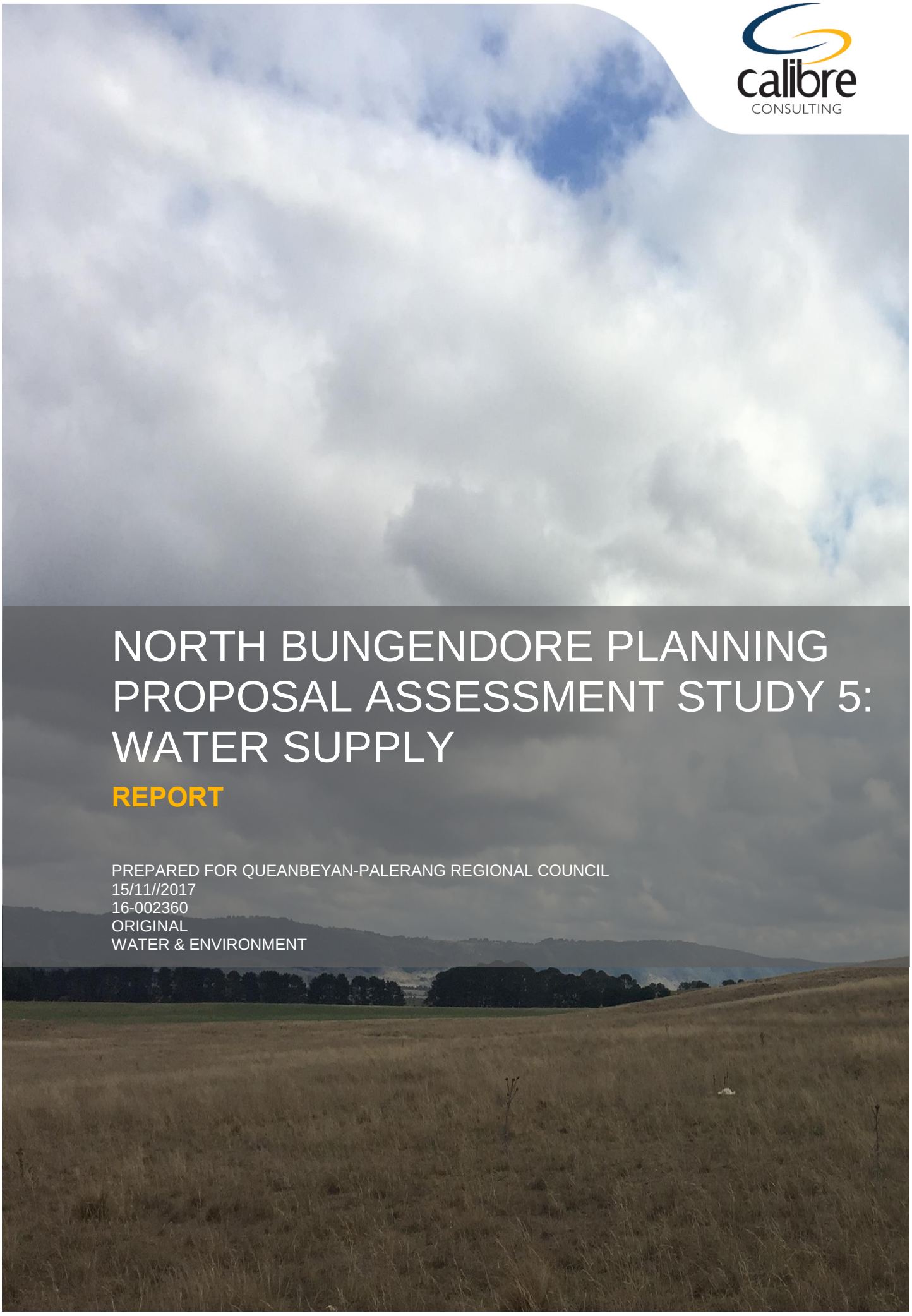


NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT STUDY 5: WATER SUPPLY

REPORT

PREPARED FOR QUEANBEYAN-PALERANG REGIONAL COUNCIL
15/11//2017
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ORIGINAL
WATER & ENVIRONMENT

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ABBREVIATIONS

ADD	Average Day Demand
AHD	Average Height Datum
BWL	Bottom Water Level
EP	Equivalent Person
ET	Equivalent Tenement
PDD	Peak Day Demand
PHD	Peak Hour Demand
PS	Pump Station
TWL	Top Water Level
VSD	Variable Speed Drive
WSA	Water Services Association of Australia
WSZ	Water Supply Zone

1 INTRODUCTION

This report has been prepared on behalf of Queanbeyan-Palerang Regional Council (QPRC) for the North Bungendore Planning Proposal Assessment (Lot 1 DP798111, part) Study 5: Water Supply.

QPRC received a planning proposal for the rezoning of partial Lot DP 7988111 (Figure 1-1) from RU1 Primary Production to R2 Low Density Residential, R5 Large Lot Residential and RE1 Public Recreation. The proposal states that the indicative lot yield is approximately 309 lots, with block sizes ranging between 800m^2 and 1,200m^2.

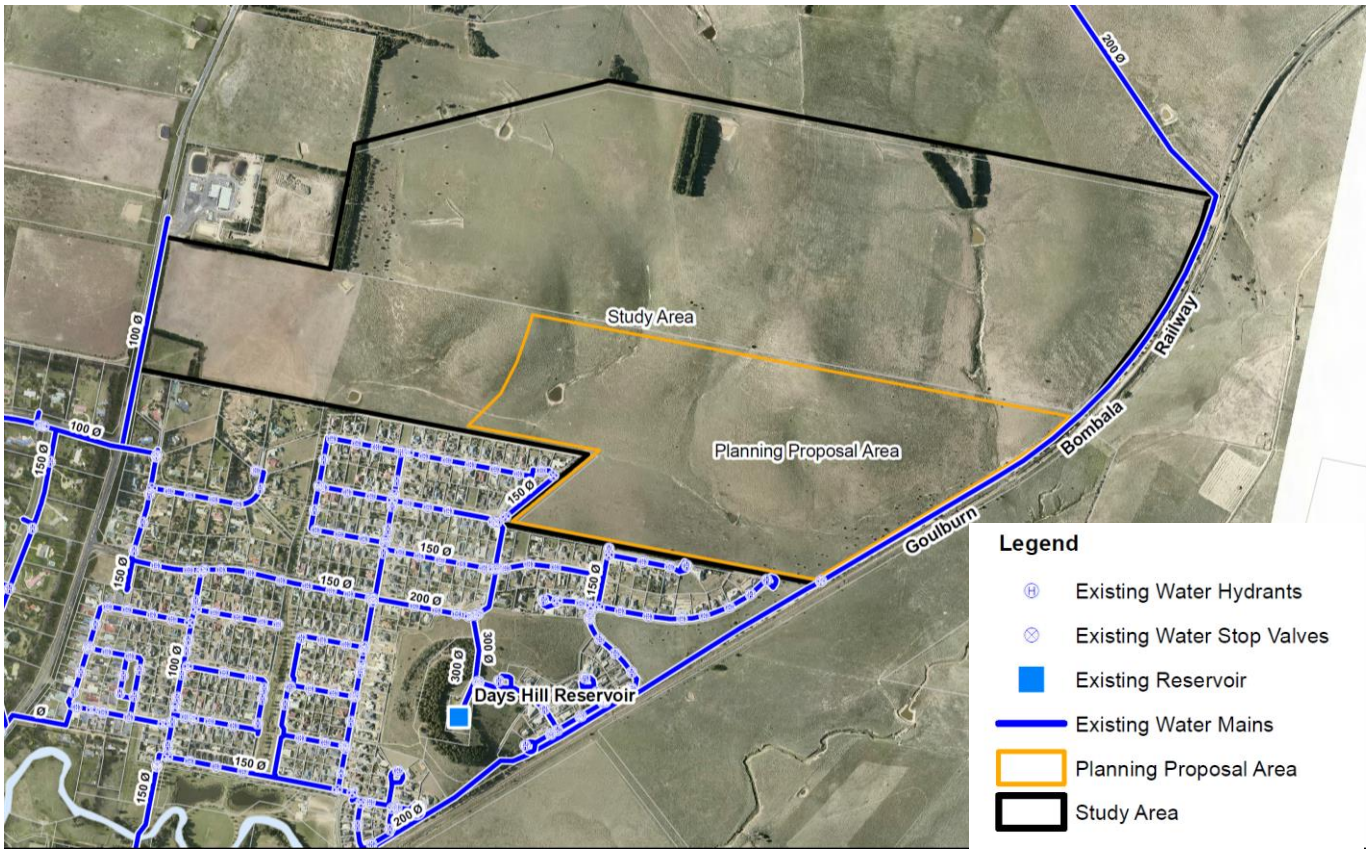


Figure 1-1: Study Area and Planning Proposal Area

On 27 April 2015 the NSW Department of Planning and Environment provided a gateway determination that the proposal may proceed, subject to a range of conditions, one of which is a network assessment and report outlining the methods proposed to connect to the existing water supply reticulation network.

It is possible that the area to the north of Lot DP 1 798111, Lot 1 DP8800871, may also be developed in the future subject to a planning proposal being supported by Council and the NSW Department of Planning and Environment. This parcel of land has been considered in this report for possible future growth identified as the study area.

1.1 SCOPE OF SERVICES

The scope of services for this project is summarised below:

- Undertake a review of the information provided by proponents within the submitted planning proposal as relevant to this study;
- Prepare a concept plan for the study area, identifying existing water supply connection locations;
- Recommend strategies to service the study area in accordance with the Water Supply Code of Australia;
- Prepare a report, including maps and infrastructure cost estimates; and
- An options and feasibility report into the use of recycled water.

1.2 PURPOSE OF THE REPORT

The purpose of this report is to support a planning proposal to rezone the subject land from RU1 Primary Production to a range of land use zones including R2 Low Density Residential, R5 Large Lot Residential and RE1 Public Recreation.

The potable water supply section of the planning proposal, provides a short section on the water allocation available to service future developments and the need for a network analysis be carried out, outlining the methods proposed (and ability) to provide potable water flows and water pressure to comply with the service levels for the whole site (and possibly for the northern property). This report aims to expand on these desired outcomes.

1.3 CATCHMENT OVERVIEW

The topography within the study area varies from flat to undulating sloping areas. A knoll is located centrally within the study area. The study area is bound by Tarago Road to the west, the existing Elmslea Estate to the south, the Goulburn Bombala Railway to the east, agricultural land to the north and the waste transfer station to the north west. The study area consists of mostly cleared vegetation with small patches of planted vegetation located within the north and west of the study area, refer Figure 1-1, above.

The study area is located to the north east of the existing Bungendore water supply network and includes the planning proposal area within the south eastern corner. The total catchment area of the study area is 186.1 Ha and is proposed to contain 1,028 single residential dwellings. The current elevation of the study area ranges between 700 m AHD to the south east and south west increasing to 760 m AHD at the identified knoll.

The planning proposal area is located to the north east of the existing Bungendore water supply network. The total catchment area provided by QPRC GIS layers was measured at 50.5 Ha and is proposed to contain 309 single residential dwellings.

This report focuses on servicing initially the planning proposal area with a water supply network able to service the development with adequate flows and pressure in accordance with the desired standards of service, with consideration given to future growth from the study area.

2 DESIRED STANDARDS OF SERVICE

QPRC is committed to maintaining and increasing its standards of services to its customers. The standards of service relevant to this project have been sourced from the Water Services Association of Australia's Water Supply Code of Australia with assistance from QPRC. The adopted desired standards of service are summarised in Table 2-1.

Table 2-1 Desired Standards of Service

Design Criteria	Value	Notes	Source
Water Flows			
Average Day Demand (ADD)	665.3 L/ET/day (243 kL/ET/yr)		1
EP/ET	= 2.9		1
Peak Day Factor (PDF)	= 2.8		1
Peak Day Demand (PDD)	= PDF × ADD		2
Peak Hour Factor of PDD (PHF)	= 2.0		1
Peak Hour Demand (PDD)	= PHF × PDD		2
Fire Flow (Residential)	10 l/s		1
Fire Flow (Commercial / Industrial)	30 l/s		1
Applicable Pressure			
Minimum	20m	Serviced by a gravity network	2
Maximum	80m		1
Desired	50m		2
Minimum Fire Flow	15m		3
Reservoir Design			
Reservoir Volume	24hr of PDD + 1/3 × 24hr of PDD Reserve Storage		1
Inlet Main Pressure Capacity	= 20/24 × PDD		1
Pipeline Design			
Flow Equation	Colebrook White		1
Friction Factor	0.30 mm		1
Optimum Velocity	0.8 – 1.4 m/s		2
Headloss Gradient	<3m/km >= DN200 <5m/km <= DN150		2

Notes
1 QPRC Correspondence
2 WSA Water Supply Code of Australia 3.1
3 AS 2419.1-2005

3 EXISTING AND PROJECTED DEMANDS

The QPRC regional cadasta has been provided by QPRC to assess the existing demands on the existing water supply infrastructure within Bungendore. Two pressure zones have been identified which are serviced by two reservoirs located to the south and north of Turallo Creek. The existing demands for the Bungendore Township catchments are shown in Table 3-1.

Table 3-1 Existing Demands – Bungendore Township (Low Zone)

Water Supply Zone (Service Reservoir)	Area (Ha)	ET	EP	ADD (l/s)	PDD (l/s)	PHD (l/s)
Turallo Low (Turallo Reservoirs)	193.0	772	2238.8	5.94	16.64	33.29
Days Hill Low (Days Hill Reservoir)	178.9	519	1505.1	4.00	11.19	22.38
Bungendore Township	**371.9**	**1291**	**3743.9**	**9.94** [1]	**27.83**	**55.67**

Note

1 Equates to 313 ML/yr

713 ties have been identified in the supplied GIS data however it is anticipated that the number of dwellings connected to the water supply network is larger. This analysis has assumed 1291 dwellings are serviceable to the water supply network, which aligns with QPRC correspondence.

Due to the existing topography the planning proposal and study area have been separated into two pressure zones (high and extra high) the pressure zones are based on the likely Bottom Water Level (BWL) of the existing and proposed reservoirs required to service the planning proposal and study areas. Table 3-2 and Table 3-3 summaries the anticipated planning proposal and study area demand and flows.

Table 3-2 Proposed Study Area Demands

Development	High Zone	Extra High Zone	Total
Planning Proposal Area - Area (Ha)	46	5	51
Study Area - Area (Ha)	79	57	136
Total - Area (Ha)	**124**	**62**	**186**
Planning Proposal Area - ET	280	29	309
Study Area - ET	417	302	719
Total - ET	**697**	**331**	**1028**
Planning Proposal Area - EP	812	83	896
Study Area - EP	1210	875	2085
Total - EP	**2022**	**959**	**2981**

Table 3-3 Proposed Study Area Flows

Development	High Zone	Extra High Zone	Total
Planning Proposal Area - ADD (l/s)	2.16	0.22	2.38
Study Area - ADD (l/s)	3.21	2.32	5.54
Total - ADD (l/s)	**5.37**	**2.55**	**7.91** [1]
Planning Proposal Area - PDD (l/s)	6.04	0.62	6.66
Study Area - PDD (l/s)	8.99	6.51	15.50
Total - PDD (l/s)	**15.03**	**7.13**	**22.16**
Planning Proposal Area - PHD (l/s)	12.08	1.24	13.32
Study Area - PHD (l/s)	17.99	13.01	31.00
Total - PHD (l/s)	**30.07**	**14.25**	**44.32**

Note

1 Equates to 250 ML/yr

Calibre understand the potential for a new development to the east of the Goulburn Bombala Railway Line (Bungendore East development). The total demand for this development is not known and any proposed augmentation works will need to account for any possible increase in demand created from the adjacent development.

4 EXISTING WATER SUPPLY SYSTEM

The Bungendore Township is serviced by an existing water supply network. The Bungendore Township sources raw water from the Turallo Borefields with the additional Currandooly Borefield located to the north of the Bungendore Township. The Turallo water sources are pumped to the water supply treatment facility to the west on Bungendore Road. Water treatment is minor before being sent to distribution/storage. Treatment includes aeration, fluoridation and chlorination. The Currandooly water source is treated by a special WTP at Currandooly about 5km north from Bungendore on the Tarago Road. The raw water is chemically treated, clarified, filtered, fluoridated and chlorinated to remove high iron and manganese before being sent to distribution/storage via a dedicated 4.5km 200mm DICL trunk main. The two systems are entirely independent but ultimately service the town together.

The two reservoir locations (Turallo Road and Days Hill) are serviced independently by the two water sources, with the Turallo Creek forming the water supply boundary. Based on the supplied information the Bungendore WTP pump and Currandooly Borefield pump supplies peak day demands separately towards the two reservoirs. Based on the existing valving arrangements, each reservoir can be supplied by either WTP pump, which in turn can service development on the either side of Turallo Creek, when required.

With the exception of the Currandooly delivery main, no distinctive trunk network occurs through the township with mains alternating in size between 100 to 300 mm in diameter, this is notable in the centre of town where mains are no larger than 150mm in diameter. A schematic of the Bungendore Township water supply network and adjacent bore locations is shown in Figure 4-1.

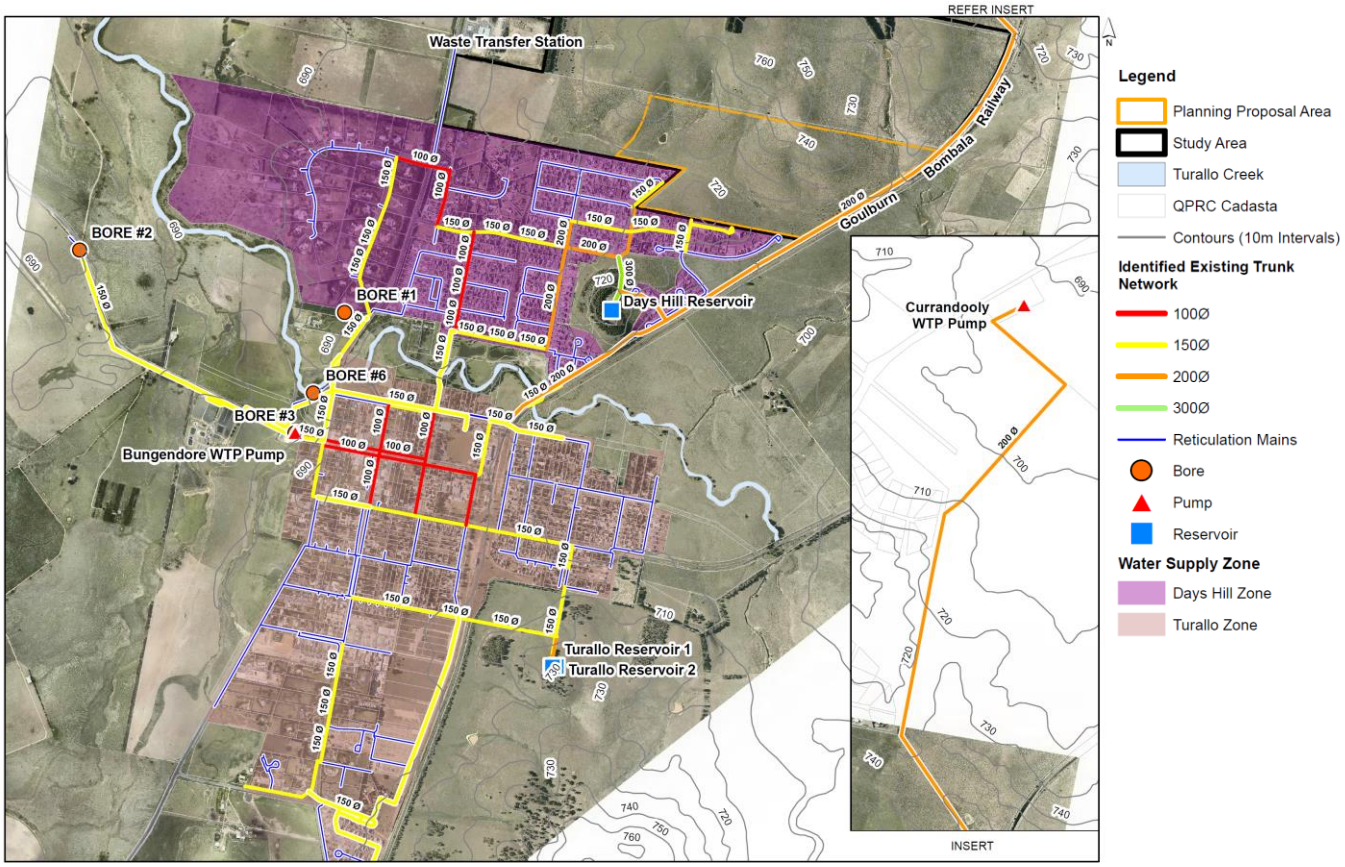


Figure 4-1: Existing Bungendore Water Supply Schematic

4.1 EXISTING CAPACITY

The QPRC provided cadasta and water supply GIS data was collated and analysed in an excel model, created by Calibre Consulting. With the assumed existing connected dwellings of 1,291, the existing system generally meets the desired standards of service.

4.1.1 PUMP STATION

The following table assesses the current capacity of the existing pumps, Table 4-1.

Table 4-1 Existing Pump Station Assessment

Asset (WSZ)	20 hrs × PDD (l/s)	PHD (l/s)	Pump Duty Flow (l/s)	Pump RL (m AHD)	Pump Duty Head (m)	Maximum Serviceable Elevation (m AHD)	Pump Duty Head (m AHD)
Bungendore WTP (Turallo)	19.97	33.29	40	690.0	40	734.0 [1]	730.0 [2]
Currandooly (Days Hill)	13.43	22.38	25	695.0	50	734.0 [1]	745.0 [2]
Total	**33.40**	**55.67**					

Note

1 Days Hill Top Water Level's (TWL)
2 Excludes friction losses through the network

The supplied duties indicate the Bungendore system can deliver peak day demands to both reservoirs together, however can only supply peak hour demands to the Turallo Reservoirs. The system however, could struggle in delivering flows to the Days Hill Reservoir TWL due to insufficient head, based on the supplied single point duty provided. Council have indicated that no issues have occurred and the pump likely operates away from the supplied duty to fill the Days Hill Reservoir.

The Currandooly system cannot deliver peak day demands to both reservoirs, but can deliver peak day demands independently to each reservoir. This indicates both pumps are adequate for the intended purpose delivering peak day demands to their respective reservoir. The current valving arrangement allows for pumps to be taken offline independently while still being able to service the entire Bungendore network, under average day conditions.

4.1.2 RESERVOIRS

The two reservoir locations contain floor RL's of 723.91 for Turallo and 725.683 for Days Hill Reservoirs. This assessment assumes the current network valving arrangement with the Turallo Reservoirs service the Bungendore Township to the south (Turallo Low Zone) with the Days Hill Reservoir servicing the Bungendore Township to north (Days Hill Low Zone), refer Table 4-2.

Table 4-2 Existing Reservoir Assessment

Reservoir	Capacity when Full (ML)	Required Volume (ML) [1]	Spare Capacity (ML)	BWL (m AHD)	TWL (m AHD)	Minimum Serviceable Area (m AHD)	Maximum Serviceable Area (m AHD)
Turallo Reservoir 1	0.90	1.92	0.43	723.91	729.4	649.8	705.4
Turallo Reservoir 2	1.45						
Days Hill Reservoir	2.20	1.29	0.91	725.683	734.0	653.0	706.3
Total	**4.55**	**3.21**	**1.34**				

Note

3 Equates to 24hrs of peak day demand + 1/3 peak day demand for storage.

The available data indicates that the Bungendore Township contains sufficient reservoir capacity. The Days Hill Reservoir located near the study area contains an additional 0.91 ML of spare capacity. Dwellings located near the two reservoir locations appear to be above the maximum serviceable area and may not meet the desired standards of service, the analysis assumes the BWL of each reservoir is equal to the floor level of the reservoir.

4.2 RENEWALS

The existing water supply network of the Bungendore Township was built on or after 1966 (50 years old). The following indicates the likely design life of a typical water supply network.

Table 4-3 Typical Asset Design Life of Water Infrastructure

Asset Type	Typical Asset Design Life
Water Mains	100 years
Reservoirs	50 years
Valves	30 years
Pumps	20 years
Telemetry	15 years

Any proposed augmentation works to the existing water supply mains or reservoirs will require assessment to see if the existing mains are to be replaced or augmented with an adjacent main, subject to the mains condition.

Pumps, valves and telemetry typical have a shorter design life in the order of 15-30 years. Any proposed pump station augmentations will likely require the existing pump station to be augmented as components of the pump station will be nearing its design life.

5 ULTIMATE AND STAGED WATER SUPPLY SERVICING STRATEGY

The proposed planning proposal and study area demands for the High and Extra High Zones were added to the existing network model. Refer to F005 and F010 in Appendix A for the location of the proposed connection details and proposed augmentations.

The planning proposal area contains an elevation range between 710 – 750 m AHD. The study area consists of a wider elevation range of 700 – 760 m and will need to be considered for any proposed planning proposal augmentations.

It is proposed to service the study area and subsequent planning proposal area via the Currandooly WTP and connecting Currandooly main, which currently services the adjacent Elmslea Estate via the Days Hill Reservoir. Due to the elevation differences between the study area and the existing water supply network (Days Hill Low Zone and Turallo Low Zone), two additional water supply zones will be required:

- High Zone: Study area below 735m AHD
- Extra High Zone: Study area above the 735m AHD.

The following sections detail the proposed augmentations required to supply adequate flow and pressure to the study area.

5.1 EXISTING INFRASTRUCUTRE (DAYS HILL LOW AND TURALLO LOW)

The following augmentations to the existing infrastructure are required to maintain the desired standards of service within the inclusion of the study area demand.

5.1.1 PUMP STATION

To supply the required peak day flows towards the proposed reservoir (refer Section 5.2.2) and maintain the desired standards of service within the existing network, two pump stations will be required. Due to the increase in peak day demand, from the study area, the Currandooly WTP pump will be required to be augmented and a second pump station location constructed within the planning proposal area. The below table summarises the existing and proposed pump duties required to supply the required flow and pressure to the study area, refer Table 5-1.

Table 5-1 Proposed Pump Station Augmentations

Pump Station	Existing Duty Flow (l/s)	Existing Duty Head (m)	Proposed Duty Flow (l/s)	Proposed Duty Head (m)
Bungendore WTP Pump [1]	40	40	-	-
Currandooly WTP Pump [2]	25	50	40	65
Proposed Pump 1	-	-	25	40

Note

1 Analysis assumes that the Bungendore WTP pump will not supply the proposed study area, however will be able to under average day conditions when the Currandooly WTP is taken offline via the proposed connection point off Simms Drive, refer F010 in Appendix A.
2 Analysis indicates that the main is at capacity with the inclusion of the study area demand, any additional demand will trigger the Currandooly main to be duplicated.

5.1.2 TRUNK MAINS

The existing trunk network will be sufficient to supply the required flows and head towards the study area, noting that the Currandooly main will be at capacity, allowing for no additional demand.

5.2 HIGH ZONE

To service the High Zone and supply the first dwellings of the planning proposal area, the following infrastructure is required.

5.2.1 PUMP STATION

The Proposed Pump 1 will be required to supply peak day demands from the planning proposal area at Simms Drive to the proposed Reservoir location, refer to Section 5.1.1 for the required pump duties.

5.2.2 RESERVOIR

The following reservoir siting locations have been assessed to service the study area:

- Days Hill Reservoir Augmented
- Ground Level Study Area Knoll Reservoir
- Elevated Study Area Knoll Reservoir
- Gibraltar Hill Reservoir

Refer to F003 in Appendix A for the identified possible reservoir locations to service the study area.

5.2.2.1 DAYS HILL RESERVOIR AUGMENTED

The Days Hill reservoir is located approximately 490m away from the planning proposal area and services the existing development with a peak hour supply and firefighting storage requirements. The peak hour demand is serviced by a 300mm diameter main before dividing into two 200mm diameter mains. One which runs adjacent to the planning proposal and study area.

Depending on the staging of the planning proposal the existing Days Hill Reservoir could service a small portion of the planning proposal area in a temporary or permanent situation.

Due to elevation differences, the Days Hill Reservoir can only service limited areas of the study area (areas less than 706m) and is not proposed to be utilised or upgraded for the study area.

5.2.2.2 GROUND LEVEL STUDY AREA KNOLL RESERVOIR

To provide the necessary storage it is proposed to construct a reservoir at the top of the knoll within the study area at RL 760m AHD. The reservoir will be sized for the High Zone demand with provisions for the Extra High Zone demand. This analysis assumes the study area and planning proposal area will be constructed within a short time period however a staged approach could also be adopted. The following summarises the requirements of the new reservoir, refer Table 5-2.

Table 5-2 Ground Level Study Area Knoll Reservoir Required Size

Operating Volume Capacity (ML)	Storage Volume Capacity (ML)	Total Capacity (ML)	Floor Level (m AHD)	BWL (m AHD)	TWL (m AHD)	Minimum Serviceable Area (m AHD)	Maximum Serviceable Area (m AHD)
1.66	0.55	2.22	760.0	761.7	765.0	685.0	735.0

The ground level reservoir will be able to service the study area via a gravity network between the elevations of 685m and 735m AHD, that accounts for approximately 65% (124 Ha) of the study area and the majority of the planning proposal area.

5.2.2.3 ELEVATED STUDY AREA KNOLL RESERVOIR

To supply the study area under one pressure zone 700 – 760 m AHD the ground level study area knoll reservoir can be converted to an elevated reservoir. This will increase the maximum serviceable elevation to cover the entire study area.

Typically, elevated reservoirs are more expensive than ground level reservoirs, require extensive screening from the public eye and are subject to geotechnical investigations for their suitability. Due to this and correspondence with QPRC indicating this type of reservoir is not favourable, the elevated reservoir has not been considered further.

5.2.2.4 GIBRALTAR HILL RESERVOIR

An alternative reservoir location has been identified to service the study area located at Gibraltar Hill, located to the south east of the site. The reservoir can be located at an elevation of approximately 795m AHD. Gibraltar Hill is located 2,000 – 5,000m away from the study area (depending on the final trunk main alignment) and will be able to service the study area under one pressure zone.

The proposed trunk main alignment required to connect the proposed reservoir to the study area would likely run adjacent or through the potential development to the east of the Goulburn Bombala Railway. If this option is to be considered, cost sharing between the developments would likely be required.

This location has been discontinued due to the high capital costs to supply the first dwellings of the planning proposal area and the uncertainty in timing with the adjacent developments.

The remainder of the analysis assumes that the study area and planning proposal area will be serviced by the ground level reservoir RL 760.0 m AHD (study area knoll)

5.2.3 TRUNK MAINS

To service the proposed reservoir a dedicated 200mm pressure main is required to supply peak day demands from the Currandooly offtake to the proposed Pump Station 1 through to the ground level study area knoll reservoir. The total length of the main will be approximately 1,200m and will depend on the final road layout of the study area. No peak hour demand is proposed to connect off the 200mm diameter main.

To service the High Zone a 300mm diameter gravity main from the reservoir will be required. The final road layout will dictate where the 300mm main can branch and reduce in diameter.

5.3 EXTRA HIGH ZONE

An Extra High Zone has been identified within the planning proposal and study area. To service this zone from the currently proposed reservoir location, a booster pump station will be required. Correspondence with QPRC indicate they

are not in favour of a WSZ being serviced via a pump due to the uncertain risk of power outages during a firefighting event, this has led to the remove of potentially developable land located above the 735m contour.

Alternative options to service the extra high WSZ that were discussed with QPRC that could be considered in any future analysis include:

- Construct an elevated reservoir at the proposed reservoir location and upgrade Pump Station 1 duty head by an additional 20m and remove the need for a booster pump station, refer Section 5.2.2.3.
- Utilise the alternative reservoir location at Gibraltar Hill, which will be able to supply firefighting flows to the entire study area, refer Section 5.2.2.4.

Refer to F003 and F004 in Appendix A for the location of the proposed reservoirs and unserviceable zone with the adopted ground level reservoir at the study area knoll.

5.4 STAGING

The following indicates the adopted staging methodology to service the initial planning proposal area and later study area.

Table 5-3 Proposed Staging of Planning Proposal and Study Area

Asset	Infrastructure Required to Service Zone	Timing of Upgrade	Sized for
Pump Stations	Days Hill Low [1]	Study Area	Study Area
	High	Planning Proposal	Planning Proposal [2]
Pressure Trunk Mains	High	Planning Proposal	Study Area
Gravity Trunk Mains	High	Planning Proposal	Study Area [3]
Reservoirs	High	Planning Proposal	Study Area

Note

1 Low zone includes the Currandooly main that services the Days Hill reservoir
2 Additional augmentations are required to service the study area.
3 Extensions to the proposed augmentations are required to service the study area

Once the final road layouts and road verge width of the study area are confirmed the total length and diameter of the internal infrastructure can be undertaken. Depending on the final road layout it may be possible to stage gravity and pressure main infrastructure to suit the increasing demand.

5.4.1 PLANNING PROPOSAL REQUIRED AUGMENTATION SUMMARY

To service the planning proposal area with the adopted staging, the following augmentations will be required.

- New Pump Station 1 with a duty of 10 l/s @ 35 m;
- 1,200 m of 200mm diameter pressure main to connect the Currandooly main to the proposed Pump Station 1 through to the proposed reservoir;
- 2.3 ML ground level reservoir at RL 760m AHD; and
- Internal gravity mains consisting of 100mm – 300mm in diameter to service the High Zone;

No infrastructure is proposed to service the unserviceable Extra High Zone, however its demand has been included in the sizing of the required High Zone infrastructure. This infrastructure can be reassessed once the road layout and anticipated yield is identified for the High Zone.

Refer to F005 in Appendix A for the location of proposed connection details and proposed main locations.

5.4.2 STUDY AREA REQUIRED AUGMENTATION SUMMARY

To service the study area with the adopted staging, the following augmentations will be required.

- Augmentation of the Currandooly WTP pump to a duty of 40 l/s @ 65 m;
- Augmentation to Pump Station 1 with a duty of 25 l/s @ 40 m;
- Internal gravity mains consisting of 100mm – 300 mm in diameter to service the High Zone;

No infrastructure is proposed to service the unserviceable Extra High Zone, however its demand has been included in the sizing of the required High Zone infrastructure. This infrastructure can be reassessed once the road layout and anticipated yield is identified for the High Zone.

Refer to F010 in Appendix A for the location of proposed connection details, proposed augmentation locations and proposed main locations.

6 BUNGENDORE WATER TREATMENT PLANT AND BOREFIELDS

It is understood that QPRC are currently undertaking an Integrated Water Cycle Management Strategy for the former Palerang local government area. As part of the Strategy, the current groundwater allocation, existing treatment plants and existing borefield infrastructure are being assessed to determine if they are sufficient for future growth. As such, these have not been considered in this report.

7 RECYCLED WATER

Consideration to supplying the study area with a dual water supply consisting of potable water and recycled water was undertaken. The proximity of the study area to the Bungendore Sewerage Treatment Plant (STP) provides an opportunity to utilise treated effluent from the Bungendore STP for a range of on block uses. Currently the Bungendore Township contains a recycled water network to irrigate existing ovals within the township.

Other sources such as rainwater harvesting have already been considered and are represented in the adopted average day demand of 243 kL/ET/yr.

7.1 REVISED PROJECTED DEMANDS

With the inclusion of recycled water as a dual water supply, the potable water demand will reduce. This analysis has assumed the recycled water will directly connect to each on block rainwater tank and supplement the rainwater harvesting system. The following uses have been identified for recycled water:

- Toilet flushing;
- Cold water laundry; and
- On block irrigation;

The breakdown in demand between potable and recycled has been taken from the Water Association of Australia and based on similar experience in regional NSW. Due to the large block sizes proposed, a greater irrigation demand is likely to occur increasing the proportion of recycled water use, refer Table 7-1

Table 7-1 Proposed Demand Breakdown Dual Water Supply

Water Type	% of Peak Day Demand			% of Peak Hour Demand		
	WSA [1]	Googong IWC	Adopted	WSA [1]	Googong IWC	Adopted
Potable Water	30-40%	32%	30%	30-40%	32%	30%
Recycled Water	60-70%	68%	70%	60-70%	68%	70%

Note

1 WSA Water Supply Code of Australia 3.1

An additional 10% has been included on both the potable and recycled water average day demands to account for discrepancy between the potable and recycled breakdown. Peak day and peak hour factors have been adopted based on an exclusively potable water network. A summary of the proposed flows for the planning proposal and study area are summarised in Table 7-2.

Table 7-2 Proposed Development Flows Dual Water Supply

Development	Potable Water			Recycled Water		
	High Zone	Extra High Zone	Total	High Zone	Extra High Zone	Total
Planning Proposal Area - ADD (l/s)	0.71	0.07	0.78	1.66	0.17	1.83
Study Area - ADD (l/s)	1.06	0.77	1.83	2.47	1.79	4.26
Total - ADD (l/s)	**1.77**	**0.84**	**2.61[1]**	**4.13**	**1.96**	**6.09**
Planning Proposal Area - PDD (l/s)	1.99	0.20	2.20	4.65	0.48	5.13
Study Area - PDD (l/s)	2.97	2.15	5.12	6.93	5.01	11.94
Total - PDD (l/s)	**4.96**	**2.35**	**7.31**	**11.58**	**5.49**	**17.06**
Planning Proposal Area - PHD (l/s)	3.99	0.41	4.39	9.30	0.95	10.25
Study Area - PHD (l/s)	5.94	4.29	10.23	13.85	10.02	23.87
Total - PHD (l/s)	**9.92**	**4.70**	**14.63**	**23.15**	**10.97**	**34.13**

Note

1 Equates to 82.4ML/yr or a reduction of 167.6 ML/yr on the potable water network.

The inclusion of recycled water sees the average day demand for potable water reduce from 250 ML/yr to 82.4 ML/yr, based on 243 kL/ET/yr. This additional source of non potable water will allow the development to fall within the existing licence requirements allowing the study area to be serviced with no additional sources required.

It is unclear if the Bungendore STP contains sufficient capacity to supply a peak day demand of 17.06 l/s to the study area. In addition, suppling recycled water to dwellings will also impact water sensitive urban design principles as rainwater tanks that are typically supplied by rainwater become diluted with recycled water.

A three waters assessment is recommended to be carried out to determine the likely benefits of a dual supply network mainly surrounding:

- Security of supply for potable and recycled water;
- Receiving environment health regarding treated effluent and Water Sensitive Urban Design principles; and
- Operation costs and reliability of a separate network.

7.2 REVISED SERVICING STRATERGY – DUAL WATER SUPPLY

With the inclusion of a recycled water network within the study area, the following potable water and recycled water infrastructure will be required.

7.2.1 STUDY AREA REQUIRED AUGMENTATION SUMMARY – DUAL WATER SUPPLY

To service the study area incorporating a recycled water network, the following augmentations will be required.

Potable Water

- New Pump Station 1 with a duty of 15 l/s @ 50 m;
- 1,200 m of 150mm diameter pressure main to connect the Currandooly main to the proposed Pump Station 1 through to the proposed reservoir;
- 1.0 ML ground level reservoir at RL 760m AHD; and
- Internal gravity mains consisting of 100mm – 200mm in diameter to service the High Zone;

With the reduction in demand on the potable network, the existing trunk network, contains sufficient capacity and does not need to be augmented.

Recycled Water

The recycled water network will follow a similar strategy to the potable water network with the following exceptions:

1) The supply main from the Bungendore STP is proposed to supply peak day demands directly to a dedicated recycled water reservoir. As no ties are proposed off this main the pump can contain heads in excess of 80m which will remove the need for a second pump station within the planning proposal area.

Based on the above requirements and assumptions, the following new infrastructure will be required:

- New pump station at the Bungendore STP to pump a duty of 20 l/s @ 50 m to pump flows towards a dedicated recycled water reservoir;
- 3,600 m of 200mm diameter pressure main to connect the Bungendore STP pump to the proposed reservoir;
- 1.8 ML ground level reservoir at RL 760m AHD. This may need to be increased to smooth out season fluctuations between the likely recycled water summer demand and supply from the Bungendore STP; and
- Internal gravity mains consisting of 100mm – 300mm in diameter to service the High Zone.

Refer to F015 and F016 in Appendix A for the location of proposed connection details and proposed main locations.

8 INFRASTRUCTURE OPINION OF COSTS

The following indicates the likely costs to supply the study area with an exclusive potable only and a dual supply network. Sizing is based on the adopted strategy highlighted in the report and shown in Appendix A.

Quantities are based on identified sizes, where no information is available for costing, such as internal reticulation mains, previous experience has been taken for both exclusive potable and dual network developments. Once a road layout for the study area is confirmed a more accurate cost estimate can be carried out. Table 8-1 details the costs associated with the supplying the study area with potable only and Table 8-2 details the cost associated with a dual water supply network.

Table 8-1 Opinion of Costs Exclusive Potable Network

Item	Cost
200mm diameter Trunk Main	$ 236,740.00
Internal Reticulation Mains	$ 4,728,800.00
2.3 ML Reservoir and Associated Valving	$ 850,000.00
Pump Station 1 and Associated Valving	$ 350,000.00
Various Pump Augmentations	$ 100,000.00
Sub Total	**$ 6,265,540.00**
Contingency 30%	**$ 1,879,662.00**
TOTAL	**$ 8,145,202.00**

Table 8-2 Opinion of Costs Dual Supply Network

Item	Cost
Potable Water	
150mm diameter Trunk Main	$ 199,360.00
Internal Reticulation Mains	$ 3,803,600.00
1.0ML Reservoir and Associated Valving	$ 550,000.00
Pump Station 1 and Associated Valving	$ 175,000.00
Pump Augmentations	$ 50,000.00
Total – Potable Water	**$ 4,777,960.00**
Recycled Water	
200mm diameter Trunk Main	$ 684,000.00
Internal Reticulation Mains	$ 4,317,600.00
1.8ML Reservoir and Associated Valving	$ 708,334.00
STP Pump Station and Associated Valving	$ 350,000.00
Pump Augmentations	$ 50,000.00
Total – Recycled Water	**$ 6,109,934.00**
Combined	
Total – Combined	**$ 10,887,894.00**
Contingency 30%	**$ 3,266,368.20**
TOTAL – Combined	**$ 14,154,262.20**

The cost estimate is prepared based on the following assumptions:

- Cost estimate are based on current market rates as at July 2016;
- A contingency of 30% has been allowed for the proposed works;
- No allowance for relocation or protection of existing services; and
- Operation costs, treatment plant upgrades and bore augmentations have been omitted.
- Works located within the study area will be carried out as part of the development.

9 RECOMMENDATIONS

To service the planning proposal and study area the follow water infrastructure will be required:

9.1 PLANNING PROPOSAL AUGMENTATIONS - POTABLE ONLY

To service the planning proposal area with the adopted staging, the following augmentations will be required.

- New Pump Station 1 with a duty of 10 l/s @ 35 m;
- 1,200 m of 200mm diameter pressure main to connect the Currandooly main to the proposed Pump Station 1 through to the proposed reservoir;
- 2.3 ML ground level reservoir at RL 760m AHD; and
- Internal gravity mains consisting of 100mm – 300mm in diameter to service the High Zone;

Once the final road layouts and road verge width of the study area are confirmed can the total length and diameter of the internal infrastructure be undertaken. Depending on the final road layout it may be possible to stage gravity and pressure main infrastructure to suit the increasing demand.

9.2 STUDY AREA AUGMENTATIONS - POTABLE ONLY

To service the study area with the adopted staging, the following augmentations will be required.

- Augmentation of the Currandooly WTP pump to a duty of 40 l/s @ 65 m;
- Augmentation to Pump Station 1 with a duty of 25 l/s @ 40 m;
- Internal gravity mains consisting of 100mm – 300 mm in diameter to service the High Zone;

Once the final road layouts and road verge width of the study area are confirmed can the total length and diameter of the internal infrastructure be undertaken. Depending on the final road layout it may be possible to stage gravity and pressure main infrastructure to suit the increasing demand.

9.3 STUDY AREA AUGMENTATIONS – DUAL NETWORK

To service the study area incorporating a recycled water network, the following augmentations will be required.

Potable Water

- New Pump Station 1 with a duty of 15 l/s @ 50 m;
- 1,200 m of 150mm diameter pressure main to connect the proposed Pump Station 1 to the proposed reservoir;
- 1.0 ML ground level reservoir at RL 760m AHD; and
- Internal gravity mains consisting of 100mm – 200mm in diameter to service the High Zone;

With the reduction in demand on the potable network, the existing trunk network, contains sufficient capacity and does not need to be augmented. In addition no additional sources of water will be required under the current licence agreement, subject to any adjacent development.

Recycled Water

- New Pump Station at the Bungendore STP to pump a duty of 20 l/s @ 50 m to pump flows towards a dedicated recycled water reservoir;
- 3,600 m of 200mm diameter pressure main to connect the Bungendore STP pump to the proposed reservoir;
- 1.8 ML ground level reservoir at RL 760m AHD. This may need to be increased to smooth out season fluctuations between the likely recycled water summer demand and supply from the Bungendore STP; and
- Internal gravity mains consisting of 100mm – 300mm in diameter to service the High Zone.

10 CONCLUSIONS

The existing Bungendore water network generally complies with the desired standards of service, with the inclusion of the recently constructed Currandooly main providing additional capacity to the Bungendore network.

The site is capable of supporting development in accordance with QPRC desired standards of services, if the proposed augmentations identified in this report are carried out in conjunction with the proposed development staging and timing. The area of development identified as the Extra High Zone (area above the 735m contour), has been identified as undevelopable from the preferred reservoir location. This report identifies alternative reservoir options to service the Extra High Zone however further investigations are required to determine the suitability of these options.

No infrastructure is proposed to service the unserviceable Extra High Zone, however its demand has been included in the sizing of the required High Zone infrastructure. This infrastructure can be reassessed once the road layout and anticipated yield is identified for the High Zone.

The capital cost to supply the study are with an exclusive potable water and a dual water supply is summarised in Table 10-1.

Table 10-1 Cost Comparison Exclusive Water Supply versus Dual Water Supply

Scenario	Cost
Exclusive Potable Water Supply	$ 8,145,202.00
Dual Water Supply	$ 14,154,262.20

10.1 ASSUMPTIONS AND FURTHER ANALYSIS

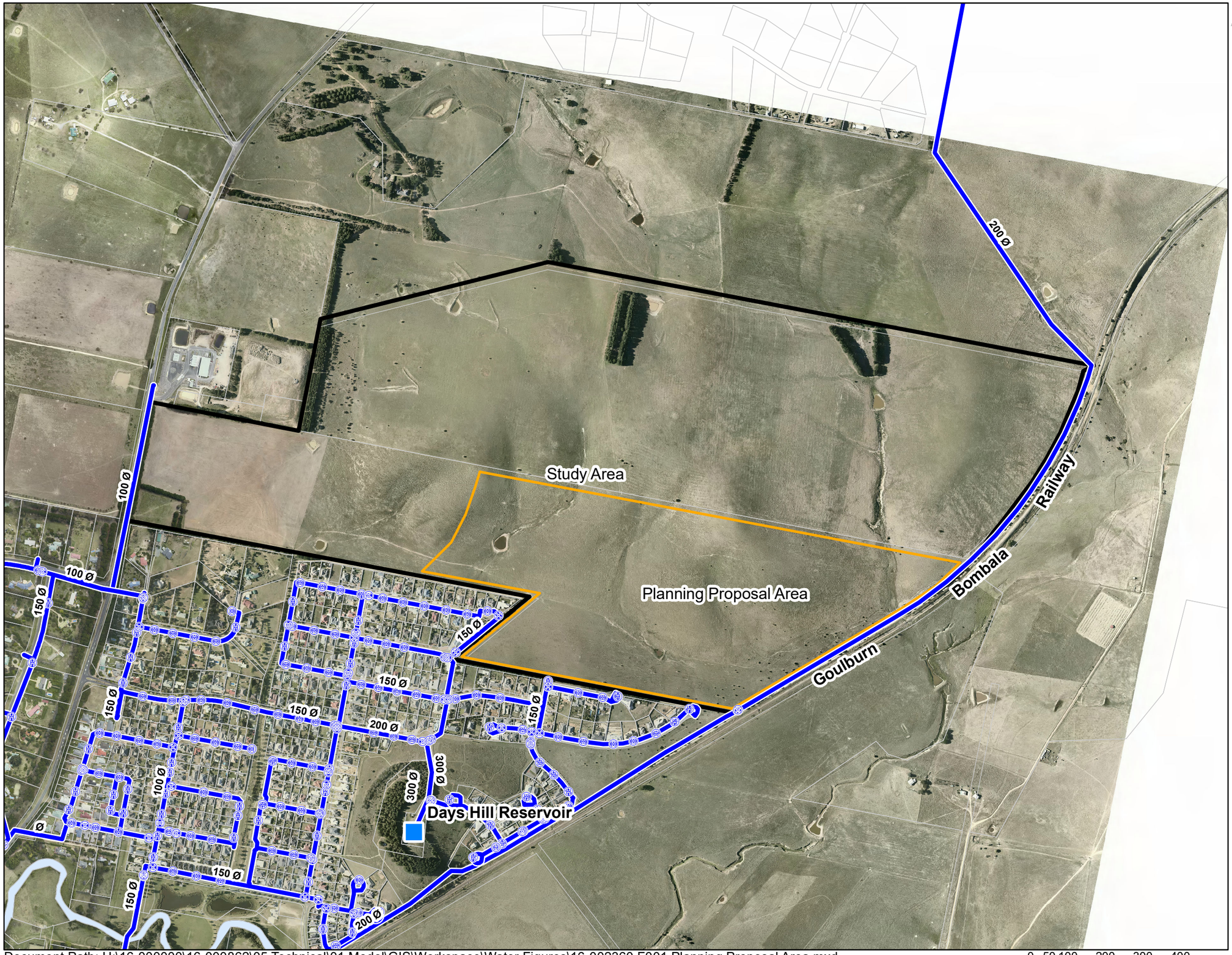
The above recommendations are based on the information available from QPRC at the time of writing this report. The following additional information will be required during the detailed design of the offsite works to confirm if additional benefits to the strategy can be identified:

- A total of 1028 dwellings are proposed within the study area, however some dwellings will be located within the Extra High Zone and will not be able to be serviced based on the current servicing strategy. A road layout and proposed earthwork extent will need to be carried out to determine the actual yield that can be serviced by the proposed reservoir location.
- A capacity assessment of the Bungendore STP, Bungendore WTP and Currandooly WTP will need to be carried out to assess if sufficient capacity to supply the required flows to service the study area exist.
- A three waters assessment is recommended to be carried out to determine the likely benefits of dual supply network incorporating potable water, recycled water and on block rainwater harvesting.

The Bungendore East development located to the east of the Goulburn Bomballa Railway will likely contain a connection off the Currandooly main. This may trigger additional or an increase in augmentations required for the Bungendore North development. It is recommended both developments Bungendore North and Bungendore East be assessed together to optimise the required augmentations, as well as looking at alternative ways to service the Extra High Zone within the Bungendore North.

APPENDICES

APPENDIX A DRAWINGS



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calibre

Legend

- Existing Water Hydrants
- Existing Water Stop Valves
- Existing Reservoir
- Existing Water Mains
- Planning Proposal Area
- Study Area

Notes:

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

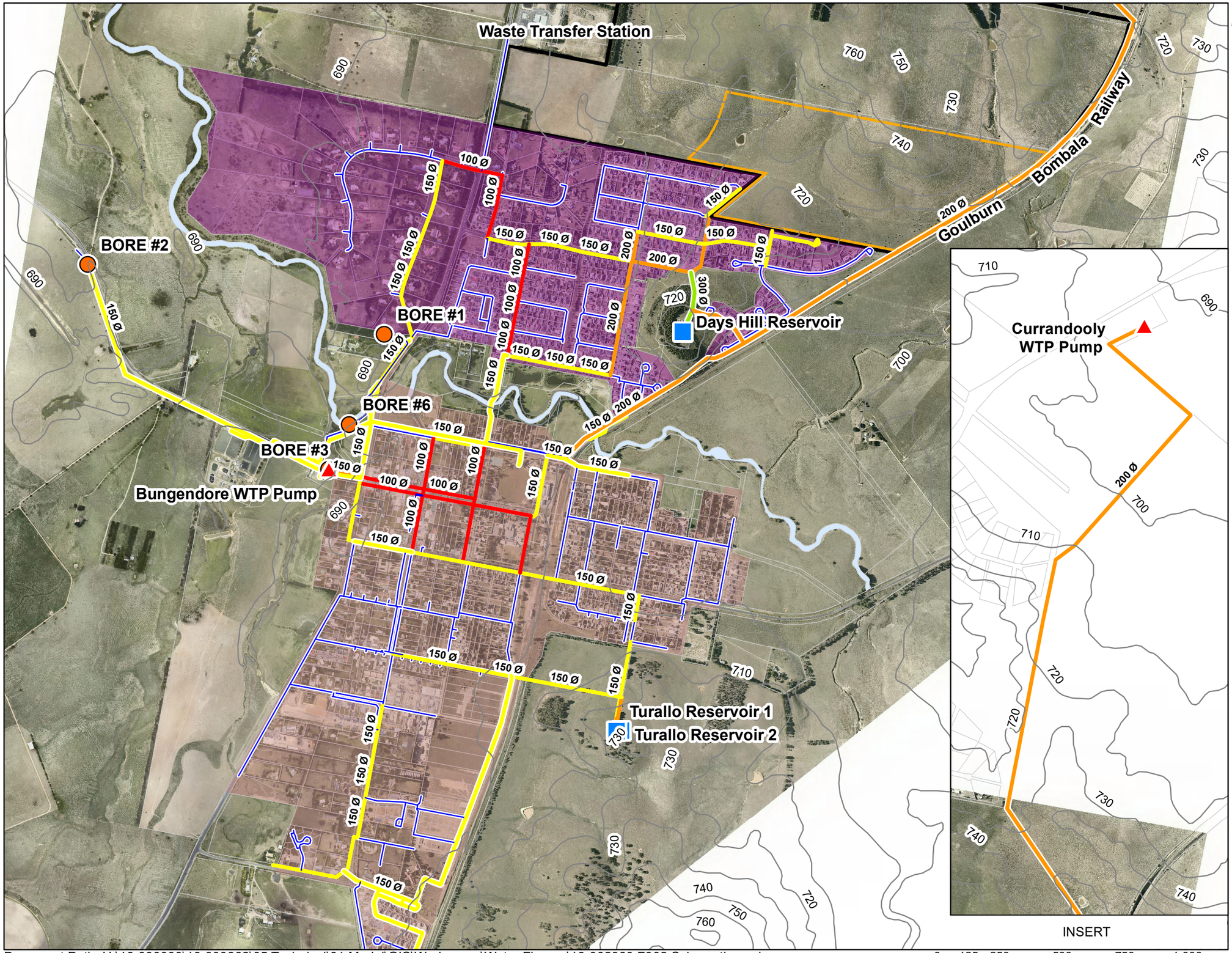
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PLANNING PROPOSAL AND STUDY AREA

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Figure	F001

Issue **1**

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calibre

Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Identified Existing Trunk Network

- 100Ø
- 150Ø
- 200Ø
- 300Ø
- Reticulation Mains
- Bore
- Pump
- Reservoir

Water Supply Zone

- Days Hill Zone
- Turallo Zone

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

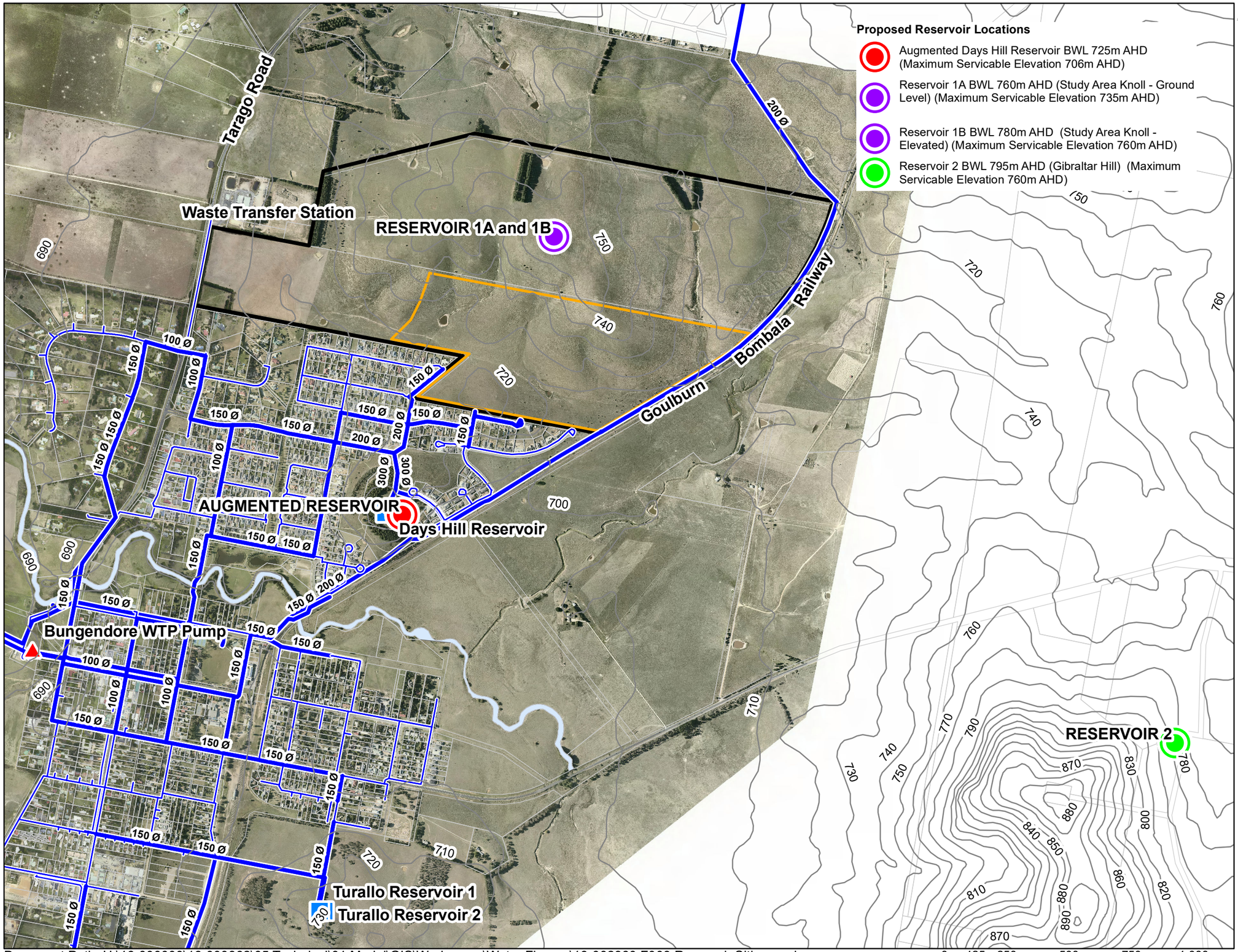
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Drawing Title

EXISTING WATER NETWORK SCHEMATIC

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Job No.	16-002360
Figure	F002

Issue **1**



calibre

Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Existing Infrastructure

- Reticulation Main
- Trunk Mains
- Pump
- Reservoir

Notes:
Analysis Carried out on supplied 10m contour data.

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

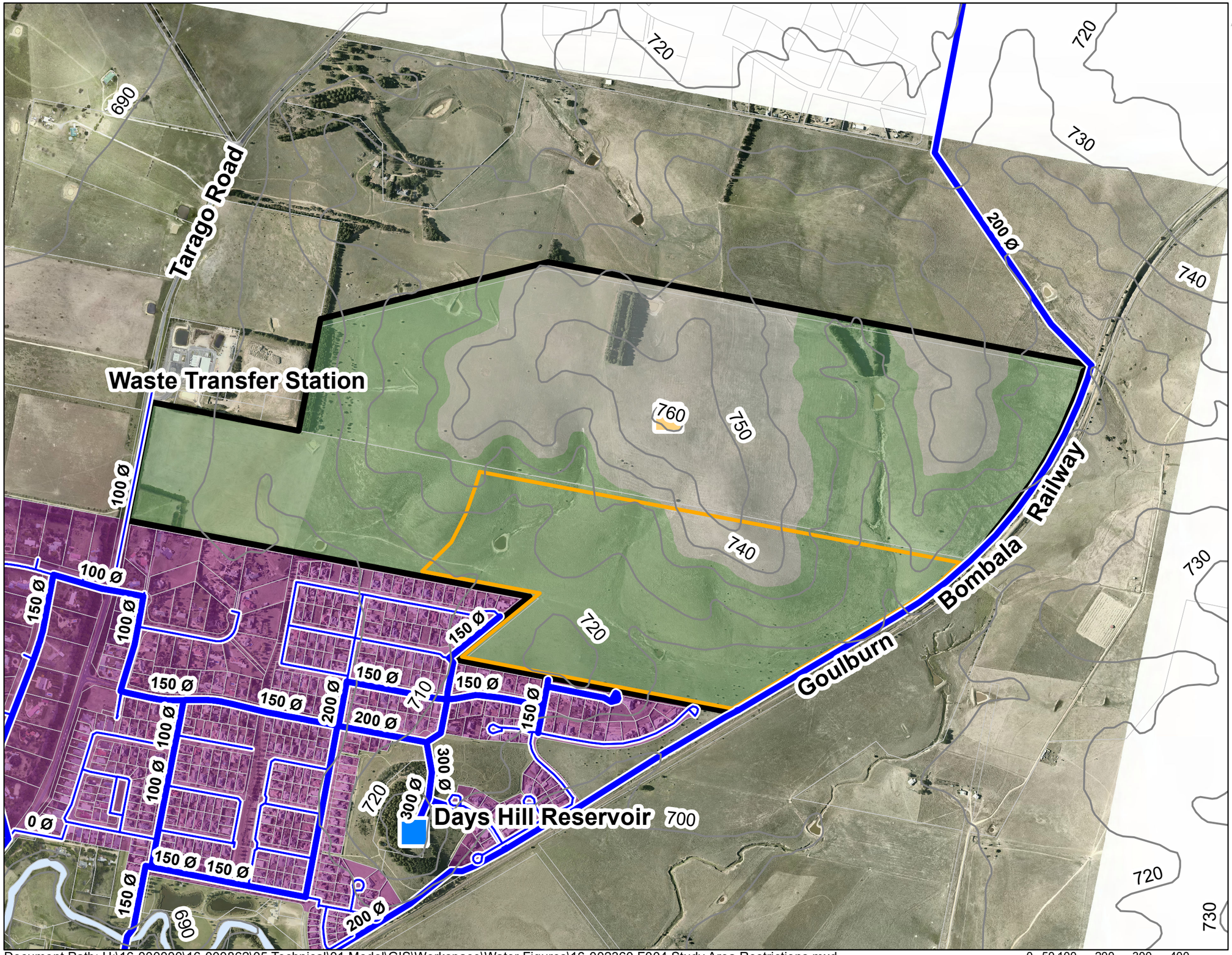
NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

Drawing Title

STUDY AREA RESERVOIR SITING

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Job No.	16-002360
Figure	F003

Issue **1**



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Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Proposed High Level Infrastructure

- Ground Level Reservoir

Water Supply Zone

- Days Hill Zone
- High Zone
- Extra High Zone - Unservicable

Existing Infrastructure

- Reticulation Mains
- Trunk Mains
- Reservoir

Notes:
Analysis carried out on supplied 10m contour data.

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

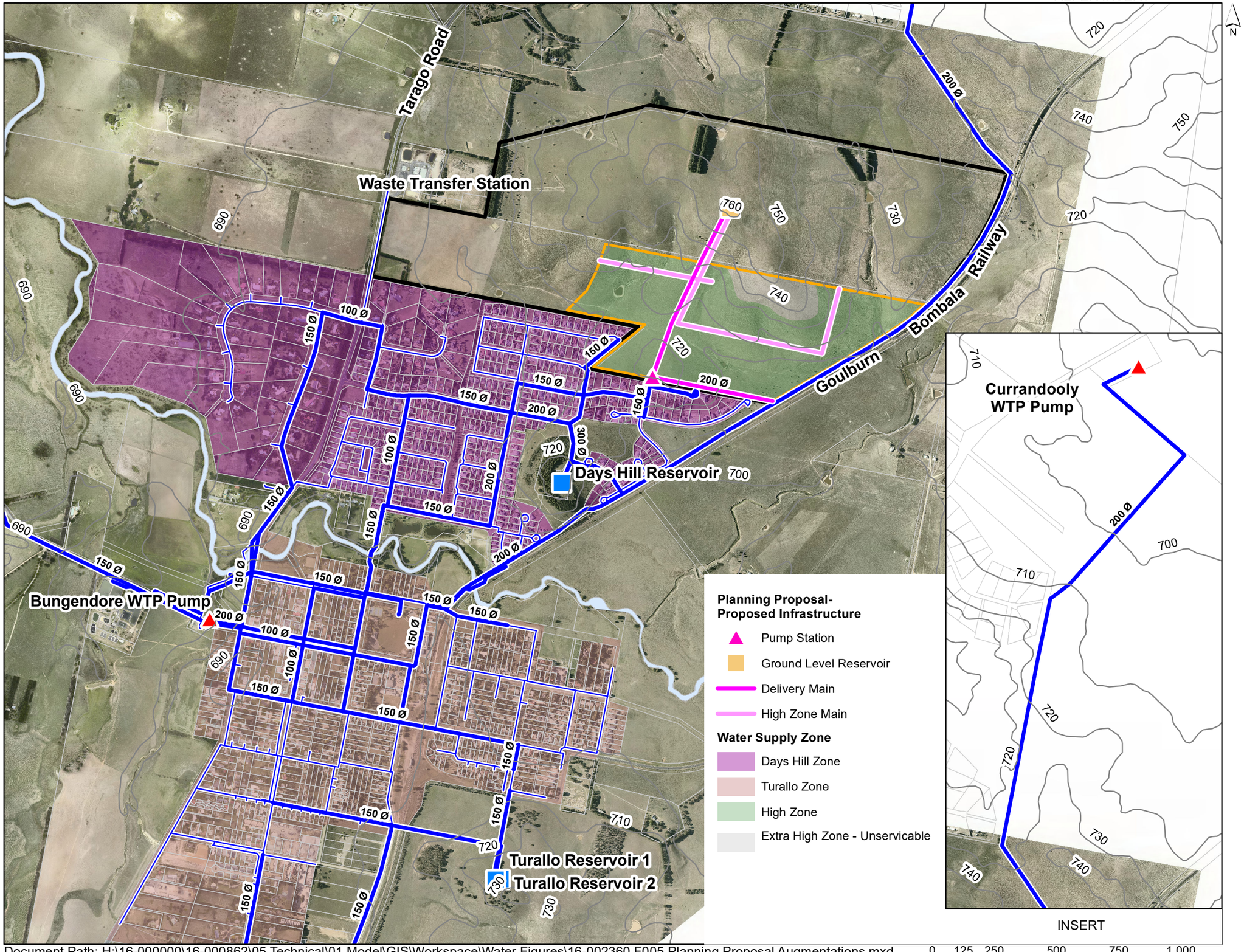
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STUDY AREA IDENTIFIED CONSTRAINTS

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Job No.	16-002360
Figure	F004

Issue 1

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**Planning Proposal-
Proposed Infrastructure**

- Pump Station
- Ground Level Reservoir
- Delivery Main
- High Zone Main

Water Supply Zone

- Days Hill Zone
- Turallo Zone
- High Zone
- Extra High Zone - Unservicable

Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Existing Infrastructure

- Reticulation Main
- Trunk Main
- Pump
- Reservoir

Notes:
Final arrangment and staging of internal reticualtion mains subject to study area road layout

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

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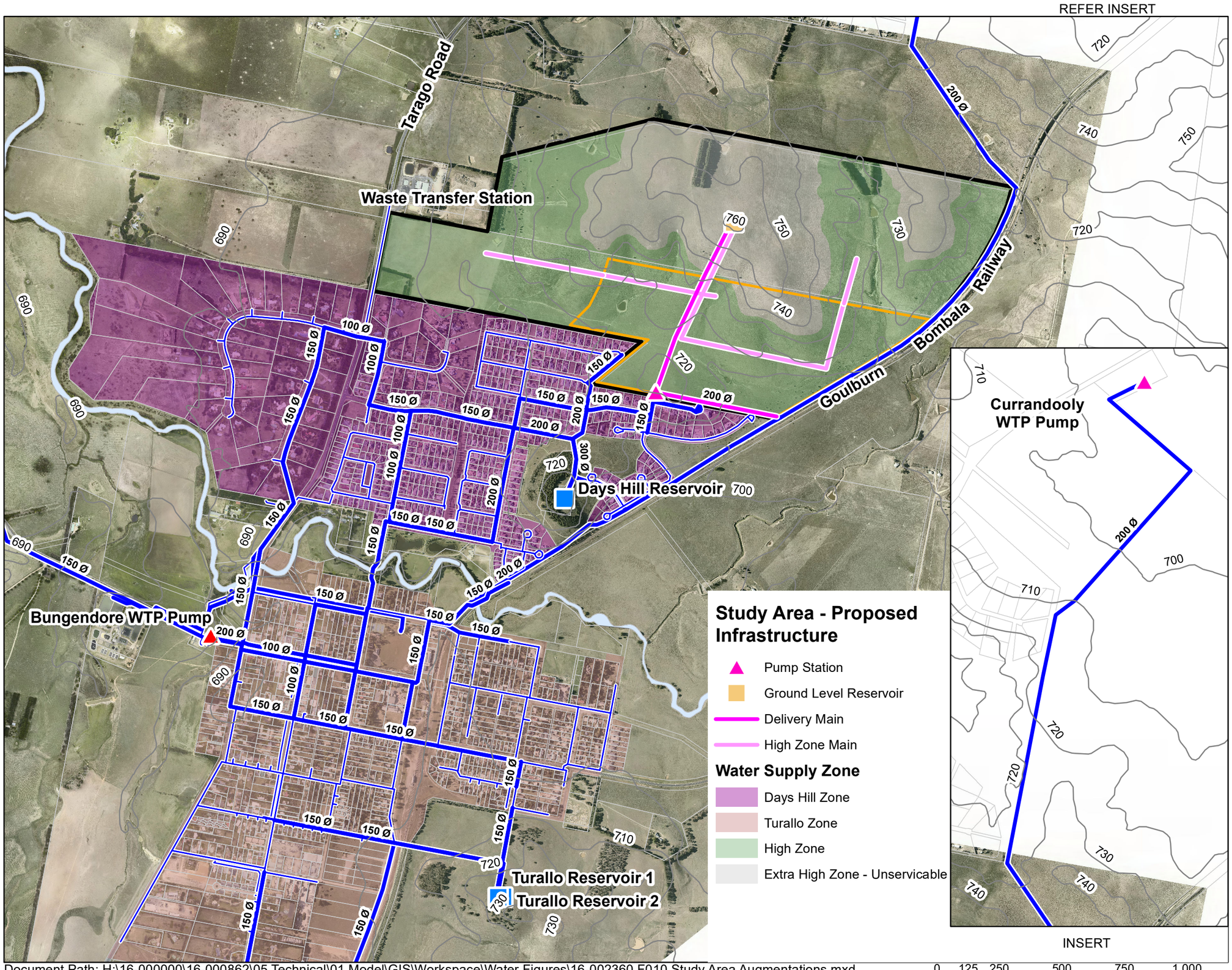
**PLANNING PROPOSAL
PROPOSED WATER SUPPLY
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Issue 1

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Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Existing Infrastructure

- Reticulation Main
- Trunk Main
- Pump
- Reservoir

Notes:
Final arrangment and staging of internal reticualtion mains subject to study area road layout

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

Drawing Title

STUDY AREA PROPOSED WATER SUPPLY INFRASTRUCUTRE

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Figure	F010

Issue **1**

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Tarago Road

Waste Transfer Station

Bombala Railway

Goulburn

Days Hill Reservoir

Bungendore WTP Pump

Turallo Reservoir 1

Turallo Reservoir 2

Currandooly WTP Pump

INSERT

Study Area - Proposed Potable Water Infrastructure

- Pump Station
- Ground level Reservoir

Water Supply Zone

- Days Hill Zone
- Turallo Zone Zone
- High Zone
- Extra High Zone - Unservicable

Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Existing Infrastructure

- Reticulation Main
- Trunk Main
- Pump
- Reservoir

Notes:
Final arrangment and staging of internal reticualtion mains subject to study area road layout

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

Drawing Title

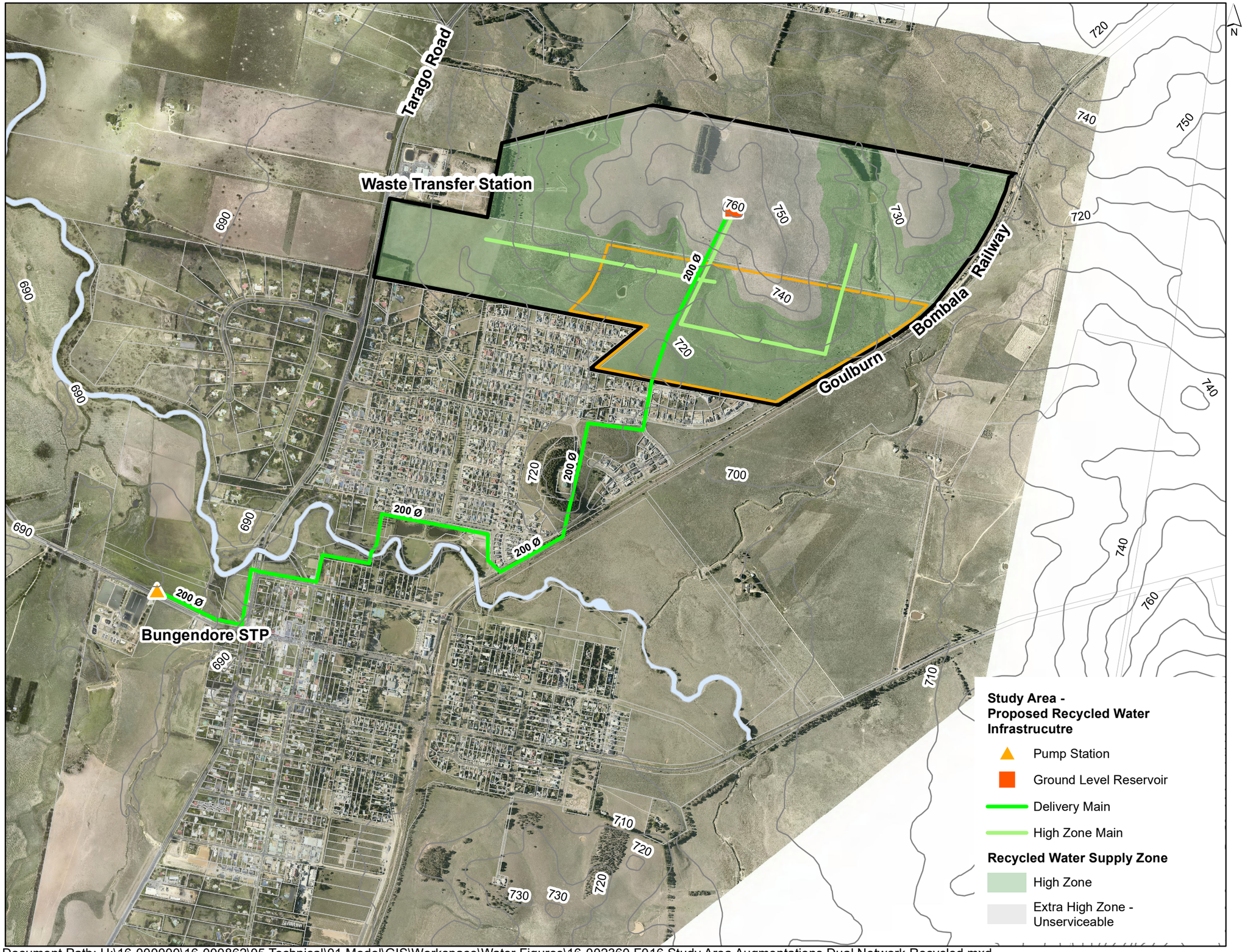
STUDY AREA PROPOSED DUAL NETWORK POTABLE WATER INFRASTRUCUTRE

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Figure	F015

Issue 1

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Legend

- Planning Proposal Area
- Study Area
- Turallo Creek
- QPRC Cadasta
- Contours (10m Intervals)

Notes:
Final arrangment and staging of internal reticualtion mains subject to study area road layout

Details

Issue	Amendment	Date
0	Draft	16-Jan-2017
1	Final	17-Oct-2017

Project

NORTH BUNGENDORE PLANNING PROPOSAL ASSESSMENT - STUDY 5 WATER SUPPLY

Drawing Title

**STUDY AREA
PROPOSED DUAL NETWORK
RECYCLED WATER
INFRASTRUCUTRE**

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Figure	F016

Issue **1**