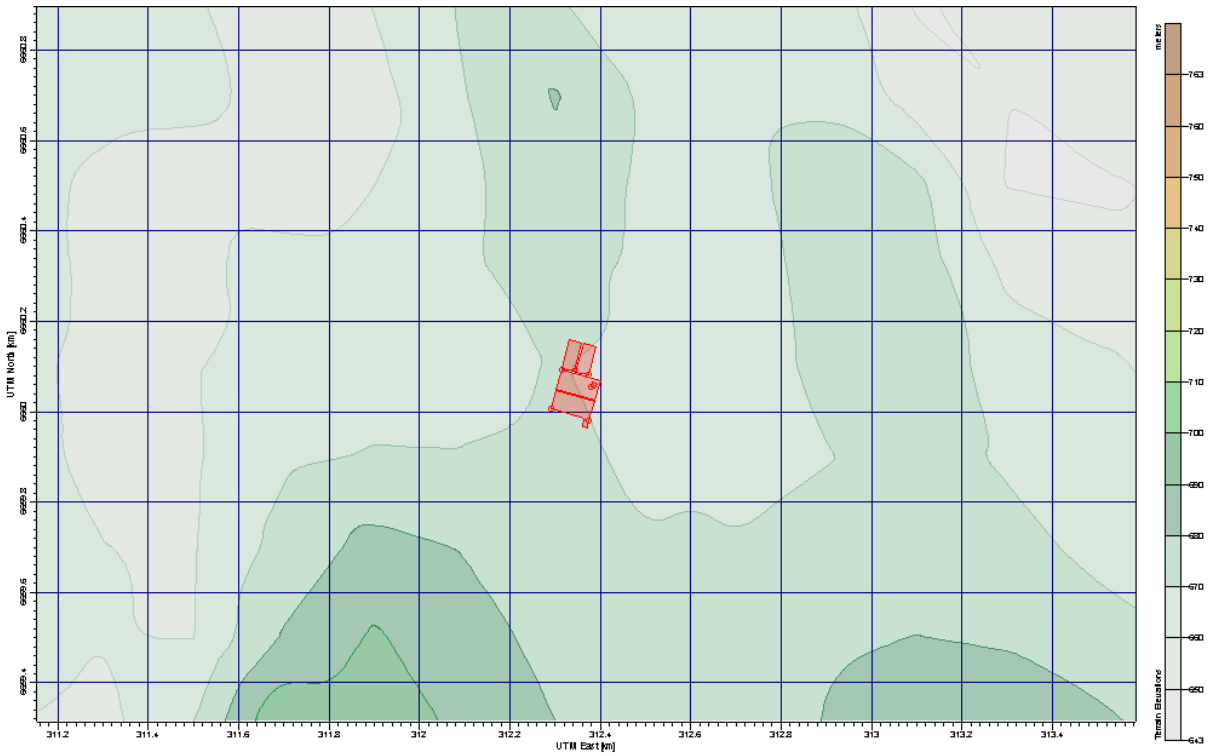


Figure 5-1 CALMET terrain data surrounding the site

The TERRAD variable was set to a value of 6 km based on an inspection of the terrain elevations in the immediate vicinity of the site, based on OEH (2011) guidance. The CALMET model parameters are summarised in Table 5-2.

Table 5-2 Selected CALMET model settings

Parameter	Value
Mode	NOOBS (Prognostic data only)
UTM zone	56
Domain origin (SW corner)	Easting: 307,200 m Northing: 6655,200 m
Grid resolution	50 x 50 at 0.2 km resolution (10 km x 10 km)
Number of vertical levels	11
Vertical levels (m)	20, 40, 60, 90, 120, 180, 250, 500, 1000, 2000, 3000
CALMET settings for no-obs mode (OEH, 2011)	TERRAD = 6 km

5.3 Site specific meteorology

5.3.1 Wind

The local meteorology largely determines the pattern of off-site air quality impact on receptors. The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site. The winds at a site are most readily displayed by means of wind rose and stability distribution plots.

The features of particular interest in this assessment are: (i) the dominant wind directions and (ii) the relative incidence of stable light wind conditions that yield minimal mixing.

Figure 5-2 shows the annual average wind rose for the site for the period 1 January 2016 to 1 January 2017, and the following features can be seen:

- Annual average wind speed of 2.59 m/s.
- Winds are most prevalent from the South east.
- Winds are least prevalent from the South and the East.
- Light winds (< 2m/s) are more prevalent form the South east.
- Calms occur 3.34% of the time.

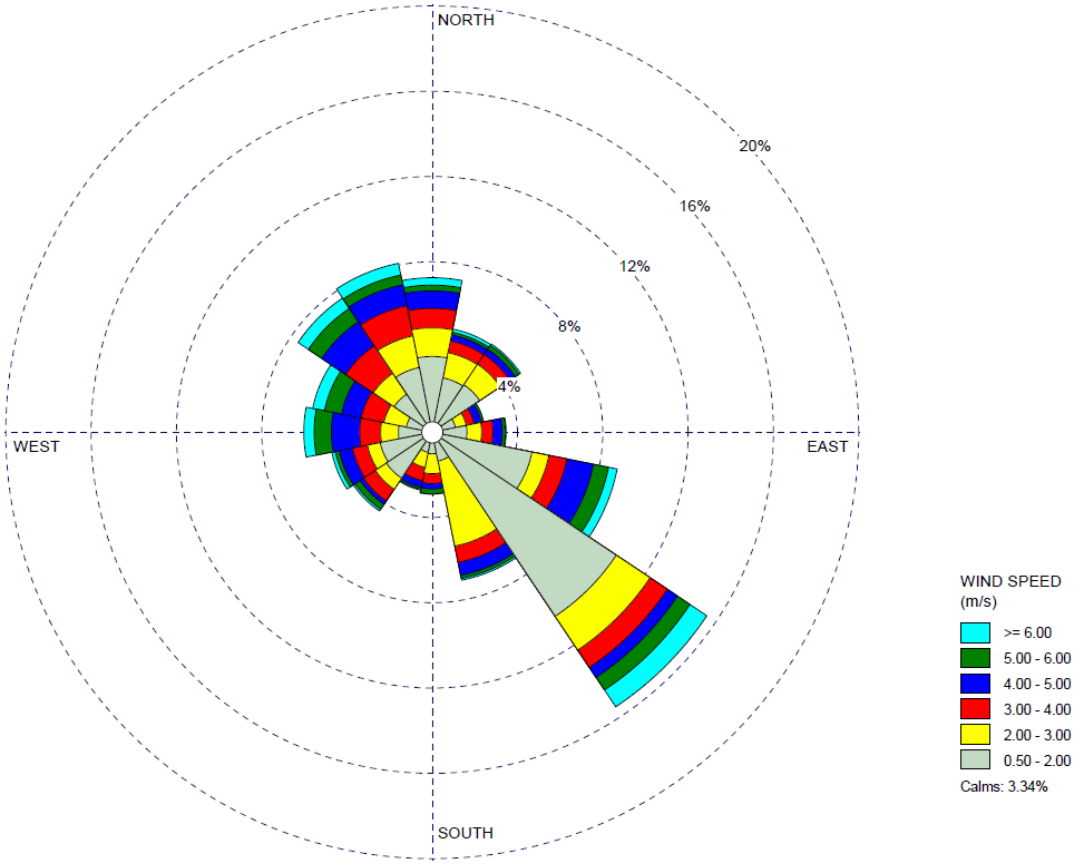


Figure 5-2 CALMET wind rose at the site (average wind speed = 2.59 m/s)

5.3.2 Atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill–Gifford classes (A-F) used to describe atmospheric stability, and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and insolation are used to define the stability category as shown in Table 5-3, and as these parameters vary diurnally, there is a corresponding variation in the occurrence of each stability category. Stability is most readily displayed by means of stability rose plots, giving the frequency of winds from different directions for various stability classes A to F.

Table 5-3 Stability category relationship to wind speed, and stability characteristics

Stability category	Wind speed range (m/s) [a]	Stability characteristics
A	0 to 2.8	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.
B	2.9 to 4.8	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.
C	4.9 to 5.9	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.
D	≥6	Neutral atmospheric conditions. Occur during the day or night with stronger winds or during periods of total cloud cover, or during the twilight period.
E	3.4 – 5.4 [b]	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds.
F	0 – 3.3 [b]	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.

a. Data sourced from the Turner's Key to the P-G stability Categories, assuming a Net Radiation Index of +4 for daytime conditions (between 10:00 am and 6:00 pm) and –2 for night-time conditions (between 6:00 pm and 10:00 am)

b. Assumed to only occur at night, during Net Radiation Index categories of –2.

Figure 5-3 shows the frequency distribution of stability classes for the entire data period (one year). The figure shows that stable atmospheres (E and F) occur for 47% of the total time period. Unstable atmospheres (A, B and C) occur 38% of the total time period while neutral conditions (D) occur 15% of the total time period. The dominant state of the atmosphere is stable conditions (E and F).

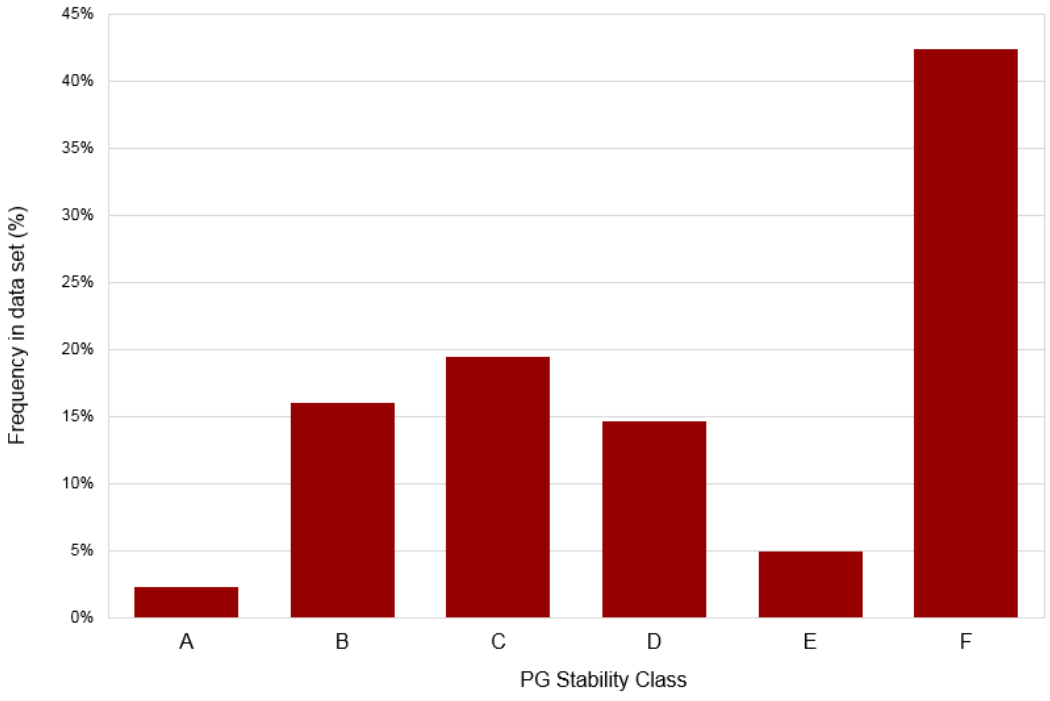


Figure 5-3 CALMET atmospheric stability class distribution at the site

5.4 CALPUFF settings

Atmospheric dispersion modelling was carried out using the CALPUFF dispersion model. CALPUFF is a non-steady-state, Lagrangian puff dispersion model. It is accepted for use by the Office of Environment and Heritage and NSW Environment Protection Authority for application in environments where wind patterns and plume dispersion is strongly influenced by complex terrain, the land-sea interface or where there is a high frequency of stable calm night-time conditions.

For this assessment, the CALPUFF dispersion model was used to predict ground-level concentrations of modelled pollutants downwind of the proposal. The grid size used in the CALPUFF model was equivalent to the CALMET domain. A grid resolution of 250 m was used in CALPUFF.

6. Odour impact assessment

Dispersion modelling was undertaken to predict the maximum ground level odour concentrations resulting from odour emissions as a result of normal operations of the new STP. The objective of the modelling was to generate predicted peak 99th percentile one second averaged ground level odour concentration at nearby sensitive receptors.

The operational model was iterated multiple times to account for the following scenarios:

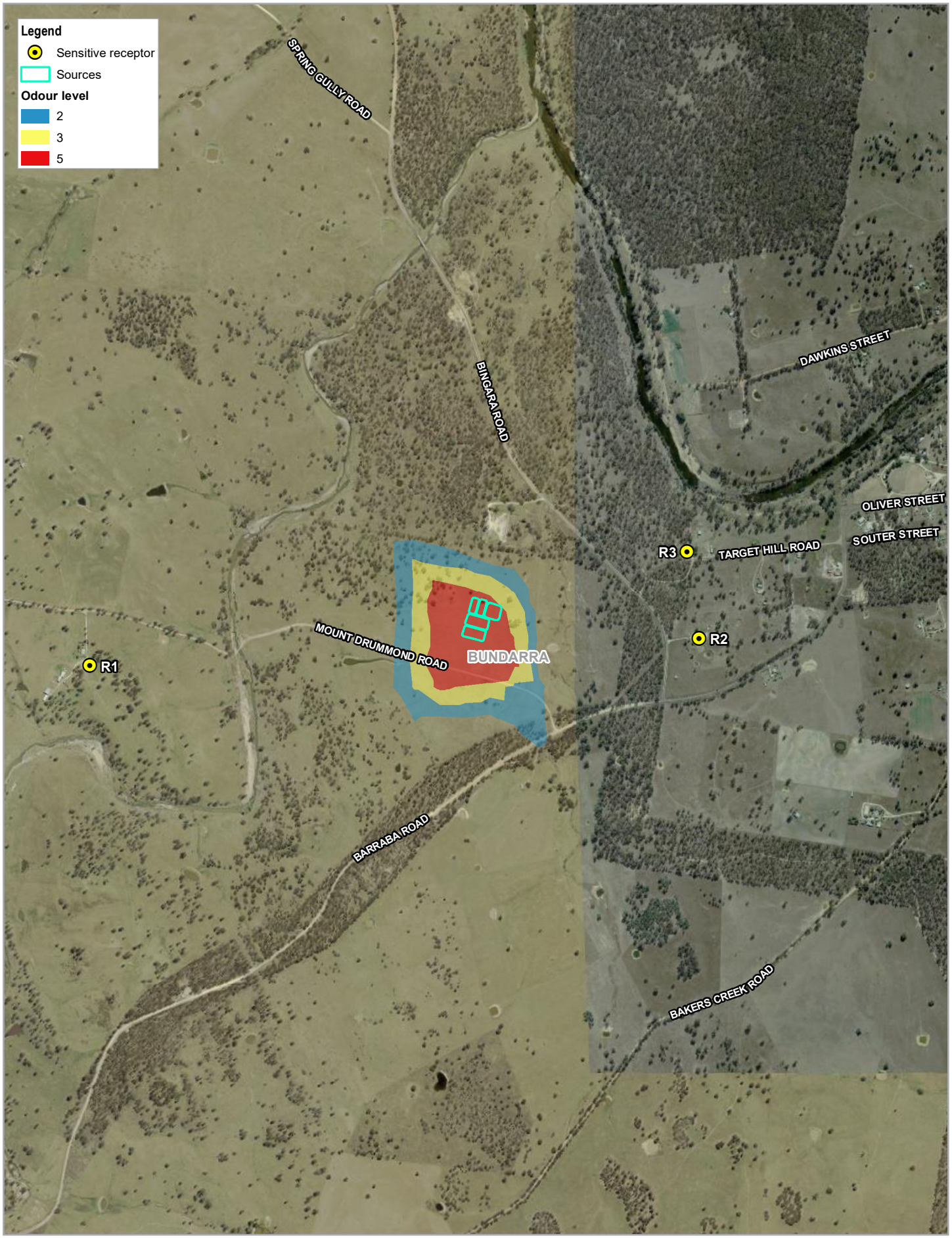
- Normal operations
- Normal operations with pond inversion
- Normal operations with desludging

Predicted 99th percentile odour impact is presented in Table 6-1. Results show that the STP is located sufficiently far away from the village so odour impacts are low. No criteria exceedances are predicted.

Contour plots presenting the predicted 99th percentile odour impacts are supplied for normal operations in Figure 6-1, normal operations with pond inversion in Figure 6-2 and normal operations with desludging in Figure 6-3.

Table 6-1 Predicted odour impact for each scenario

Receptor	Criteria (OU)	Predicted odour impact for each scenario (OU) (99th percentile)		
		Normal Operations	Normal operations with pond inversion	Normal operations with desludging
R1	3	0.1	0.1	0.3
R2	3	0.3	0.4	0.9
R3	3	0.1	0.2	0.5



Paper Size ISO A4

0 150 300 450 600

Metres

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

N

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Uralla Shire Council
Bundarra Sewerage Scheme

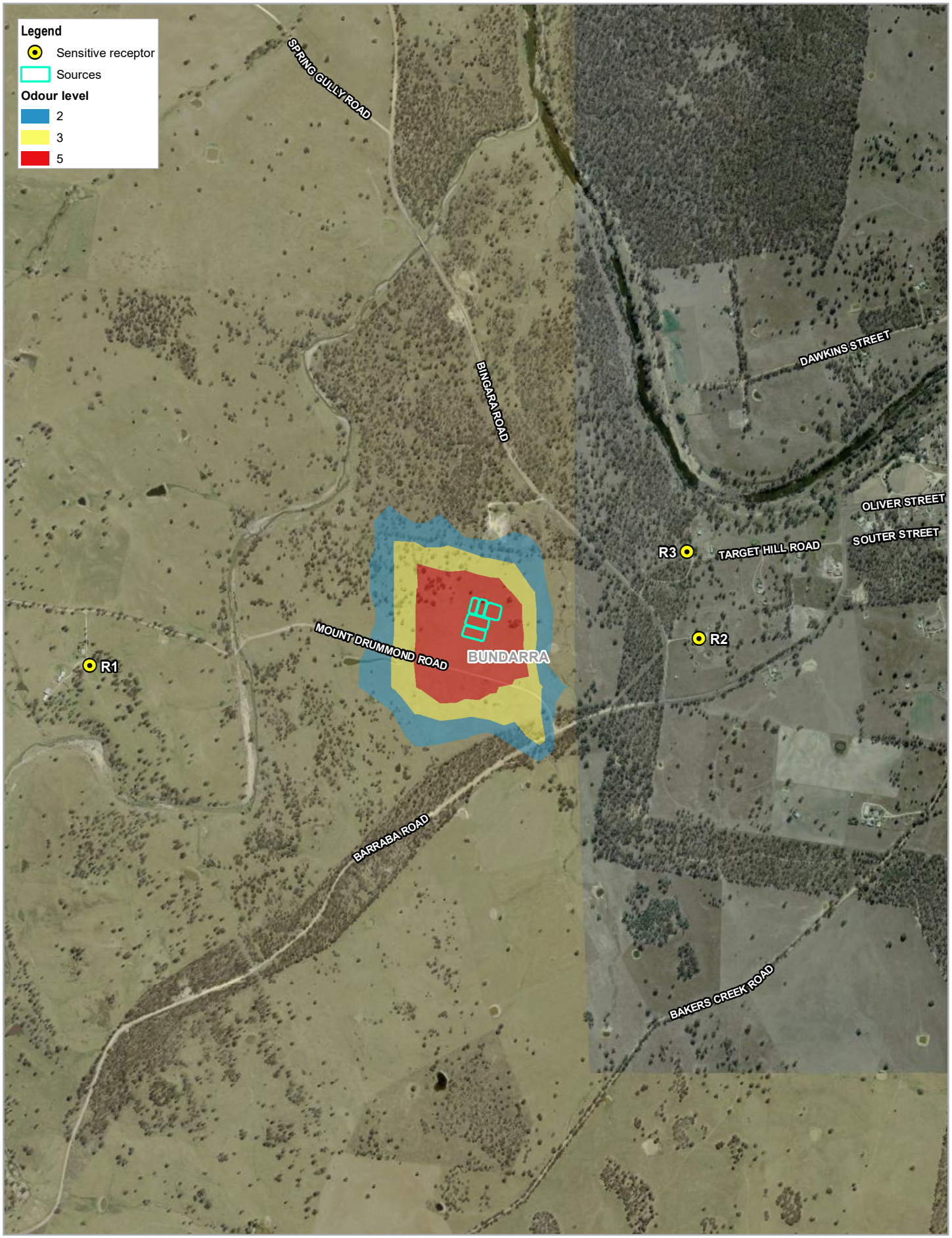
Predicted odour impact of normal operations scenario

Project No. **22-19174**
Revision No. **1**
Date **29/07/2019**

Figure 6-1

G:\22\19174\GIS\Maps\Deliverables\2219174_007_Air_NormalOperations_1.mxd
Print date: 29 Jul 2019 - 14:47

Data source: LPI: DTDB / DCDB /Aerial Imagery, 2017. Created by: mking, gmcdiarmid



Paper Size ISO A4

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Metres

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

N

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Predicted odour impact of normal operations with pond inversion scenario

Project No. 22-19174
Revision No. 1
Date 29/07/2019

Figure 6-2

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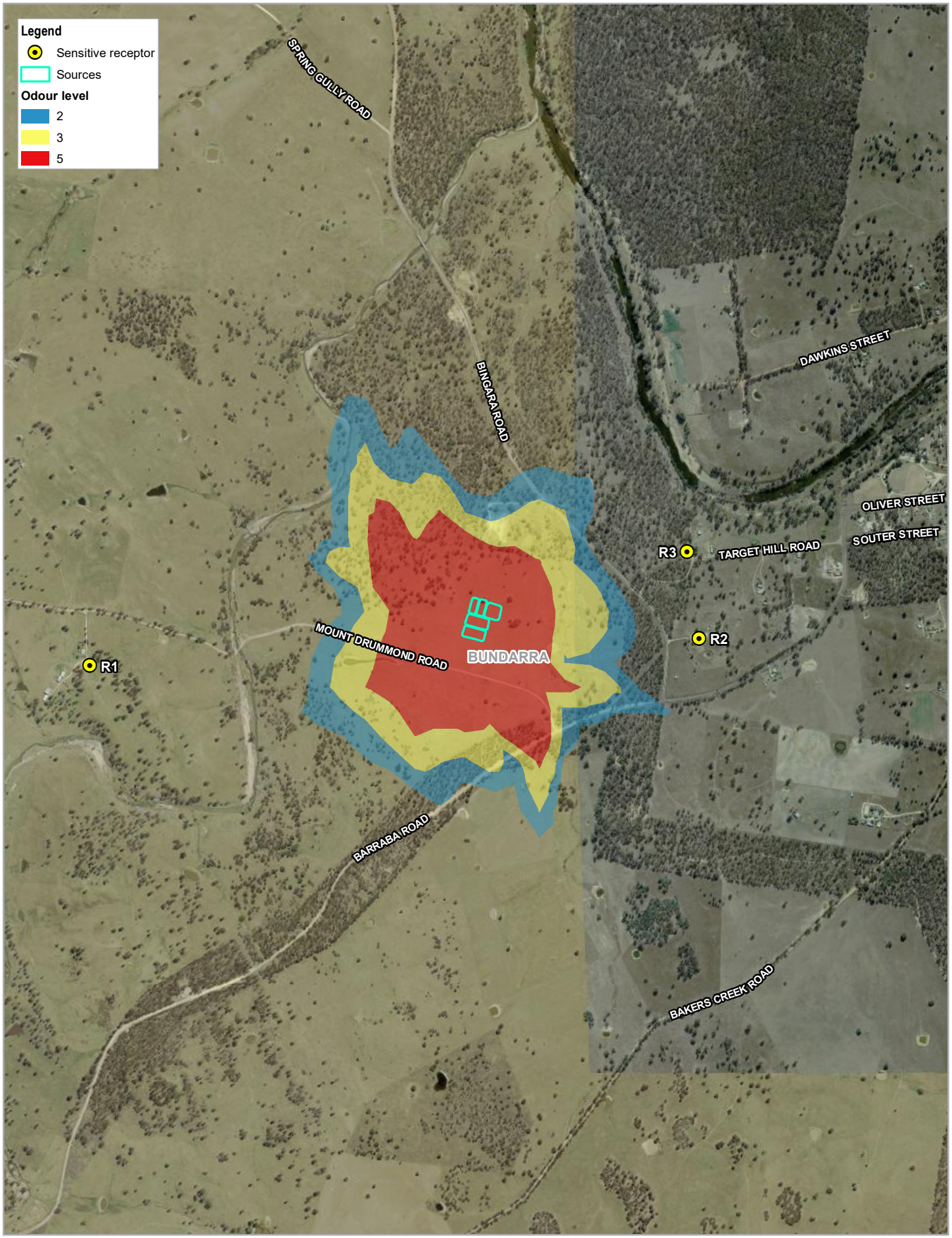
Data source: LPI: DTDB / DCDB /Aerial Imagery, 2017. Created by: mking, gmcdiarmid



Paper Size ISO A4

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Metres

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

N

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Predicted odour impact of normal operations with desludging scenario

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Figure 6-3

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Data source: LPI: DTDB / DCDB /Aerial Imagery, 2017. Created by: mking, gmcdiarmid

7. Mitigation

Odour impacts under general operating conditions are not predicted. The following mitigation measures would be implemented during operation:

- Any odour complaints would be managed in accordance with Uralla Shire Council Customer Complaint Procedure.
- Wherever practicable, de-sludging would be limited to the day time after 7 am, and would be avoided during worst case meteorological conditions (winds from the west), and conducted in the shortest timeframe possible.
- If any odours are noticed offsite during spray irrigation (especially during westerly winds towards receptors), stop irrigation until the weather conditions change.

Other options to further minimise the potential for operational odours include ensuring the clean state of discharge location at the first oxidation pond, and avoiding any stockpiling of sludge or other residuals at the site (from de-sludging operations).

8. Conclusion

This odour assessment assessed the potential odour impacts on surrounding receptors due to the operations of the Bundarra Sewerage Scheme and associated STP.

The assessment outlined that no odour criteria exceedance are predicted to occur during any modelled scenario. Based on the assumptions and methodology stated in this assessment, the proposed STP will comply with the adopted assessment. General odour mitigation should be applied and any odorous activities should be limited during adverse weather conditions.

There is one pumping station with a vent stack and a total of 18 double acting air valves required within the sewerage scheme system. These valves are proposed to have a compact, carbon filled vessel to mitigate any potential odour issues.

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