APPENDIX L

Water and Sewerage Strategy

MWH

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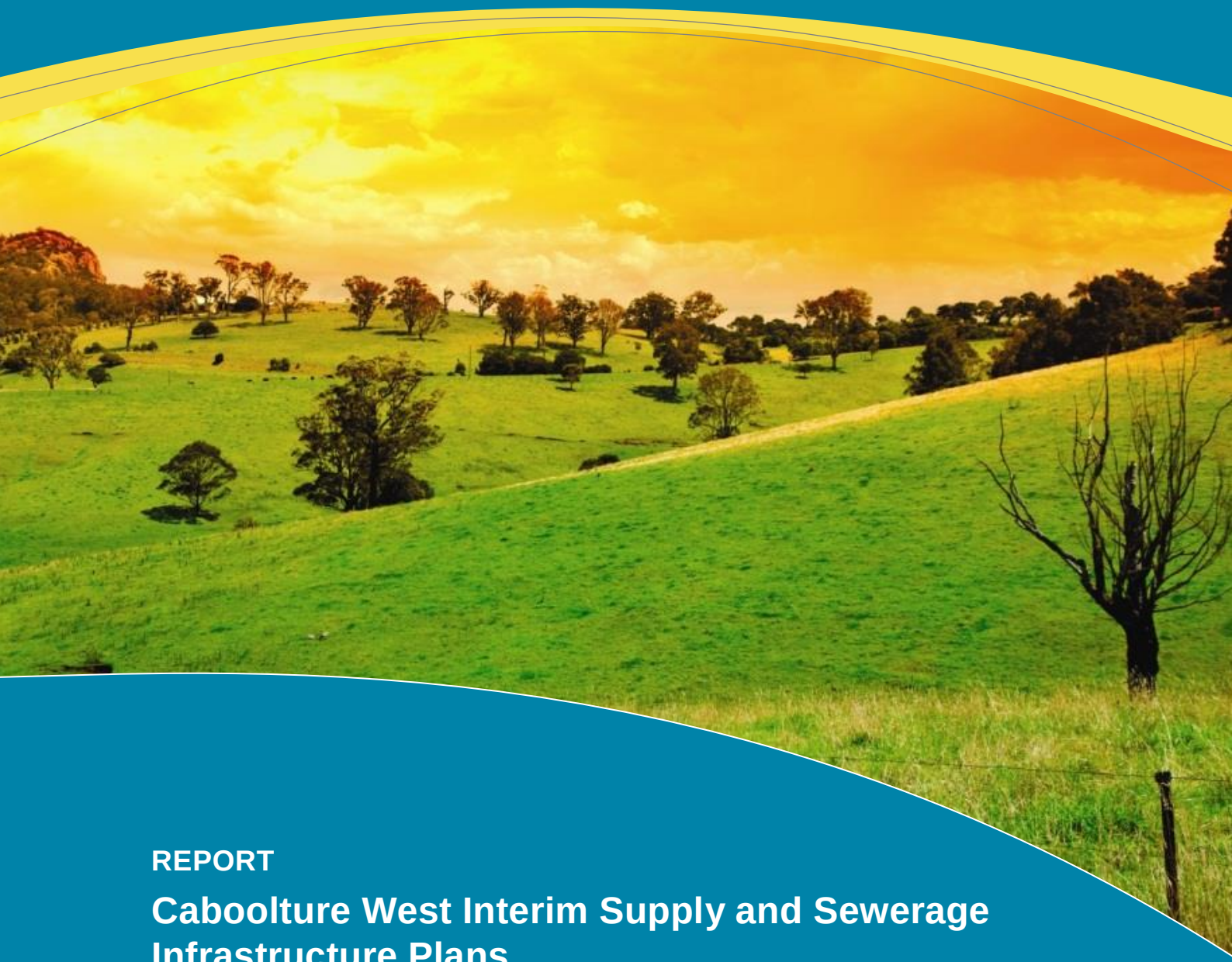


REPORT

Caboolture West Interim Supply and Sewerage Infrastructure Plans

Prepared for Unitywater

October 2013

Executive Summary

Caboolture West is located within Moreton Bay Region Council (MBRC) to the west of existing development in Caboolture and Morayfield and approximately 5 km west of the Caboolture district centre. The Caboolture West investigation area is approximately 2,350 ha in area and is bounded by the D'Aguilar Highway to the north, Caboolture River Road to the south and Caboolture City to the east.

The Caboolture West area was first considered for urban development in the mid 1980's in a draft strategic plan for the Caboolture Shire Council and is now recognised as an identified growth area within the South East Queensland Regional Plan. The Caboolture West Area was declared a master planned area on 17 February 2012. In response to the progression of Caboolture West as a development area MBRC require Unitywater to develop a water supply and sewerage infrastructure plans for the area. MWH have been commissioned by Unitywater to these infrastructure plans for Ultimate development.

This report sets out the philosophy, process, assumptions and methodologies used for the development of Ultimate benchmark infrastructure solutions for servicing the Caboolture West investigation area with water supply and sewerage. The scenarios developed are considered to be benchmark as they reflect current best practice traditional servicing strategies. That is, they reflect current legislation and aim to ensure water supply and sewerage service are supplied in the most efficient manner. This approach provides a benchmark for other scenarios (e.g. third pipe, stormwater harvesting) to be measured against.

Additionally, to enable the early stages of the development to progress without investing in the ultimate infrastructure, MBRC have requested that Unitywater investigate opportunities to provide interim water and sewage services to the area. Unitywater have also commissioned MWH to investigate options for interim water supply and sewage servicing plans for Caboolture West. This report details the results and technical outcomes of this interim servicing assessment.

From the development of water supply and sewerage infrastructure plans for Caboolture West the following is concluded:

From the development of water supply and sewerage infrastructure plans for Caboolture West the following is concluded:

1. Water supply and sewerage demands for Caboolture West have been developed based on population estimates and sequencing provided by MBRC. A total EP for the development of 76,565 was developed for both water supply and sewerage networks. A maximum day (MD) demand of 434 L/s was identified for the water supply network. A peak wet weather flow (PWWF) of 935 L/s was identified for the sewerage network
2. Infrastructure plans have been developed for Ultimate development to which timing in 5 year planning horizons has been applied. Interim servicing strategies have also been developed.
3. Infrastructure has been sized according to the standards of service contained within the SEQ Code planning guidelines for water supply and sewerage
4. Features of the ultimate proposed water supply network are as follows:
    a. The NPI has been assumed as the water supply source
    b. A reservoir site located toward the west of the site has a proposed ultimate volume of 38 ML and a TWL of 100 m AHD. There are options for staging of the reservoir capacity to a 20 ML reservoir by 2021 and 20 ML by 2031.
    c. Supply to the reservoir is delivered from the NPI via a pump supply main following Bellmere and Jackson Roads.
    d. A trunk distribution network has been developed to deliver supply to assumed neighbourhoods throughout Caboolture West. Indicative DMA inlet locations have been represented in mapping. Pressure management is proposed for DMA inlets servicing properties < 40 m AHD elevation
5. Features of the preferred interim water supply strategy is as follows:

a. Supply of the first 2,200 EP from the Morayfield HLZ via a connection to the 375 mm diameter main in Tinney Road. A risk management plan and an asset maintenance plan will be required for the Morayfield HLZ pump station and the 375 mm diameter HLZ Supply main. An emergency connection to the low level zone is also required to mitigate the consequence of failure. Currently the Morayfield HLZ consists of approximately 6,800 EP fed directly from the Morayfield HLZ pump station. No emergency storage is available for these customers in the event of pump station failure.

b. At 2,201 EP an interim reservoir of 5.5 ML is proposed to provide storage to Caboolture West. The reservoir is to be supplied from the NPI. All properties previously serviced from Morayfield HLZ are to be supplied from the proposed interim reservoir to facilitate reservoir turnover and release the 2200 EP capacity back to the Morayfield HLZ.

c. The interim reservoir can service up to 10,000 EP at which time a reservoir at the Ultimate location is required to service Caboolture West.

6. Features of the ultimate proposed sewerage network are as follows:
   a. The network has been developed based on the existing topology for the Caboolture West site.
   b. Gravity trunk mains are generally located to follow water courses to facilitate collection via gravity.
   c. Initial treatment of sewage at the South Caboolture STP has been assumed for Caboolture West with treatment of Ultimate flows at a new STP located at Redcliffe. The infrastructure and costing assessment undertaken within this report has limited assessment to delivery of sewage as far as the existing Burpengary East STP from which flows are to be re-directed to the new Redcliffe STP in the future.
   d. Five sewerage pump stations are proposed. This includes a terminal station, located at the south eastern corner of the Caboolture West site, for transfer of raw sewage via a rising main to the Burpengary East STP. Possible future pumps for the transfer of sewage from the current Burpengary East STP site to the planned Redcliffe STP site are not included in this number.
7. The external sewerage servicing strategy is summarised as follows:
   a. **Stage 1** – The existing 914 mm diameter trunk sewer to South Caboolture STP requires augmentation. The final size of the augmentation will be determined based on the needs of the full catchment. For the purposes of this study a 900 mm diameter duplication has been proposed.
   b. **Stage 2** – New short term pumping station and 900m of 150 mm diameter rising main delivering sewerage into the existing 375 mm sewer on Dobson Lane. This will provide between **1,200 and 2,000 EP** (up to 25 L/s) to start the Caboolture West development.
   c. **Stage 3** – Stop the diversion into Dobson Lane and start diverting flows 3.6km to Serenity Way, joining to the 610 mm diameter sewer. Sizing of this rising main will be dependent on the rate of growth in Caboolture West and the potential to temporarily not meet Unitywater design standards and ferric dose the sewage. From the assumptions adopted within this study a 375 mm diameter rising main is proposed. Additional discharge is proposed to be obtained for the purposes of reducing detention times obtained by reversing flows in the Stage 2 150 mm sewer in Dobson Lane such that the upstream catchment of the original discharge point is diverted to the Caboolture West pump station.
   d. **Stage 4** – The existing 610 mm and 762 mm diameter sewer could potentially allow up to **8,000 EP** from Caboolture West. However, the rate of development from other areas will require monitoring. South Caboolture STP capacity is likely to be exceeded by 2021. Therefore the diversion to the new Redcliffe STP will need to occur before 2021, before the South Caboolture STP reaches capacity or once 8,000 EP is exceeded

e. **Stage 5** – Divert all flows to the new Redcliffe STP, initially via a single 750 mm main to the existing Burpengary STP site from which point further redirection of flow to Redcliffe will be required.

f. **Stage 5b** – Divert additional flows from South Caboolture STP to the new Redcliffe STP via the rising main to Burpengary. This will supplement flows in the rising main until Caboolture West and Morayfield Burpengary produce enough flow to maintain healthy flows conditions.

g. **Stage 6** – Duplicate the 375 mm diameter main from Caboolture west with a 525 mm diameter main to provide additional capacity from Caboolture West to the 750 mm diameter main.

h. **Stage 7** - Replace the original 375 mm diameter main with a 525 mm diameter main providing two 525 mm diameter mains and the pumps require upsizing.

i. **Stage 8** – Provide a second 750 mm diameter main to Burpengary East STP with associated pump upgrades, this is predicted to be after 2034

8. A significant number of assumptions have been made in regard to uplift factors and contingencies in the development of cost estimates for Caboolture West water supply and sewerage infrastructure. All costing assumptions are provided within **Section 2.3** of this report. **Section 5** of this report includes a discussion of some of the issues related to the assumptions used with the potential to impact both infrastructure plans and cost estimates developed in this report.

9. A summary of cost estimation outcomes is provided in **Table E1.**

Table E1: Caboolture West Infrastructure Cost Estimate Summary

Water Network Infrastructure	Cost	Cost / EP
Water Trunk Mains	$158,193,585	$2,066
Major Valves and Fittings	$7,414,915	$97
Water Pump Stations	$7,414,915	$97
Reservoirs	$28,836,122	$377
Other	$801,000	$10
Total Water Trunk Infrastructure	**$202,660,537**	**$2,647**
Donated/Reticulation Water Assets	**$149,118,092**	**$1,948**
Total Water Assets	**$351,778,629**	**$4,595**
Sewerage Infrastructure	**Cost**	**Cost / EP**
Gravity Trunk Mains	$57,251,953	$748
Rising Mains	$92,848,342	$1,213
Sewage Pump Stations	$52,113,227	$681
Sewage Treatment Plant Upgrades	$99,563,616	$1,300
Total Sewerage Trunk Infrastructure	**$301,777,138**	**$3,941**
Donated/Reticulation Sewerage Assets	**$192,041,907**	**$2,508**
Total Sewerage Assets	**$493,819,045**	**$6,450**
Total Infrastructure	**Cost**	**Cost / EP**
Total Trunk Infrastructure	**$504,437,675**	**$6,588**
Total Donated/Reticulation Assets	**$341,159,999**	**$4,456**
All Assets	**$845,597,674**	**$11,045**

10. A number of other considerations relating to the servicing of Caboolture West with water supply and sewerage infrastructure that are not specifically addressed within this technical report are discussed in **Section 9** of this report. Theses consideration are as follows:

a. Alignment with strategic framework (including alignment with re-use and irrigation strategies and final regional sewerage servicing and treatment strategies)
b. Issues surrounding diverse land holding
c. Infrastructure corridors and resource entitlements
d. Mechanisms for provision of infrastructure
e. Relevance for SEQWater.

Recommendations from this assessment are as follows:

1. The infrastructure plans contained within this report have been developed based on a number of assumptions. Changes to the base information adopted in this assessment are likely over the life of the Caboolture West development. Future changes have the potential to impact these infrastructure plans. It is recommended that this be understood and considered in using the infrastructure plans and/or costing contained within this report for decision making purposes. Future revisions of the infrastructure plans are also recommended as new and updated information becomes available.
2. A significant assumption in the development of the infrastructure plans is connection to the NPI as the water supply source. Discussion with LinkWater/Seqwater is recommended to secure approval for this connection.
3. The interim water supply strategy, which involves the provision of 2,200 EP from the Morayfield HLZ, increases the criticality of both the Morayfield HLZ pump station and the 375 mm diameter supply main in Tinney Road. As a result the criticality of these assets is increased during the period of interim supply. It is recommended asset maintenance plans for both assets are developed. It is recommended the asset maintenance plans ensure the 375 mm diameter main is accessible for regular inspection. It is also recommended that risk management plans are developed including the development of an operational contingency plan for implementation in the event of failure. Currently this option does not meet Unitywater standards of service due to insufficient storage.
4. As part of the interim supply solution, an emergency connection to the Morayfield LLZ via the Morayfield West reservoirs is recommended. The connection will only be required to provide supply under emergency conditions. Water quality may be a concern at this location due to the infrequency of use and it is recommended the setup of the connection be developed to minimise water quality concerns. Development of a plan to exercise this connection to ensure its operation when required is also recommended.
5. The alignment of the external rising mains used to convey sewage away from the Caboolture West development have been proposed to enable greatest interaction and use of interim capacity in the existing sewage collection network. The alignment also enables flexibility to temporarily take flows from the existing network to promote healthy flow conditions within the rising mains. The alignment will require the construction of two large pipes and may not be possible. Assessment into this alignment is recommended along with actions toward securing a proposed alignment. For the purposes of this study, the external rising main pipe alignments presented should be taken as indicative only for the purposes of establishing likely lengths and estimated costs.
6. This assessment assumes treatment of flows at a new Redcliffe STP will be required once capacity of the existing South Caboolture STP is reached. Within this study external infrastructure assessment has been limited to the delivery of sewage flows as far as the site of the existing Burpengary East STP. Sewage delivered to this point will require further redirection to the Redcliffe STP. The report proposes a rising main system for the transfer of sewage to the Burpengary East site. It is recommended that in future assessment, the vertical alignment of this main be assessed and options for full gravity transfer (deep sewers) or partial gravity transfer (with lift stations) be investigated due to the potential operational and operational cost advantages that maximising gravity transfer can provide. Should a rising main be implemented it is recommended that options for ensuring pipe full flow be identified. One such option may be the installation of a barometric loop at the Redcliffe STP and/or the Burpengary East transfer site.
7. This assessment assumes transfer of Ultimate sewage to the Redcliffe STP in line with the Unitywater TSS. It is recommended that as regional planning is undertaken and a preferred

option and strategy for the transfer of flows from Burpengary East STP and or South Caboolture STP is identified, the outcomes of this report are revisited.

8. The infrastructure and costs associated with the ongoing transfer of sewage from the Burpengary East site to the new Redcliffe STP do not form part of this study. It is recommended that the infrastructure costs associated with this ongoing transfer are developed by Unitywater and their impacts on Caboolture West be understood and incorporated into the outcomes of this study. Significant technical assessments are likely required in identifying a preferred transfer strategy and associated infrastructure sizes and costs.
9. Transfer of sewage for treatment to the Redcliffe STP may potentially involve construction of an ocean outfall. No allowance for ocean outfall costs and their potential impacts on Caboolture West have been made within this study. As any ocean outfall requirements are understood it is recommended that the outcomes of this report are revisited.
10. The rate of growth of external developments such as Morayfield Burpengary LPA have the potential to impact the timing of external sewage infrastructure requirements. It is recommended that the outcomes of this report are revised if updated information regarding other external developments becomes available.
11. It is recommended that in progressing the water supply and sewerage infrastructure plans for Caboolture West the following issues (discussed in Chapter 9) are further considered:
    a. Alignment with strategic framework (including alignment with re-use and irrigation strategies and long term regional sewerage servicing strategy).
    b. Issues surrounding diverse land holding
    c. Infrastructure corridors and resource entitlements
    d. Mechanisms for provision of infrastructure
    e. Relevance for SEQWater.

Unitywater

Caboolture West Interim Supply and Sewerage Infrastructure Plans

CONTENTS

LIST OF TABLES

APPENDICES

1 Introduction

Caboolture West is located within Moreton Bay Region Council (MBRC) to the west of existing development in Caboolture and Morayfield and approximately 5 km west of the Caboolture district centre. The Caboolture West investigation area is approximately 2350 ha in area and is bounded by the D'Aguilar Highway to the north, Caboolture River Road to the south and Caboolture City to the east.

The Caboolture West area was first considered for urban development in the mid 1980's in a draft strategic plan for the Caboolture Shire Council and is now recognised as an identified growth area within the South East Queensland Regional Plan. The Caboolture West Area was declared a master planned area on 17 February 2012. In response to the progression of Caboolture West as a development area MBRC require Unitywater to develop a water supply and sewerage infrastructure plans for the area. MWH have been commissioned by Unitywater to these infrastructure plans for Ultimate development.

The Ultimate plans involve a significant amount of large and expensive infrastructure, in particular related to sourcing and storing water supply from the Northern Pipeline Interconnector (NPI) and the transfer of raw sewage from the site to the Burpengary East Sewage Treatment Plant (STP). MBRC has since provided a revised land use plan, development extent and sequencing plan for Caboolture West. Within this assessment the Ultimate water supply and sewerage plans will be reassessed based on the updated land use plan. Trunk infrastructure will also be timing in five (5) year planning horizons based on the sequencing plan provided by MBRC.

To enable the early stages of the development to progress without investing in the ultimate infrastructure, MBRC have requested that Unitywater investigate opportunities to provide interim water and sewage services to the area. Unitywater have also commissioned MWH to investigate options for interim water supply and sewage servicing plans for Caboolture West. This report details the results and technical outcomes of this interim servicing assessment.

With MBRC in the process of developing a structure plan for Caboolture West, updated and evolving information will become available with the potential for significant impact on the Ultimate water supply and sewerage infrastructure plans presented in this report. The infrastructure plans presented in this report are up-to-date as of 26 October 2013 and based on the assumptions outlined in this report. A number of iterative updates to the Ultimate water supply and sewerage infrastructure plans presented in this report are likely to be required over the structure plan development period.

This report sets out the philosophy, process, assumptions and methodologies used for the development of Ultimate benchmark infrastructure solutions for servicing the Caboolture West investigation area with water supply and sewerage. The scenarios developed are considered to be benchmark as they reflect current best practice traditional servicing strategies. That is, they reflect current legislation and aim to ensure water supply and sewerage service are supplied in the most efficient manner. This approach provides a benchmark for other scenarios (e.g. third pipe, stormwater harvesting) to be measured against.

2 Scope

The scope of this assessment involves two components as follows:

1. Developed an updated Ultimate infrastructure plan to accommodate the new land use plan for Caboolture West. Timing is to be provided to internal trunk infrastructure in 5 year planning horizons to accommodate the sequencing plan provided by MBRC.

2. Develop preferred interim servicing options for water supply and sewerage to accommodate servicing early stages of the Caboolture West development through utilising any available capacity in the existing water supply and sewerage networks.

In order to develop interim servicing options for Caboolture West the following tasks were undertaken:

- Development of Caboolture West water supply and sewerage demands and flows for each planning horizon based on landuse and job projections for the area supplied by MBRC;
- Updated information for the staging and sequencing of development of the Morayfield Burpengary LGA has recently become available. As these demands impact the interim servicing options for Caboolture West; water supply and sewerage demands and flows were also derived for each planning horizon for Morayfield Burpengary, based on EP figures and staging information supplied by MBRC;
- Review of existing water supply and sewage networks and identification of potential connection points;
- Assessment of the capacity of the existing network at the identified connection points to service Caboolture West;
- Quantification of any existing capacity (storage and pump stations) within the existing network;
- Development of internal trunk infrastructure requirements to utilise the spare capacity of the existing water supply and sewerage networks keeping consistency with the ultimate planning for the development;
- Preparation of cost estimates for infrastructure upgrades;
- Preparation of an interim servicing plan report for Caboolture West.

3 Population Assessment

In order to assess the trunk infrastructure requirements for Caboolture West it was necessary to develop the demand in conjunction with the projected growth in the Morayfield Burpengary LGA; given the options to supply from the same source especially in the initial stages of development. This section describes the development of the EP and staging for each area.

3.1 Caboolture West LGA

The latest landuse and staging years for the Caboolture West development was supplied by MBRC in GIS format (Caboolture_West_Landuse_Plan_Grid_100m_October_2013_Draft.lyr). The development plan is based on 100m^2 (1 Ha) blocks and the geographical distribution is shown in **Figure A1** of **Appendix A.**

The adopted development densities as supplied by MBRC (Staging_Years_and_Geographic_Catchments_Grid_EP Staging.xlsx) are shown in **Table 3-1** below and are in line with "Caboolture Planning Scheme Policy 22 - Water Supply and Sewerage Infrastructure Contributions".

In order to convert these values into water supply and sewerage Equivalent Persons (EPs) the following factors were also adopted in line with the "Caboolture Planning Scheme Policy 22 Water Supply and Sewerage Infrastructure Contributions" document:

- Jobs (industrial, office, commercial) : 0.25 EP / Job
- Schools / Students: 0.21 EP / student[1]

Table 3-1: Adopted Development Densities

Area Type	Residential Development		Non-Residential Development		
	Dwellings/Ha	Occupancy rate	Jobs/ Ha	Home Jobs/ Ha	Dispersed jobs / Ha
Centre Neighbourhood	-	-	93	-	-
Enterprise & Employment	-	-	22	0.0	-
Enterprise Local	-	-	28	-	-
Green Space	-	-	0	-	-
High School	-	-	17	-	-
Local Centre	-	-	93	-	-
Next Generation Suburban Neighbourhood	20.0	2.7	-	1.4	0.7
Rural Living	1.6	2.7	-	0.1	0.1
Specialised Centre	-	-	44	0.0	-
Schools Primary	-	-	12	-	-
Sports & Recreation	-	-	-	-	-
TAFE	-	-	10	-	-
Town Centre	-	-	191	-	-
Town Centre E & E	-	-	28	-	-
Town Centre Residential	60.0	2.0	-	4.2	1.4
Urban Neighbourhood	30.0	2.3	-	2.1	0.6

[1] Based on the estimated number of students for Caboolture West (16,882 students), an EP conversion factor of 0.21 EP/student results in a demand contribution of 3,545 EP. Therefore, the demand for Caboolture West is estimated at 89.8% residential and 10.2% non-residential. In recent studies including development of the Unitywater northern region demand model, lower EP/student factors have been applied in the order of 0.1 EP/student. Applying the lower value the total demand drops by approximately 1,850 EP resulting in demand of approximately 92.0% residential and 8.0% non-residential. For consistency with the other adopted factors from the Caboolture Planning Scheme Policy and due to the relatively low impact of the factor on total demands the 0.21 EP/student factor was retained.

From this data an EP value was developed in GIS for each 100m grid**. Table 3-2** shows the resultant EP breakdown for each landuse type for each planning horizon.

Table 3-2: Water and Sewerage EP and Staging for Caboolture West

Area Type	No of Grid Squares (Ha)	Planning Horizon									
		2011	2016	2021	2026	2031	2036	2041	2046	2051	Ultimate
Centre Neighbourhood	8	0	23	47	93	116	116	163	186	186	186
Enterprise & Employment	114	0	0	0	0	77	226	374	490	627	627
Enterprise Local	17	0	0	56	56	56	56	56	119	119	119
Green Space	867	0	0	0	0	0	0	0	0	0	0
High School	25	0	0	575	575	575	575	1,198	1,198	1,198	1,198
Local Centre	20	0	47	116	186	256	256	395	395	465	465
Next Generation Suburban Neighbourhood	971	709	4,471	10,523	21,047	31,897	35,387	44,274	49,291	52,944	52,944
Rural Living	60	79	87	140	149	153	153	153	249	262	262
Specialised Centre	40	0	0	0	0	99	198	297	308	440	440
Schools Primary	54	0	249	704	994	1,243	1,243	1,740	1,989	2,237	2,237
Sports & Recreation	279	0	0	0	0	0	0	0	0	0	0
TAFE	9	0	0	0	0	0	134	401	401	401	401
Town Centre	29	0	0	0	0	430	621	812	907	1,051	1,385
Town Centre E & E	9	0	0	0	0	21	63	63	63	63	63
Town Centre Residential	58	0	0	0	0	1,335	2,671	4,006	5,342	6,677	7,041
Urban Neighbourhood	132	0	13,24	2,439	4,738	5,922	6,062	7,734	8,709	9,197	9,197
Total Residential	**N/A**	**779**	**5,826**	**12,975**	**25,683**	**38,927**	**43,840**	**55,618**	**62,967**	**68,402**	**68,761**
Total Non-Residential	**N/A**	**8**	**375**	**1,625**	**2,155**	**3,254**	**3,919**	**6,048**	**6,679**	**7,465**	**7,804**
TOTAL	**2,692**	**787**	**6,201**	**14,600**	**27,838**	**42,181**	**47,759**	**61,666**	**69,646**	**75,867**	**76,565**

3.2 Morayfield Burpengary LPA

The Landuse and Ultimate EP projections for Morayfield Burpengary were provided by MBRC on 11 October 2013 and were adopted for the development of water supply and sewerage demand projections for this area. The information supplied by MBRC is summarised in **Table 3-3.**

Indications of the growth rate, sequencing and distribution of development across the Morayfield Burpengary site was provided by MBRC on 11 October 2013. This distribution of development is reflected in **Figure A2** which shows the Ultimate Concept Plan and Early Release Areas. The EP growth plan for each planning horizon is shown in **Table 3-3** and has been developed based on the information supplied by MBRC which is summarised as follows:

- Minimal take-up for the period up until 2016 (essentially 0);
- Approximately 120-130 dwellings per annum for the period 2016-2026;
- Approximately 320 dwellings per annum beyond 2026.
- Early Release Areas 85 Ha of Areas A and B (see **Figure A2** of **Appendix A**) to be developed first and will be required by 2021
- Following the above, the order of priority for development of the MBLPA is as follows:
    - Remainder of areas A, B and C followed by D and E followed by F to N as long term requirement.

Conversion of the development rate from a dwelling/year rate to EP was undertaken using an average factor of 2.43 EP / dwelling based on the conversion factors supplied by MBRC and listed below. An assumption that 1/3 of dwellings will be attached was used, in line with MBRC assumptions for the area.

- Detached dwelling : 2.7 EP / dwelling
- Attached dwelling : 1.7 EP / dwelling

Table 3-3: MBRC Supplied Landuse and EP Data for Morayfield Burpengary

Deve lop-ment Area	Area (Ha)	Develop-ment Type	Persons (EP)									
			2016	2021	2026	2031	2036	2041	2046	2051	2056	Ultimate
A	89.3	Medium Density	0	1,915	3,831	5,031	5,031	5,031	5,031	5,031	5,031	5,031
B	15.9	Medium Density	0	299	598	598	598	598	598	598	598	598
C	43.4	Medium Density	0	0	0	2,039	2,039	2,039	2,039	2,039	2,039	2,039
D	106.1	Medium Density	0	0	0	274	2,168	3,985	3,985	3,985	3,985	3,985
E	70.4	Medium Density	0	0	0	274	2,167	3,305	3,305	3,305	3,305	3,305
F	23.7	Local Centre	0	0	0	0	0	416	1,781	1,781	1,781	1,781
G	23.6	Local Centre	0	0	0	0	0	0	177	718	1,259	1,773
H	28.4	Medium Density	0	0	0	0	0	416	1,599	1,599	1,599	1,599
I	30.4	Medium Density	0	0	0	0	0	0	177	718	1,259	1,712
J	33.1	Low Density	0	0	0	0	0	0	177	718	1,259	934
K	35.4	Low Density	0	0	0	0	0	0	177	718	1,259	998
L	67	Low Density	0	0	0	0	0	0	177	718	1,259	1,889
M	87.1	Low Density	0	0	0	0	0	0	177	718	1,259	2,455
N	84.8	Low Density	0	0	0	0	0	0	177	718	1,259	2,388
TOTAL	738.6			**2,214**	**4,429**	**8,216**	**12,003**	**15,790**	**19,577**	**23,364**	**27,151**	**30,487**

3.3 Summary of Population Growth

Table 3-4 summarises the population growth rate for Caboolture West and Morayfield Burpengary Local Growth Areas.

Table 3-4: Summary of Population (EP) Growth Rates for both LGAs^^

Planning Horizon	Caboolture West	Morayfield Burpengary
2011	787	
2016	6,201	
2021	14,600	2,214
2026	27,838	4,429
2031	42,181	8,216
2036	47,759	12,003
2041	61,666	15,790
2046	69,646	19,577
2051	75,867	23,364
2056	76,374	27,151
Ultimate	76,565	30,487

^^ Base information for development of EP demand and timing for Caboolture West and Morayfield Burpengary was provided by Moreton Bay Regional Council (MBRC).

4 Technical Assumptions

The technical assumptions and standards of service adopted for assessment of the water supply and sewerage infrastructure requirements for Caboolture West are provided within this section of the report.

4.1 Water Supply

4.1.1 Demand Development

Water supply demands for Caboolture West and Morayfield Burpengary were developed based on the SEQ standards of service for new developments (SEQ Water Supply and Sewerage Design & Construction Code – Design Criteria, July 2013). The criteria relevant to this study are as follows:

- Average Day Consumption
    - Average Day (AD) consumption : 230 L/EP/day
    - Non-revenue water (NRW) : 30 L/EP/day
    - Total AD demand : 260 L/EP/day
- Peaking factors were applied to the consumption component of the AD demand only. The NRW component was maintained as a 30 L/EP/day base flow.
    - Residential
        - Mean Day Maximum Month (MDMM) :1.5 x AD
        - Maximum Day (MD) : 2 x AD
        - Maximum Hour (MH) : 4 x AD

    It is noted that the peaking factor for Low and Medium density housing has been adopted for all residences as this is the worst case peaking factor.
    - Non-residential
        - Mean Day Maximum Month (MDMM) : 1.5 x AD
        - Maximum Day (MD) : 2 x AD
        - Maximum Hour (MH) : 2.8 x AD

    It is noted that the worst case peaking factor was adopted for all residential areas.

Demand outcomes are provided within Section 5 of this report.

4.1.2 Standards of Service for Infrastructure Performance

Standard of service for sizing the water supply network were generally adopted from the SEQ Code Planning Guidelines for water supply (Jan 2013). A summary of the standards relevant to this assessment are provided in **Table 4-1**.

Table 4-1: Water Supply Performance Based Standards of Service

Water Network Parameter	Desired Level of Service
Minimum Pressure at Property Boundary	22 m
Maximum Pressure at Property Boundary	55 m
Maximum Velocity	2.5 m/s

Water Network Parameter	Desired Level of Service
Reservoir Emergency Storage	Greater of 4 hrs at MDMM or 0.5 ML
Pump Station Serving Ground Level Reservoir	MDMM in 20 hours + equivalent standby capacity
Maximum Mains Headloss	5m/km for DN<=150 3m/km for DN>=200
Reservoir Supply Main Capacity	MDMM in 20 hours
Hazen Williams Friction Factors	<= 150 mm : c = 100 >150 to 300 mm : c = 110 > 300 mm : c = 120

4.2 Sewerage

4.2.1 Demand Development

Sewerage loading for Caboolture West and Morayfield Burpengary were developed based on the SEQ standards of service for new developments (SEQ Water Supply and Sewerage Design & Construction Code – Design Criteria, Jan 2013). The criteria relevant to this study are as follows:

- Average Day Consumption
  - Average Dry Weather Flow (ADWF): 210 L/EP/day
- Peaking factors were applied to the ADWF as follows:
  - Peak Dry Weather Flow (PDWF) = 4.7 x $(EP)^{-0.105}$ x ADWF
  - Peak Wet Weather Flow (PWWF) = 5 x ADWF

4.2.2 Standards of Service for Infrastructure Performance

Standard of service for sizing the sewerage network were generally adopted from the SEQ Code Planning Guidelines for water supply. A summary of the standards relevant to this assessment are provided in **Table 4-2.**

Table 4-2: Sewerage Infrastructure Performance Based Standards of Service

Sewer Network Parameter	Desired Level of Service
Minimum Grade	See Table 4-3
Minimum Scour Velocity (Gravity Sewers)	0.7 m/s @ PDWF
Maximum Velocity (Gravity Sewers)	3.0 m/s
Minimum Velocity (Rising Mains)	0.75 m/s
Maximum Velocity (Rising Mains)	3.0 m/s
Design Depth of Pipes	75% d @ PWWF
Friction Coefficient for manning's 'n'	0.0128
Hazen Williams Coefficient for rising mains	120
Single pump capacity	ADWF x 15 x $(EP)^{-0.1587}$

Pump Arrangement	Duty – Assist

Table 4-3: Sewerage Gravity Mains Minimum Slope

Nominal Bore (mm)	Slope
100	House Connection Branch, one allotment only at 1:60
150	House connection Branch and/or sewers for first 10 allotments: 1:100 Sewer after first 10 allotments 1:180 (see Note 1)
225	1:300
300	1:400
375	1:550
450	1:700
525	1:750
600	1:900
675	1:1,050
750	1:1,200
825	1:1,380
900	1:1,600
1,050	1:2,000
1,200	1:2,400
1,350	1:2,800
1,500	1:3,250
1,650	1:3,700
1,800	1:4,200

Note 1 – where approved by the Water Agency, DN 150 main line sewers may be laid at 1:200 in Canal Developments together with a Water Agency agreed reduction in the minimum PDWF Velocity Criteria for the DN 150 main line sewer

The external sewage collection strategy contained within this report assumes initial collection of sewage from Caboolture West to the South Caboolture STP with sewage ultimately delivered to a new STP at Redcliffe. Assessment of external sewerage infrastructure requirements has been limited to delivery of sewage from Caboolture West as far as the existing Burpengary East STP site. Flow is expected to be redirected to the new Redcliffe STP site in the future.

Regional sewerage infrastructure planning is required to develop a region wide strategy and preferred option for the transfer of sewage from Burpengay East STP and potentially the South Caboolture STP to the new Redcliffe STP.

Infrastructure and cost allowance has not been provided within this report for the ongoing transfer of sewage beyond the existing Burpengary East STP site to the proposed new Redcliffe STP.

4.3 Costing Assumptions

Assumptions used in the development of cost estimates are provided within this Section. Cost estimation outcomes are provided later within this report**.**

Unit rates contained with the report “Valuation of Water and Sewerage Assets (GHD; 2009)” previously provided by Unitywater were used as the base point for the majority of cost estimates. A CPI uplift factor, geology uplift factor, contingency factor and on-cost factor were added to all cost estimates. The costing assumptions adopted are detailed below.

4.3.1 General Assumptions

- Unit rates are assumed to be inclusive of construction and re-instatement costs.

- A conservative CPI uplift factor or 3% per annum was assigned to all unit rate estimates resulting in uplift to unit rates of 12.6% to reflect assumed 2013 rates.
- The geological uplift factors contained within the unit rates report were applied to all buried assets. Much of the soil within the Caboolture West development is located on relatively flat land below 30m elevation. This flat land has been assumed to be Light Soil, given the numerous watercourses in the vicinity being associated with alluvial deposits. Areas above 30m in elevation have been assumed to be variable soil for costing purposes, as the slopes of these areas is steeper and less conducive to alluvial deposits. The minimum elevation on the site is above 5 m AHD, meaning no acid sulphate soils are expected. Uplift factors were applied as follows:
    - Light Soil – 0%
    - Variable Soil – 40%
    - Rock – 80%
- An on-cost factor of 20% has been assumed based on recommendations within the unit rates report. A breakdown of the assumptions made in determining the on-cost factor is as follows:
    - Planning Costs – 4%
    - Survey – 3%
    - Geotechnical – 1%
    - Design – 4%
    - Project Management – 3%
    - Construction Supervision – 4%
    - As Constructed – 1%
    - TOTAL – 20%
- A contingency factor of 40% has been adopted for cost estimate purposes based on the high level nature of the planning and the low level of confidence in the currently available land use and demand data.
- Land acquisition costs have not been estimated.
- No ongoing operational and/or maintenance costs have been developed.
- Limited assessment of construction methodology has been undertaken at this level. As further information becomes available on sections of land not to be disturbed, alignments can be confirmed along with construction techniques and pipe material requirements. To allow for the requirement of trenchless construction through environmentally sensitive areas, creeks and existing roads, and the associated additional cost, a 10% uplift factor is applied to all pipe assets.

4.3.2 Specific Assumptions

- Hydrants have been assumed every 80 m on water reticulation mains
- Manholes have been assumed every 100 m on sewer gravity mains
- The depth matrix provided in **Table 4-4** has been used to assign depth uplift factors to sewer gravity mains.
- Allowances for section valves, air valves and scour valves have been made for all water trunk mains and sewer rising mains inclusive of a pit or chamber.
- Allowances for buried sections valves have been made for the water reticulation network
- Telemetry units and SCADA programming has been allowed for all facility sites such as pump stations and reservoirs. Telemetry units and SCADA programming has also been assumed at all PRV and flow meter locations.

- The following material types have been adopted for water supply assets:
  - Mains <= 250 mm diameter : PN16 PVC
  - Mains > 250 mm diameter : DICL PN35
- The following material types have been adopted for sewerage assets:
  - Mains <= 250 mm diameter : HDPE PN16
  - Mains >250 mm diameter : DICACL PN35
  - Rising mains : HDPE PN16
- Pump station cost estimates are inclusive of pipework and equipment, mechanical and electrical, telemetry and superstructure costs as well as wet well volumes for sewerage pump stations. For the large terminal pump station costs have been estimate based on estimates produced for comparable sized pump stations such as L1 and SPS36 in the Unitywater northern sewage network.
- Reservoir capital cost estimates have been undertaken based on the following curve equation taken from the adopted unit rates:
  - Reservoir cost = 438640 x Volume$^{0.72}$
- An estimate for the required upgrade to sewage treatment facilities required to cater for Caboolture West has been made. Based on information provided by Unitywater treatment planning section an allowance $1300 / EP has been made for sewage treatment to align with outcomes of previous studies and similar developments.
- The connection to the NPI has been assumed as $4 Million. This is based on advice from SEQWater provided in November 2012 in relation to the possible connection to the NPI to supply the Caloundra South development on the Sunshine Coast. The cost is inclusive of a large tee connection and significant valving and associated pits at the connection point.

Table 4-4: Gravity Sewer Depth Factor Matrix

Depth (m)	Diameter (mm)									
	100	200	300	400	500	600	700	800	900	1000
0 - 1.5	0	0	0	0	NA	NA	NA	NA	NA	NA
1.5 – 3.0	0.15	0.12	0.07	0.03	0	0	0	0	0	NA
3.0 – 4.5	3.41	1.22	0.75	0.4	0.31	0.22	0.19	0.15	0.13	0.11
4.5 +	4.94	2.3	1.43	0.84	0.61	0.45	0.37	0.31	0.26	0.22

4.3.3 Donated / Reticulation Assets Cost Assumptions

Water supply and sewerage reticulation asset requirements were not hydraulically assessed. However, for cost estimation purposes, an estimate on the expected cost of reticulation assets per hectare was undertaken. A sample area within the Northlakes development was selected as a donor area and an average statistics for water supply and sewerage assets per hectare was identified. Assessment was limited to water supply pipes up to and including 300 mm diameter mains and sewerage pipes up to and including 225 mm diameter mains. An estimated cost per hectare for water supply and sewerage reticulation assets was developed and applied to the Caboolture West development. The donated reticulation asset costs used are contained within **Table B3** and **Table B4** of **Appendix B**.

The assessment of reticulation assets within Northlakes identified a high dominance of 100 mm and 150 mm diameter mains with a very low portion of mains between 200 and 300 mm diameter. Due to the assumption that the Caboolture Water supply network will be setup and operated in a DMA configuration, water mains of reasonable size will be required immediately downstream of the DMA inlet. To account for this, 30% of the identified total length of 100 mm and 150 mm diameter mains

was re-assigned across the 200, 250 and 300 mm diameter mains at a ratio of 15%, 10% and 5% respectively.

No pipe-depth uplift factor has been assumed for donated assets, as it has been assumed that these pipes at the upper end of the water and sewer networks will be near surface level.

5 Demand Outcomes

Table 5-1 summaries the water supply demand and sewerage flows for the Caboolture West development based on the demand and standards of service assumptions discussed in **Section 4**. **Table 5-2** shows these values for the Morayfield Burpengary LGA.

For future cost apportionment purposes the EP associated with both the Caboolture West and Morayfield Burpengary LPA are provided per planning horizon along with the demand of existing infrastructure catchments such as the Morayfield and Elimbah reservoirs and the South Caboolture STP.

Table 5-1: Water Supply Demand and Sewerage Flow Summary for Caboolture West

Year	Water Supply				Sewerage		
	AD L/s	MDMM L/s	MD L/s	MH L/s	ADWF L/s	PDWF L/s	PWWF L/s
2011	2.4	3.4	4.5	8.6	1.9	4.5	9.6
2016	18.7	26.9	35.2	67.0	15.1	28.3	75.4
2021	43.9	63.4	82.8	155.3	35.5	60.9	177.4
2026	83.8	120.8	157.9	299.2	67.7	108.6	338.3
2031	126.9	183.1	239.2	453.4	102.5	157.5	512.6
2036	143.7	207.3	270.9	512.6	116.1	176.0	580.4
2041	185.6	267.6	349.7	658.7	149.9	221.3	749.4
2046	209.6	302.3	395.0	744.4	169.3	246.7	846.4
2051	228.3	329.3	430.3	810.3	184.4	266.3	922.0
2056	229.8	331.5	433.1	815.4	185.6	267.9	928.2
Ultimate	230.4	332.3	434.2	816.9	186.1	268.5	930.5

Table 5-2: Water Supply Demand and Sewerage Flow Summary for Morayfield Burpengary

Year	Water Supply				Sewerage		
	AD L/s	MDMM L/s	MD L/s	MH L/s	ADWF L/s	PDWF L/s	PWWF L/s
2011	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-
2021	6.7	9.6	12.6	24.3	5.4	11.3	26.9
2026	13.3	19.2	25.1	48.7	10.8	21.0	53.8
2031	24.7	35.7	46.6	90.3	20.0	36.4	99.8
2036	36.1	52.1	68.1	132.0	29.2	51.1	145.9
2041	47.5	68.5	89.5	173.6	38.4	65.4	191.9
2046	58.9	85.0	111.0	215.3	47.6	79.2	237.9
2051	70.3	101.4	132.5	256.9	56.8	92.8	283.9
2056	81.7	117.8	154.0	298.5	66.0	106.2	330.0
Ultimate	91.7	132.3	172.9	335.2	74.1	117.8	370.5

6 Water Supply Network Assessment

6.1 Introduction

Previous review of the Caboolture water supply network identified that there are no mains local to the development in the Unitywater network which have sufficient capacity to service the Ultimate Caboolture West demands without significant upgrade. In addition, significant storage upgrades would be required to existing Caboolture water storages such as Elimbah and Morayfield Reservoir if connection from the existing network was to be considered for servicing the development permanently.

Direct connection to the NPI has been identified as the preferred ultimate source of supply to the Caboolture West Development. The following sections of this report investigate the timing of the requirement to connect to the NPI and the interim infrastructure options to service development until this time and the internal infrastructure requirements for servicing Caboolture West at ultimate development.

The interim servicing strategy is developed first as it influences the timing and sizing of the Ultimate infrastructure.

6.2 Interim Water Supply Servicing Strategy

In order to assess interim connection opportunities for the Caboolture West development and their available capacity it was necessary to assess the impact of the development in conjunction with the development of the Morayfield Burpengary growth area. An existing network capacity and infrastructure assessment was undertaken using Unitywater's Caboolture water supply network hydraulic model.

6.2.1 Interim Water Supply Servicing Options

The existing water supply network was assessed in order to identify potential connection points. Given that the staging of the development starts from the south east corner of the site (See **Figure A1**) a number of locations were identified as potential connection points for interim servicing of Caboolture West. These options are listed below. An assessment of options is provided in Section 6.2.3. A discussion of options and identification of a preferred option is provided within Section 6.2.5:

The options identified for assessment are as follows:

- **Option 1** - The 375 mm main running along Tinney Road. This location provides connection to the Morayfield HLZ serviced from the Morayfield HLZ pump station which receives supply from the Morayfield reservoir. Details are shown in in **Figure A3**.
    - **Option 1a** – current operation
    - **Option 1b** – upgrade of the Morayfield HLZ pump station

- **Option 2** - The 450 mm main running along Walkers Road. This location provides connection to the Morayfield West DMA serviced from the Morayfield zone reservoir. Details are shown in in **Figure A4**.
    - **Option 2a** – current operation
    - **Option 2b** – small extension to the Morayfield HLZ to include some Morayfield West properties

- **Option 3^^** – The 200 mm main running along Caboolture River Road. This location provides a connection to the Bellmere DMA zone. Details of this option are shown in in **Figure A5**.
    - **Option 3a** – current operation
    - **Option 3b** – with local boosting

- **Option 4^^** – The 450 mm main running along Hewitt Road. This location provides a connection to the Caboolture Central DMA zone serviced from Elimbah Reservoir. This option has been included to address the possibility of development of the Industrial Area (Enterprise, Specialised

Centre and Rural land-uses) ahead of the development plan if required. Details are shown in in **Figure A6**.
  - **Option 4a** – current operation
  - **Option 4b** – with Elimbah trunk main upgrades

- **Option 5** – Servicing the area directly from the NPI from the initial stages. This may be achieved in two ways:
  - **Option 5a** – Servicing from the NPI via a PRV (unlikely to be acceptable to Seqwater);
  - **Option 5b** – Servicing from the NPI via a ground-level local storage

  Details are shown in in **Figure A7**.

^^ The connection points for Options 3 and 4 currently receive supply from the Morayfield reservoirs. Future planning involves supply to these connection points from the Elimbah reservoir. Options 3 and 4 are not viable under current operation until trunk supply to these potential connection points from Elimbah reservoir is established. Providing trunk supply from the Elimbah reservoir will require significant water supply trunk main upgrades and may not be constructed for a number of years. Therefore options 3 and 4 are not expected to be available as options in the timeframes required.

6.2.2 Interim Water Supply Storage Assessment

A dedicated reservoir storage is ultimately proposed for Caboolture West area. A potential reservoir site has been identified at 234 Jackson Road and is the assumed ultimate location for this assessment (refer to Caboolture West Ultimate Water Supply and Sewerage Infrastructure Plans - Revision 1, MWH Nov 2013). The location is shown in **Figure A3**.

Based on the SEQ Design Standards the required storages at each development horizon for Caboolture West are shown in **Table 6-1**. **Table 6-1** also shows the available storage for interim supply options Morayfield Reservoir (Options 1 & 2) and Elimbah Reservoir (Options 3 & 4 only in future). It can be seen that based on the current Standards of Service for storage requirement; there is no available capacity in the existing supply network in these zones.

Table 6-1: Reservoir Storage Requirements and Available Storage

Year	Population of Caboolture West (EP)	Required Reservoir Capacity of Caboolture West (ML)	Available reservoir capacity after servicing the existing reservoir service area (ML)[1]	
			Morayfield Reservoir	Elimbah Reservoir
2011	787	0.9	-2.9	-0.2
2016	6,201	3.5	-5.8	-2.5
2021	14,600	7.7	-9.0	-5.2
2026	27,838	14.1	-12.2	-6.7
2031	42,181	21.2	-16.0	-7.9
2036	47,759	23.9		
2041	61,666	30.7		
2046	69,646	34.6		
2051	75,867	37.7		
Ultimate	76,565	38.0		

1: Note that available reservoir capacity assessment is only available to 2031

6.2.3 Review of Existing Water Supply Network Capacity

The identified options were tested using the Caboolture Hydraulic water supply model. For each option the infrastructure was tested at 1,000 EP increments. **Table 6-2** summarises the results of this assessment for each option. Further discussion follows below Table 6-2. Each option is shown geographically in **Figures A3** to **A7** contained within **Appendix A**. **Figures A3** to **A7** also provide a commentary of each option and their service capacities.

Table 6-2: Caboolture West Interim Servicing Options Assessment Summary

Interim Option	Connection Description	Supply Zone	Reservoir	Upgrade Requirements	Service EP	HGL in Supply (m)	Max. Service Elevation $(m)_1$	Reservoir Storage Requirements (ML)	Notes
1a	Connection to 375 mm diameter main at Tinney Road	Morayfield HLZ	Morayfield Reservoir	200 m of 375 mm diameter main along Tinney Road to development boundary with required security connection to Morayfield LLZ for security of supply	2,200	69	42	1.6	**DSS Failure - Morayfield Reservoir Storage. Supply directly from Morayfield HLZ without storage.**
1b			Morayfield Reservoir	200 m of 375 mm diameter main along Tinney Road with required security connection to Morayfield LLZ for security of supply **plus** upgrade to MFHLZ pump station to 220 L/s @ 35 m head.	11,000	69	42	5.9	
2a	Connection to 450 mm diameter main at Caboolture River Road	Morayfield West DMA	Morayfield Reservoir	750 m of 300 mm diameter main along Caboolture River Road	1,000	50	23	1.0	
2b			Morayfield Reservoir	750 m of 300 mm diameter main along Caboolture River Road **plus** a small extension to Morayfield HLZ to include some Morayfield West DMA Properties	2,900	50	23	1.9	**DSS Failure - Morayfield Reservoir Storage**
3a^^	Connection to 200 mm diameter main at Bellmere Road	Bellmere DMA	Morayfield – current Elimbah - future	Connection at site boundary. Requires Elimbah trunk main upgrades^^.	0	61	34	N/A	**No Capacity - Not Assessed Further**
3b^^				Localised boosting to area south of Bellmere Road (~ 50 L/s @ 10 m head) Requires Elimbah trunk main upgrades^^.	4,000	61	34	2.5	**DSS Failure of Reservoir Storage – both Morayfield reservoir current and Elimbah reservoir in future.**
4a^^	Connection to 450 mm diameter main at	Caboolture Central DMA	Morayfield – current Elimbah - future	**(Service of Northern Industrial Area only)** 900 m of 300 mm diameter main from Hewitt Road.	0	58	31	N/A	**No Capacity - Not Assessed Further**

Interim Option	Connection Description	Supply Zone	Reservoir	Upgrade Requirements	Service EP	HGL in Supply (m)	Max. Service Elevation $(m)_1$	Reservoir Storage Requirements (ML)	Notes
4b^^	Hewitt Road			Requires Elimbah trunk main upgrades^^. 900 m of 300 mm diameter main from Hewitt Road. Requires Elimbah trunk main upgrades^^.	5,000	58	31	3.0	Option only applicable to service north eastern industrial area. Not applicable to early development stages. **DSS Failure of Reservoir Storage – both Morayfield reservoir current and Elimbah reservoir in future.**
5a	Connection to the NPI	N/A	N/A	Direct connection with PRV	50,000 (approx.)	70	43	N/A	Option Unacceptable – No Storage and direct demand from the NPI.
5b		N/A	N/A	Direct connection with interim storage (approx. 5.5 ML)	10,000	45	23	5.5	**DSS Satisfied**

1: Service Elevation = HGL – 22m (DSS requirement) – 5m (allowance for headloss)

^^ The connection points for Options 3 and 4 currently receive supply from the Morayfield reservoirs. Future planning involves supply to these connection points from the Elimbah reservoir. Options 3 and 4 are not viable under current operation until trunk supply to these potential connection points from Elimbah reservoir is established. Providing trunk supply from the Elimbah reservoir will require significant water supply trunk main upgrades and may not be constructed for a number of years. Upgrades are also costly. Therefore options 3 and 4 are not expected to be available as options in the timeframes required.

Proposed Elimbah trunk main upgrades:

- 3,900 m of 450 mm diameter trunk main
- 1,600 m of 600 mm diameter trunk main
- 1,900 m of 375 mm diameter trunk main

6.2.4 Interim Water Supply Options Cost Estimates

Estimates of cost for each identified option were derived (excluding those which did not provide any capacity). **Table 6-3** below summarises the results of this assessment. The detailed cost breakdown is contained in **Table B1** of **Appendix B**.

Table 6-3: Caboolture West Interim Water Supply Options Cost Estimate Summary

Interim Option	Upgrade Requirements	Service EP	External Trunk Mains	Major Fittings & Valves	Pump Station	Reservoirs	Other Costs	Total Cost
1a	200 m of 375 mm diameter main along Tinney Road + emergency connection to Morayfield LLZ	2,200	$527,103	-	-	-	-	**$527,103**
1b	200 m of 375 mm diameter main along Tinney Road, emergency connection to Morayfield LLZ **plus** upgrade to MFHLZ pump station (220 L/s @ 35 m head)	11,000	$527,103	-	$1,684,100	-	-	**$2,211,203**
2a	750 m of 300 mm diameter main along Caboolture River Road	1,000	$861,054	-	-	-	-	**$861,054**
2b	750 m of 300 mm diameter main along Caboolture River Road **plus** a small extension to Morayfield HLZ to include some Morayfield West Properties	2,900	$861,054	-	-	-	-	**$861,054**
3b	Localised boosting to area south of Bellmere Road (~ 50 L/s @ 10 m head) **plus** Elimbah trunk main upgrades	4,000	$6,200,000	-	$130,400	-	-	**$6,330,400**
4b	**(Service of Northern Industrial Area only)** 900 m of 300 mm diameter main from Hewitt Road **plus** Elimbah trunk main upgrades	5,000	$7,193,662	-	-			**$7,193,662**
5a	Direct connection with PRV	~50,000	$1,144,966	$79,327	-	-	$5,000,000	**$6,224,293**
5b	Direct connection with interim storage (approx. 5.5 ML)	10,000	$5,273,690	-	-	$6,400,939	$5,000,000	**$16,674,629**

Notes:
1: Cost of Elimbah trunk main upgrades (preferred option from Elimbah Trunk Main Upgrade Strategy) not yet implemented – estimated at $6.2 Million.
2: Cost Estimate for NPI connection. Based on survey cost estimation for connection of the NPI at the Nambour Showgrounds. The estimate was provided by SEQWater for the previous cost estimation of a connection to the NPI for the Caloundra South development (email received 9 Nov 2012 – estimate of $3.6 M). Estimate includes major valving and pits, tee connection, on-costs and contingency).

6.2.5 Preferred Interim Water Supply Option Discussion

The preferred option for interim supply to Caboolture West incorporates a stepped approach. A discussion into the selection of the preferred option follows the below preferred option description:

Preferred Interim Staging Approach:

- **Stage 1: timing @ 1 EP - Option 1a** – connection to 375 mm diameter main at Tinney Road from the Morayfield HLZ. This Stage 1 connection enables service up to a 42 m elevation contour due to delivery of HGL from the Morayfield HLZ pump station. 2,200 EP can be delivered to the Caboolture West boundary from the Tinney Road connection before significant external network upgrade is required in the form of the Morayfield HLZ pump station. This option does breach standards of service for storage. Additionally this option does rely entirely on the 375mm diameter main in Tinney Road for supply Caboolture West. Both issues create risk and will require monitoring and management by Unitywater. An emergency connection to Caboolture West from the Morayfield LLZ is proposed to provide a level of security of supply (although at a reduced pressure operational pressure likely below 22 m residual pressure). This option will allow initial development to occur up to 2,200 EP without significant infrastructure investment. Details are shown in **Figure A3.**

- **Stage 2: timing @ 2,201 EP - Option 5b** – once 2,200 EP has been reached, Connection to the NPI with interim storage of 5.5 ML is the preferred option. This option will service up to approximately 10,000 EP up to a service elevation of 25 mAHD. All properties originally serviced as part of the initial 2,200 EP are to be switched over to be supplied by the interim 5.5 ML reservoir. This will provide a magnitude of demand for reservoir turnover and will return the 2,200 EP capacities back to the existing network. Details are shown in **Figure A7.**

- **10,001 EP (by 2018 Planning Horizon) – Ultimate Servicing Strategy** (See Section 6.3).

The above described preferred interim option approach is recommended for the following reasons:

- The risk of delivering supply to Caboolture West from the 375 mm diameter Morayfield HLZ main beyond 2200 EP (as in Option 5b) is considered to carry too much risk to the continuity of supply to Caboolture West customers. With increasing demand the ability of the proposed emergency connection to the Morayfield LLZ to provide the necessary backup supply in the event of failure of the Morayfield HLZ pump station or the 375 mm diameter supply main is reduced. Failure of either the upgraded Morayfield HLZ pump station or the 375 mm diameter HLZ supply main would immediately result in up to 11,000 EP without water if Option 5b was to be adopted. It is envisaged that the interim risk of supplying Caboolture West from the Morayfield HLZ for a period of 2 years up to 2,200 EP can be managed by Unitywater though development of risk management or contingency plans and asset management plans for the Morayfield HLZ pump station and 375 mm diameter supply main in Tinney Road, The construction of an emergency connection to the Morayfield LLZ also provides security against failure although at a reduced level of service. Due to the increased consequence of failure as more customers in Caboolture West are connected, it is not recommended that this system supply beyond 2200 EP.

- **Option 2** - According to the Caboolture hydraulic model, the HGL in supply from option 2a or 2b is limited to approximately 50 m HGL enabling only properties below 23 m to be serviced. Though discussions with Unitywater low pressures complaints have been received in the Morayfield West DMA and as a response the Morayfield reservoir is operated at near top water level for the majority of the time. This field evidence indicates the existing network supplying properties in Morayfield West DMA is at capacity and cannot carry the additional demand of early stages of Caboolture West.

- **Option 3** - Supply through the 200 mm diameter main in Bellmere Road will require the installation of a booster pump station to service early stages of the development. The connection point is also a number of kilometres from the area of initial development in Caboolture West and would require a significant length of water main to convey water to the required location. Due to the immediate requirement for a booster pump station and the

distance from the required location of development this option was not considered preferable to Option 1a. Additionally, Option 3 is not expected to be available in the timeframe required for interim servicing of Caboolture West. Bellmere DMA is currently serviced from the Morayfield reservoir and supply in the current arrangement is not viable. Future planning is for significant trunk main upgrades to enable supply to this area to enable supply from Elimbah reservoir. The main upgrades are not expected for completion until beyond the interim servicing timeframe.

- **Option 4** is located a significant distance from the required location and requires trunk main upgrades from the Elimbah reservoir to enable any capacity for supply Caboolture West. The Elimbah trunk main upgrades are not expected for completion for a number of years. Therefore this option in not viable for supply to early stages. If industrial development to the northeast of the Caboolture West development is to be accelerated in the future this connection point may provide an option for initial supply.

- **Option 5a** which involves direct connection to the NPI via a pressure reduced supply is not considered acceptable option. The option would not provide any storage to Caboolture West customers and any temporary shut down or maintenance on the NPI would leave customers without water. It is also understood that SEQWater require all connections to the NPI to be reservoir buffered so that flows in the NPI are not subject to diurnal usage profiles of customers.

Issues related to the preferred option are as follows:

- Risk - The criticality of both the Morayfield HLZ pump station and the 375 mm diameter HLZ supply main assets is increased as a result on their reliance to deliver interim supply to Caboolture West. It is recommended that:
    - Asset maintenance plans are development suitable to the criticality of both assets. Regular condition inspections of the 375 mm diameter main are recommended. As part of the asset maintenance plans it is recommended that Unitywater review the accessibility of the main to ensure all sections can be accessed.
    - Risk management plans including operational contingency plans are developed detailing operational actions required under failure scenarios.
    - An emergency connection to the Morayfield West DMA (LLZ pressure) is constructed. In the event of failure of either the Morayfield HLZ pump station of the 375 mm diameter supply main this connection is to provide a backup supply. The pressure in supply is not expected to meet customer standards of service but will be sufficient to maintain water supply to all customers at a positive pressure. Unitywater will need to manage water quality and the potential for slugs of old water through this connection if required for use. The connection point has been proposed as a tee from an existing supply main rather than as connection from an existing dead end main for the purposed of trying to limit water quality risks.
- The interim reservoir only requires a small design life in the order of 5 to 10 years. Therefore a construction design and materials matching this design life requirement is sufficient. For the purpose of this assessment the interim reservoir has been costed based on permanent reservoir rates. A temporary reservoir is likely to provide some cost savings.
- To ensure water turnover in the reservoir the 2200 EP initially serviced from the Morayfield HLZ connection are to be transferred for supply from the interim reservoir on constructed. The 2200 EP capacity can then be returned for development in the existing network.
- The deficiency in storage at the Morayfield reservoir is not the major risk associated with this option. The greater risk identified is associated with the failure of either the Morayfield HLZ pump station or the 375 mm diameter Tinney Road supply main. Available supply to the Morayfield reservoir from the NPI is capable of maintaining levels in the Morayfield reservoir over consecutive days of maximum day demand.

6.3 Ultimate Water Supply Servicing Strategy

6.3.1 Ultimate Servicing Options

The Caboolture water supply network was initially reviewed for alternative connection points to Caboolture West from Unitywater owned trunk mains. No significant sized mains toward the west of the existing Caboolture water supply network to facility connection and supply of Ultimate demands to Caboolture West. Additionally significant storage upgrades would be required to existing Caboolture water storages such as Elimbah and Morayfield if connection from the existing network was to occur. Direct connection to the NPI was identified as the preferred development connection and source of supply to Caboolture West.

The NPI has been assumed to have a minimum operating HGL of 70m. Based on the a dedicated supply to Caboolture West from the NPI the Caboolture West Ultimate network was developed as a standalone system with no connection to the existing Caboolture water supply network.

6.3.2 Ultimate Storage & Pump Capacity Assessment

Dedicated reservoir storage is proposed for the Caboolture West network reservoir. The Caboolture West investigation area increases quickly in elevation toward the west of the site. The majority of the site is at an elevation between 10 and 40 mAHD with the maximum elevation within the area designated by the new land use plan being approximately 65 mAHD. To service the areas of high elevation within Caboolture West a reservoir with a TWL of approximately 95 mAHD with the ability to service a maximum contour of approximately 65 mAHD when providing allowance for some headloss is proposed.

A potential reservoir site has been identified at 234 Jackson Road (according to supplied DCDB) and is the assumed location for this assessment. The lot provides a number of cleared sections of land as possible sites, it is of appropriate elevation and it is accessible via Jackson Road. Some earthworks will be required due to the slope of land at the site. The proposed reservoir location is shown in **Figure A1** of **Appendix A**. Based on the SEQ Design Standards the required storage for Caboolture West at ultimate development is 38 ML (see **Table 6-1)**.

A dedicated bulk supply main from the NPI to the Caboolture West reservoir is proposed. Locating a pump station on this main to boost supply to the reservoir location is therefore required. During periods of low demand in the NPI it may be possible for the supply to be delivered to the Caboolture West reservoir without pumping however, **Table 6-1** shows that the required pump capacity under SEQ Design standards is 399 L/s plus the equivalent stand-by capacity.

There are opportunities to stage the development of the water supply reservoir and pump capacity. Investment in 20 ML of storage by the 2021 planning horizon would allow the deferment of an additional 20 ML of storage until the 2031 Planning Horizon. The deferment of the second reservoir to 2031 will also provide benefits in regard to water quality and reservoir turnover.

Staged construction of the ultimate pump station size is also proposed to enable deferment of expenditure. A supply pump station with a capacity of 220 l/s of capacity (plus equivalent standby capacity) is proposed to service the reservoir up to the 2031 Planning Horizon. Upgrade of this pump station to meet the ultimate flow requirement of 400 l/s is proposed at this 2031. Staging is discussed in more detail in **Section 6.4**.

Table 6-4: Reservoir Storage & Pump Capacity Requirements

Year	Population (EP)			Demand (ML/d)			Required Reservoir Capacity (ML)	Required Pump Capacity (L/s)
	Res-idential	Non-Res	Total	AD	MDMM	MD		
2011	780	8	787	0.2	0.3	0.4	N/A[1]	N/A[1]
2016	5,825	375	6,201	1.6	2.3	3.0	N/A[1]	N/A[1]
2021	12,975	1,625	14,600	3.8	5.5	7.2	7.7	76
2026	25,683	2,155	27,838	7.2	10.4	13.6	14.1	145
2031	38,926	3,254	42,181	11.0	15.8	20.7	21.2	220
2036	43,840	3,919	47,759	12.4	17.9	23.4	23.9	249
2041	55,618	6,048	61,666	16.0	23.1	30.2	30.7	321
2046	62,967	6,679	69,646	18.1	26.1	34.1	34.6	363
2051	68,401	7,465	75,867	19.7	28.4	37.2	37.7	395
Ultimate	68,761	7,804	76,565	19.9	28.7	37.5	38.0	399

1. Booster Pump not required until 2021 horizon as area can be serviced from the temporary storage without boosting.

6.3.3 Ultimate Water Supply Network Assessment

All water customers within the Caboolture West investigation area will ultimately receive supply from the Caboolture West reservoir described above. The trunk distribution network has been developed based on the following concepts:

- At least one water supply trunk main delivering water supply to the centre of each neighbourhood area.
- Maximising looped trunk supply through the development to for operational, water quality and security benefits.

A H_2OMAP water supply model of the network was developed for the purposes of sizing the Caboolture West water supply network. Demand junctions were assigned at a neighbourhood level.

For infrastructure identification purposes it is assumed that the Caboolture West water supply network will operate in district metering areas (DMAs) or pressure management areas (PMAs). An average size of 3000 properties has been assumed for each DMA/PMA. It is therefore assumed the Caboolture West waters supply network will operate in 9 DMA/PMA. No assessment into the development of DMA or PMA boundaries has been undertaken as part of this study. A number of DMA/PMA inlet locations have been indicatively represented in **Figure A8**. A target maximum pressure of 60m in provided within the SEQ Standards of Service. Therefore, PMA inlets servicing customers at an elevation of <40 m include a PRV to allow pressure management.

The proposed Caboolture West water supply network is shown geographically in **Figure A8** of **Appendix A**. The proposed infrastructure sizes for the water supply assets are provided in **Table B2** of **Appendix B** and can be linked to **Figure A8** through the ID reference.

6.4 Water Infrastructure Staging

As discussed in **Section 6.2**, the preferred strategy for interim servicing of Caboolture West is to service the first 2,200 EP from the Morayfield HLZ and then up to 10,000 EP via a connection from the NPI with the provision of approximately 5.5 ML of temporary storage at an elevation of 45 mAHD.

Once the development extends above 25 mAHD (approx. 10,000EP) storage is required to be at the final reservoir location as shown in **Figure A8** of **Appendix A**.

The staging of the proposed Caboolture West water supply network is shown geographically in **Figure A9** of **Appendix A**. The staging of the water major infrastructure for Caboolture West is summarised as follows:

- **2016 Planning Horizon (6,200 EP)**
  - **1 EP** – connection to 375 mm diameter main at Tinney Road from the Morayfield HLZ.
  - **2,201 EP** – connection to the NPI with interim storage of 5.5 ML at 45 mAHD
  - Reticulation, and trunk infrastructure to service 2016 development extent
- **2021 Planning Horizon (14,600 EP)**
  - **10,001 EP** – First 20 ML storage reservoir at final location required, pump station with 50% of final capacity (duty at 220 L/s plus standby)
  - Reticulation, and trunk infrastructure to service 2021 development extent
- **2026 Planning Horizon (27,800 EP)** –additional reticulation and trunk infrastructure to service 2026 development extent
- **2031 Planning Horizon (42,200 EP)** – Second 20 ML storage reservoir at final location, duplication of pumps at pump station with final capacity (duty at 400 L/s plus standby) and additional reticulation and trunk mains to service 2031 development extent.
- **2036 Planning Horizon to Ultimate (76,565 EP)** – Additional trunk mains and reticulation to service development extent at each horizon.

6.5 Water Infrastructure Cost Estimates

The cost assumptions discussed in **Section 4.3** were used in conjunction with the staging assumptions described above to develop the costs for the water infrastructure for Caboolture West. The proposed water supply infrastructure sizing, materials and staging are provided in **Table B1** of **Appendix B** and can be linked to the geographical location using **Figure A8** through the ID reference. **Table 6-5** below summarises these costs. Cost estimates are summarised into 5 year planning horizons based on development timing provided by MBRC. **Table B1** provides infrastructure triggers for interim infrastructure. This is particularly of interest for 2016 infrastructure Table 6-5 presents the majority of the interim infrastructure as the 2016, and using **Table B1** the estimate can be broken down based on development growth expressed in EP.

Table 6-5: Summary of Water Supply Infrastructure Costs

Year	Trunk Mains	Major Valves and Fittings	Pump Station	Reservoirs	Other Costs^	Reticulation (Donated Assets)	Total
2016	$94,217,542	$5,452,107		$6,400,939	$88,900	$13,610,014	**$119,769,502**
2021	$1,078,751	$361,227	$4,005,691	$12,446,570	$88,900	$14,824,986	**$32,806,125**
2026	$51,982,136	$535,750			$88,900	$25,781,568	**$78,388,354**
2031	$0	$0	$3,409,224	$9,988,613	$88,900	$27,934,544	**$41,421,281**
2036	$5,160,487	$163,340			$88,900	$10,864,402	**$16,277,129**
2041	$3,381,667	$0			$88,900	$27,085,147	**$30,555,714**
2046	$297,728	$197,887			$88,900	$15,542,093	**$16,126,608**
2051	$0	$0			$88,900	$12,115,035	**$12,203,935**
2056	$2,075,275	$139,975			$88,900	$1,360,302	**$3,664,452**
Total	**$158,193,585**	**$6,850,287**	**$7,414,915**	**$28,836,122**	**$800,100**	**$149,118,092**	**$351,213,101**

^ Other costs are related to SCADA programming and setup (DMAs inlets, reservoirs and pump stations) and Water quality and chlorination facilities.

7 Sewage Network Assessment

7.1 Introduction

The Caboolture West development area is to the West of Caboolture. The sewage treatment plants available to treat sewage are in South Caboolture to the East and Burpengary to the South East.

It has been assumed that, sewage from the Caboolture West development will ultimately be transferred to a new STP at Redcliffe. It has been assumed initial flows from Caboolture West will be treated at South Caboolture STP. Within this study treatment at a new Redcliffe STP has been assumed once the capacity of the Caboolture STP is reached. However, assessment of external sewerage transfer infrastructure has been limited to the conveyance of the sewage only as far as the Burpengary East STP site. Further re-direction of sewage with additional large trunk sewerage infrastructure will be required for the ongoing transfer of flows to Redcliffe STP.

Previous studies had assumed an onsite STP. The decision to convey sewage to a new Redcliffe STP has been communicated by Unitywater to be part of the regional sewage treatment services strategy (TSS). This decision has been based on an operational and cost preference to minimise the number of STPs across the Unitywater network.

Due to the significant cost of this ultimate infrastructure interim collection options have also been assessed. South Caboolture STP with planned upgrades can treat up to 80,000 EP, approximately 20,000 EP above what it is currently treating. However, the planned Elimbah Industrial area, Lakeside development and growth within the Caboolture catchment is expected to require all of the projected available capacity and more.

For this study, although sewerage will ultimately be treated at the new Redcliffe STP, the external sewage infrastructure requirements have been assessed only as far as conveyance to the site of the existing Burpengary East STP.

The external sewerage collection strategy and the internal sewage network are developed within this section of the report. The external/interim servicing strategy is discussed first as it may influence the internal networks.

7.2 Interim/External Sewerage Servicing Strategy

In order to determine the staging for each of the upgrades necessary to transfer sewage from the Caboolture West development it was necessary to account for the growth across the areas of Caboolture, Elimbah, Lakeside and Morayfield Burpengary. Doing this provides the best information available as to the likely timing requirement for upgrades. Table 7-1 provides details of the catchment growth with the numbers highlighted in red where the capacity limit of South Caboolture STP (assumed 80,000 EP) is exceeded. The table indicates by 2021 the area currently serviced by South Caboolture STP, the Elimbah development and the Lakeview development which have priority to discharge to South Caboolture STP will use all available capacity. **Figure A10** of **Appendix A** shows the EP growth for the identified growth areas.

Table 7-1: Catchment and Development Demands

Catchment /Capacity	2011 (EP)	2016 (EP)	2021 (EP)	2031 (EP)	Ultimate (2050) (EP)
Caboolture, current service area of South Caboolture within PIA	59,057	67,386	76,202	82,704	84,655
Elimbah	0	2,940	5,880	5,880	5,880
Lakeview	0	1,700	1,700	1,700	1,700
Caboolture West	0	6,201	14,600	42,181	76,565
Morayfield Burpengary	0	0	2,214	8,216	30,487
Total	59,057	76,527	98,896	138,981	197,587

Caboolture South STP	59,057	76,527	80,000	80,000	80,000
Transfer Required	0	0	16,814	>50,397	>107,052

7.2.1 Review of Existing Network Capacity

The existing network has some additional capacity based on the 5 x ADWF assessments for South Caboolture. As the Caboolture West development is located west of the upstream areas of the catchment there are no large trunk sewers close to the site. The closest trunk sewer is a 375 mm diameter trunk sewer approximately 900 m from the site. This sewer remains at this diameter for approximately 3.6km before increasing to larger trunk sewers.

The 375 mm diameter trunk sewer starting 900 m from the south eastern corner of the Caboolture West site has been deemed the only realistic point within the existing catchment to which the early stages of Caboolture West could drain.

Figure A11 provides the current spare capacity in sewage mains from the Caboolture West connection point to the South Caboolture STP.

7.2.1.1 914 mm Diameter Trunk Sewer to South Caboolture STP

Upgrade of the existing 900 mm diameter trunk gravity sewer used to deliver flow to SPS MF01 is proposed within this study. The 900 mm diameter gravity main in question receives flow from a significant catchment area. PWWF (5 x ADWF) modelling of the catchment has identified operating depths within the main are expected to approach a full pipe flow at some locations. The sewerage standards of service contained within the SEQ Code recommend a maximum depth of flow of 0.75 x pipe diameter. Upgrade of this gravity main has been recommended based on both the modelling outcomes and anecdotal field evidence. Through discussion with Unitywater staff it is understood that the 900 mm diameter gravity main has a history of real capacity issues, and concerns exist over the performance of this main. The model is not calibrated against real in sewer data and therefore true catchment characteristics may not be reflected in the model and real PWWF inflows have the potential to be higher than the modelled 5 x ADWF. To accept any sewage flow from Caboolture West duplication of this main with a second 900 main has been proposed within this study. Site surveys and further capacity assessment of this main are recommended which may involve flow gauging and model calibration.

The upgrade of the 914 mm diameter sewer to South Caboolture STP is required before any further development can drain into the catchment.

7.2.1.2 The Upper Reaches

Assuming the 914 mm diameter trunk is augmented the upper reaches of the catchment do have a small amount of available capacity. The gravity sewer in question is 375 mm diameter and allows total flows of around 100 L/s. Assuming Unitywater design standards of 75% pipe full an additional 1,200 EP could be drained into the upper end of the trunk sewer, increasing to approximately 2,000 EP at pipe full.

7.2.1.3 Trunk Sewer Mid-Section

Approximately 3.6km downstream of the Caboolture West development area the trunk sewer increase to 610 mm then up to 762 mm diameter before combining with the rest of the catchment in the 914 mm diameter trunk. This section based on 5 x ADWF was identified to have an additional spare capacity in the short term for an additional 7,000 - 8,000 EP (75% or 100% pipe full).

7.2.1.4 South Caboolture STP

South Caboolture STP has a small amount of existing capacity (Table 7-1). Unitywater plan to increase capacity of the South Caboolture STP to 80,000 EP. However, with developments planned within and to the north of the existing South Caboolture PIA required to drain to South Caboolture STP the spare capacity will be short lived. It is estimated that by 2021 there will be no spare capacity and all flows from the Caboolture West Development and Morayfield Burpengary will need to be discharged to a different STP.

7.2.2 External Sewerage Transfer Strategy – Preferred Strategy

To provide wastewater drainage for Caboolture West several stages have been devised to utilise the available existing capacity and maximise the lifespan of new infrastructure. Overall there are eight stages to the process, each of which are described below and presented in **Table 7-2** and **Figure A12** and **Figure A13** of **Appendix A**.

- **Stage 1** – The existing 914 mm diameter trunk sewer along Buchanan Road to South Caboolture STP requires augmentation. The final size of the augmentation will be determined based on the needs of the full catchment. For the purposes of this study a 900 mm diameter duplication has been proposed (Figure A12, augmentation ID "G_Stg_1-1).
- **Stage 2** – New short term pumping station and 900m of 150 mm diameter rising main delivering sewage into the existing 375 mm sewer on Dobson Lane. This will provide between **1,200** and **2,000 EP** (up to 25 L/s) to start the Caboolture West development (Figure A12, augmentation ID "RM_Stg_2-1).
- **Stage 3** – Stop the diversion into Dobson Lane and start diverting flows 3.6km to Serenity Way, joining to the 610 mm diameter sewer. Sizing of this rising main will be dependent on the rate of growth in Caboolture West and the potential to temporarily not meet Unitywater design standards and ferric dose the sewage. From the assumptions adopted within this study a 375 mm diameter rising main is proposed. Additional discharge is proposed to be obtained for the purposes of reducing detention times obtained by reversing flows in the Stage 2 150 mm sewer in Dobson Lane such that the upstream catchment of the original discharge point is diverted to the Caboolture West pump station (Figure A12, augmentation ID "RM_Stg_4-1).
- **Stage 4** – The existing 610 mm and 762 mm diameter sewer could potentially allow up to **8,000 EP** from Caboolture West. However, the rate of development from other areas will require monitoring. South Caboolture STP capacity is likely to be exceeded by 2021. Therefore the diversion to the new Redcliffe STP will need to occur before 2021, before the STP reaches capacity or once **8,000 EP** is exceeded
- **Stage 5** – Divert all flows to the new Redcliffe STP, initially via a single 750 mm main as far as the existing Burpengary STP site from where further re-direction of flows to the Redcliffe STP will be necessary (Figure A12, augmentation ID "RM_Stg_5-1).
- **Stage 5b** – Divert additional flows from South Caboolture STP to the Burpengary main to supplement flows until Caboolture West and Morayfield Burpengary produce enough flow to maintain healthy flows within the rising main. The diversion would be for between 18,000 and 21,000 EP. However, as this adds flexibility to how the network is operated the 450 mm rising main required may be sized differently should it be required to support or reduce flows to South Caboolture in the longer term (Figure A12, augmentation ID "RM_Stg_5-2).
- **Stage 6** – Duplicate the 375 mm diameter main from Caboolture west with a 525 mm diameter main to provide additional capacity from Caboolture West to the 750 mm diameter main (Figure A12, augmentation ID "RM_Stg_6-1).
- **Stage 7** – Replace the 375 mm diameter rising main with a 525 mm diameter rising main, twining the 525 mm diameter sewers. The pumping station will also require upsizing (Figure A12, augmentation ID "RM_Stg_7-1).
- **Stage 8** – Provide a second 750 mm diameter main to Burpengary East STP site, this is predicted to be around 2036. The pumping station will also require augmenting (Figure A12, augmentation ID "RM_Stg_8-1).

The proposed external servicing plan described above is provided below in **Table 7-2** in tabular format providing infrastructure details and serviceable EP.

Table 7-2: Caboolture West External Sewage Transfer Strategy

Interim Stage	Discharge Description	Location	Upgrade Requirement	Serviceable (EP)	Diameter (mm)	Length (m)	Pump (L/s)	Total Head (m)	Pump (kW)
1 2016	No available capacity in the existing system.	Behind Buchanan Road – South Caboolture STP	Augmentation of the existing 914 mm gravity sewer	0	900 Gravity	1,350	-	-	-
2 2016	Initial connection to the existing system	Caboolture West site to Dobson Lane	New rising main and pumping station	1,200	150 Rising Main	900	15	10	3
3 2016	Increase flows from 75% pipe full to 100%	Caboolture West site to Dobson Lane	Utilise infrastructure from Stage 2 and increase pump flow	2,000	150 Rising Main	-	25	22	8
4 2016	Connect to 610 mm Gravity Sewer & reverse 150 mm main	Caboolture West site to behind Serenity Way	New rising main and upgraded pumping station	7,000 – 8,000	375 Rising Main	3600	Use 182	43	117
5 2021	Disconnect at Serenity Way and extend to Burpengary STP	Caboolture to Burpengary	New Rising main and Pumping station	8,000 – 55,000	750 Rising Main	10,420	668	51	517
5b 2021	Connect South Caboolture STP to the new 750 mm main (5)	South Caboolture STP to Serenity Way	New Rising main and Pumping station	18,000 – 21,000	450 Rising Main	4,090	255	30	115
6 2026	The growth of Caboolture West requires additional rising main capacity	Caboolture West site to behind Serenity Way	New 525 mm rising main to augment the 375 mm and pumping station augmentation	15,000 – 40,000	525 Rising Main	3600	486	46	341
7 2036	The growth of Caboolture West required the replacement and enlargement of the 375 mm sewer	Caboolture West site to behind Serenity Way	New 525 mm rising main replacing the 375 mm rising main and pumping station augmentation	40,000 (80,000, with its twin, stage 6)	525 Rising Main	3600	486	46	341
8 2036	Growth form Caboolture West and Morayfield Burpengary requires a second main	Caboolture to Burpengary	New rising main and pumping station augmentation	55,000 (110,000 with its twin, stage 5)	750 Rising Main	10,420	668	51	517

7.2.3 Discussion of External Sewage Transfer Strategy

The alignment of the sewerage rising mains from Caboolture West to the Burpengary East STP has been preliminarily selected to enable the best use of spare capacity in the existing network and to enable future interaction between the networks such that flexibility is provided to enable the existing network to contribute to flows in the rising mains such that required flow conditions are met. A significant easement will be required to locate two large diameter pipes. An assessment into alignment options will be required. Should the proposed alignment or similar not be possible, locating the rising main further to the south away from development may be required. A more southern alignment may impact the opportunities to utilise the capacity of the existing network on an interim basis and manage flows between assets to ensure healthy flow conditions.

The external sewage collection strategy is based on the assumption that all flows should be drained into the existing network where possible at the earliest opportunity. However, for the initial 1,000 to 2,000 EP it may be worth investigating the provision of storage and the tankering of flows until a more permanent option is available.

The operational cost of long and large rising mains can be significant. The option of gravity mains and a small number of lift stations could be of benefit to investigate as this could provide a better long term solution to servicing the catchment, particularly if the vertical profile of the rising main proves problematic and the rising main cannot be kept full at all times. The installation of a barometric loop at the rising main discharge point is also worth investigation if it enables the rising main to operate full and under pressure at all times.

7.3 Internal Sewerage Collection Strategy

Sewerage catchments and the sewerage gravity network were developed based on the topography of the Caboolture West investigation area. The network was developed to minimise pumping and maximise the extent of the gravity network. 20 sewage catchments were identified, as shown in **Figure A12** of **Appendix A**. Each catchment was given an ID matching the Sewer Point receiving flow from that catchment. The topography of the site facilitates collection of sewerage west to east. To limit sewage pumping station requirements trunk gravity mains generally follow water courses and are located in low lying areas to facility delivery of sewage to these trunk mains via gravity. Alignments avoid critical habitat where possible, however, as much of the critical habitat follows creek banks and is also located in the low lying areas similar to the proposed trunk sewers, future assessment will likely be required into sewerage alignments and construction techniques to minimise disruption.

The size and alignment of sewerage gravity mains were generally developed on a point to point basis using contours and natural grade of the land. Where gravity mains were identified to cross creeks and or hills in between the points identified further assessment was undertaken. The maximum depth of sewer was generally maintained shallower than 5 m depth. Creek crossing were assessed on an individual basis considering the width of the crossing, and the slope of the creek banks. For the purpose of this assessment it was assumed the small creeks or gullies rarely carrying water could be crossed at grade. Rising mains were selected for a number of the major creek crossings.

Crossing of some major creeks was unavoidable. Major creek crossings include RM02 (SPS02), RM03 and RM04 (SPS04). The rising mains that connects the terminal pump station (SPS01) to the Burpengary East STP has been discussed above in the external servicing strategy.

For infrastructure sizing purposes, sewage flows were allocated to the gravity trunk mains through geospatial queries identifying catchment demands. Flows were then assigned to the upstream ends of pipes from the contributing catchment area and sized based on the manning's equation using a spread sheet model.

For large internal gravity mains, internal rising mains and pump stations infrastructure has been staged where beneficial in order for the network to operate more effectively in regard to minimum flows and self cleansing velocities and appropriate sizing. Stage assets are generally located toward the downstream of the network where the greater Ultimate flows are experienced.

The proposed Caboolture West sewerage network is shown geographically in **Figure A12** and **Figure A13** of **Appendix A**. Proposed infrastructure sizes for the proposed sewerage assets are provided in **Table B2** of **Appendix B** and can be linked to the **Figure A12** through the ID reference.

7.4 Sewerage Infrastructure Cost Estimates

The cost assumptions discussed in **Section 4.3** were used in conjunction with the staging assumptions described above to develop the costs for the sewerage infrastructure for Caboolture West. The proposed sewerage infrastructure sizing, materials and staging are provided in **Table B2** of **Appendix B** and can be linked to the geographical location using **Figure A12** through the ID reference. Table 7-3 below summarises these costs. Cost estimates are summarised into 5 year planning horizons based on development timing provided by MBRC. **Table B2** provides infrastructure triggers for external infrastructure. This is particularly of interest for 2016 infrastructure as **Table 7-3** presents the majority of the external infrastructure as 2016 and through using **Table B2** the 2016 estimate can be broken down based on development growth expressed in EP.

Table 7-3: Summary of Sewerage Infrastructure Costs

Year	Gravity Main Infra-structure	Rising Main Infra-structure	Pump Station	Reticulation (Donated Assets)	STP Upgrade	Total
2016	$12,724,683	$4,878,835	$4,704,563	$17,527,672		**$39,835,753**
2021	$5,795,001	$46,545,247	$25,381,855	$19,092,375	$12,445,452	**$109,259,931**
2026	$14,537,241	$0	$0	$33,202,823	$12,445,452	**$60,185,516**
2031	$10,887,918	$6,999,901	$9,371,478	$35,975,535	$12,445,452	**$75,680,285**
2036	$689,419	$0	$0	$13,991,733	$12,445,452	**$27,126,605**
2041	$8,839,907	$34,424,359	$12,655,330	$34,881,638	$12,445,452	**$103,246,685**
2046	$3,277,130	$0	$0	$20,015,902	$12,445,452	**$35,738,484**
2051	$500,654	$0	$0	$15,602,362	$12,445,452	**$28,548,468**
Ultimate	$0	$0	$0	$1,751,867	$12,445,452	**$14,197,319**
Total	**$57,251,953**	**$92,848,342**	**$52,113,227**	**$192,041,907**	**$99,563,616**	**$493,819,045**

8 Combined Cost Estimation Summary

Table 8-1 provides a summary of total Caboolture West water supply and sewerage infrastructure cost estimates excluding timing. The table provides costs estimates for trunk assets, reticulation/donated assets and combined assets as well as an estimated cost per EP for each level.

Table 8-2 and **Table 8-3** provide the cost estimates for water supply and sewerage infrastructure in five year planning horizons. As the tables groups infrastructure in five year planning horizons, much of the interim/external infrastructure proposed to service the early stages of the development and is represented in 2016. **Tables B1 and B2** of **Appendix B** provide an EP trigger for this interim infrastructure.

Water and sewerage trunk assets required to service Caboolture West were estimated to cost a combined $504.4 Million.

The total combined capital cost for water supply and sewerage infrastructure required to service Caboolture West and including reticulation assets was estimated at $845.6 Million.

The assumptions used in the development of these cost estimates are provided in Section 4.3 of this report. The cost estimates have been formulated based on the development of high level water supply and sewerage infrastructure plans with the potential to significantly change during future stages of Caboolture West development planning. Some of the issues with the potential to impact both infrastructure plans and cost estimates developed in this report are listed as follows:

1. Refinement of expected population and employment numbers for Caboolture West by MBRC including the geographical distribution of population and commercial or industrial centres across the site will require reassessment of infrastructure sizing.
2. Future changes to development sequencing has the potential to significantly impact on infrastructure plans and servicing strategies for the area.
3. Environmental and constraints layers were considered at a high level in this assessment. However, the full impact of environmental constraints on the servicing strategy and alternative construction techniques will not be understood until more detailed studies are undertaken.
4. The integration with other services such as roads and stormwater was only considered at a high level within this assessment. Water supply infrastructure was generally located within existing road reserve. New proposed roads layouts for Caboolture West have the potential to impact on the infrastructure plans developed.
5. Infrastructure plans have been developed assuming the natural topology of the land. Any significant earthworks will have the potential to impact on proposed infrastructure sizing and alignments.
6. Major water supply infrastructure assumptions such as the availability of the NPI have the potential to change. Any changes to these major servicing assumptions will have a significant impact on the cost estimates in this report.
7. Major sewerage infrastructure assumptions adopted have the potential to change and have significant impacts to the cost estimates in this report. The external sewage collection strategy contained within this report assumes initial collection of sewage from Caboolture West to the South Caboolture STP with sewage ultimately delivered to a new STP at Redcliffe. Assessment of external sewerage infrastructure requirements in this report has been limited to delivery of sewage from Caboolture West as far as the existing Burpengary East STP site. Flow is expected to be redirected to the new Redcliffe STP site in the future. Regional sewerage infrastructure planning is required to develop a region wide strategy and preferred option for the transfer of sewage from Burpengay East STP and potentially the South Caboolture STP to the new Redcliffe STP. Infrastructure and cost allowance **has not** been provided within this report for the ongoing transfer of sewage beyond the existing Burpengary East STP site to the proposed new Redcliffe STP.

8. Infrastructure has been sized based on the standards of service for water supply and sewerage at the current time (SEQ Code; July 2013). Standards of service are known to undergo regular change and update. Future updates have the potential to impact infrastructure sizing.
9. External sewerage infrastructure strategy has the potential to be impacted by other external developments such as Morayfield Burpengary LPA which could intern impact cost estimation.
10. The alignment of external infrastructure, in particular the sewerage rising main alignments from Caboolture West will require studies to confirm their practicality. Changes to the proposed alignment have the potential to impact cost estimates.
11. The interim 5.5 ML reservoir has been costed assuming permanent reservoir assumptions. A short term storage facility based on a reduced design life may be identified to carry reduced cost if adopted.
12. The assessment does not consider the costs associate with a potential future ocean outfall required to protect the health of current receiving waters. These costs have the potential to be significant and apportionment of costs across parties contributing to sewage flows is likely required.
13. An indicative allowance for sewage treatment of flows from Caboolture West has been allowed. The actual cost of STP upgrade requirements either at South Caboolture STP or Redcliffe STP are not known at this time.

Accuracy of cost estimates within this report at + or – 50%.

Table 8-1: Caboolture West Infrastructure Cost Summary

Water Network Infrastructure	Cost	Cost / EP
Water Trunk Mains	$158,193,585	$2,066
Major Valves and Fittings	$7,414,915	$97
Water Pump Stations	$7,414,915	$97
Reservoirs	$28,836,122	$377
Other	$801,000	$10
Total Water Trunk Infrastructure	**$202,660,537**	**$2,647**
Donated/Reticulation Water Assets	**$149,118,092**	**$1,948**
Total Water Assets	**$351,778,629**	**$4,595**
Sewerage Infrastructure	**Cost**	**Cost / EP**
Gravity Trunk Mains	$57,251,953	$748
Rising Mains	$92,848,342	$1,213
Sewage Pump Stations	$52,113,227	$681
Sewage Treatment Plant Upgrades	$99,563,616	$1,300
Total Sewerage Trunk Infrastructure	**$301,777,138**	**$3,941**
Donated/Reticulation Sewerage Assets	**$192,041,907**	**$2,508**
Total Sewerage Assets	**$493,819,045**	**$6,450**
Total Infrastructure	**Cost**	**Cost / EP**
Total Trunk Infrastructure	**$504,437,675**	**$6,588**
Total Donated/Reticulation Assets	**$341,159,999**	**$4,456**
All Assets	**$845,597,674**	**$11,045**

Table 8-2: Summary of Water Supply Infrastructure Costs

Year	Trunk Mains	Major Valves and Fittings	Pump Station	Reservoirs	Other Costs^	Reticulation (Donated Assets)	Total
2016	$94,217,542	$5,452,107		$6,400,939	$88,900	$13,610,014	**$119,769,502**
2021	$1,078,751	$361,227	$4,005,691	$12,446,570	$88,900	$14,824,986	**$32,806,125**
2026	$51,982,136	$535,750			$88,900	$25,781,568	**$78,388,354**
2031	$0	$0	$3,409,224	$9,988,613	$88,900	$27,934,544	**$41,421,281**
2036	$5,160,487	$163,340			$88,900	$10,864,402	**$16,277,129**
2041	$3,381,667	$0			$88,900	$27,085,147	**$30,555,714**
2046	$297,728	$197,887			$88,900	$15,542,093	**$16,126,608**
2051	$0	$0			$88,900	$12,115,035	**$12,203,935**
2056	$2,075,275	$139,975			$88,900	$1,360,302	**$3,664,452**
Total	**$158,193,585**	**$6,850,287**	**$7,414,915**	**$28,836,122**	**$800,100**	**$149,118,092**	**$351,213,101**

Table 8-3: Summary of Sewerage Infrastructure Costs

Year	Gravity Main Infra-structure	Rising Main Infra-structure	Pump Station	Reticulation (Donated Assets)	STP Upgrade	Total
2016	$12,724,683	$4,878,835	$4,704,563	$17,527,672		**$39,835,753**
2021	$5,795,001	$46,545,247	$25,381,855	$19,092,375	$12,445,452	**$109,259,931**
2026	$14,537,241	$0	$0	$33,202,823	$12,445,452	**$60,185,516**
2031	$10,887,918	$6,999,901	$9,371,478	$35,975,535	$12,445,452	**$75,680,285**
2036	$689,419	$0	$0	$13,991,733	$12,445,452	**$27,126,605**
2041	$8,839,907	$34,424,359	$12,655,330	$34,881,638	$12,445,452	**$103,246,685**
2046	$3,277,130	$0	$0	$20,015,902	$12,445,452	**$35,738,484**
2051	$500,654	$0	$0	$15,602,362	$12,445,452	**$28,548,468**
Ultimate	$0	$0	$0	$1,751,867	$12,445,452	**$14,197,319**
Total	**$57,251,953**	**$92,848,342**	**$52,113,227**	**$192,041,907**	**$99,563,616**	**$493,819,045**

9 Other Considerations

9.1 Alignment with Strategic Framework

Water supply, collection and treatment for the Caboolture West area is considered in a number of strategic and policy documents. There are a number of assumptions within this infrastructure plan that have specific relevance to two of these documents:

- Unitywater Treatment Services Strategy (January, 2013)
- Total Water Cycle Management Strategy for Moreton Bay Regional Council (June, 2012)

The infrastructure solutions documented in this report are generally in alignment with the Treatment Services Strategy (TSS) in that there is no “on-site” local or regional treatment facility nominated for Caboolture West. The TSS recommends a solution that ultimately involves directing flow from a number of catchments in Unitywater’s southern area to a regional treatment facility at Redcliffe. The external sewage collection strategy contained within this report assumes initial collection of sewage from Caboolture West to the South Caboolture STP with sewage ultimately delivered to a new STP at Redcliffe. Assessment of external sewerage infrastructure requirements in this report has been limited to delivery of sewage from Caboolture West as far as the existing Burpengary East STP site. Flow is

expected to be redirected to the new Redcliffe STP site in the future in alignment with the TSS. Regional sewerage infrastructure planning is required to develop a region wide strategy and preferred option for the transfer of sewage from Burpengay East STP and potentially the South Caboolture STP to the new Redcliffe STP. Infrastructure and cost allowance **has not** been provided within this report for the ongoing transfer of sewage beyond the existing Burpengary East STP site to the proposed new Redcliffe STP.

The TSS also acknowledges the potential role of water re-use in managing water issues associated with population growth.

The infrastructure solutions documented in this report provide a benchmark for which other options may be assessed and are not intended to rule out or limit the opportunities identified in the Total Water Cycle Management Plan (TWCMP). The TWCMP identifies a number of management scenarios that may complement the benchmark scenario described in this report. For example, the TWCMP indicates a preference for a local STP with recycled water for public open space irrigation and remainder discharged to land. There may be opportunities to include smaller scale treatment facilities for activities such as sewer mining and local re-use whilst managing wet weather flow through regional infrastructure. Should these facilities be realised their location will need to be carefully planned and consider:

- The amount of flow to be treated and reused;
- Management of concentrates and wet weather;
- Optimisation of operational costs e.g. energy and chemicals; and
- Issues relating to the community such as odour and access

9.2 Issues Surrounding Diverse Landholding

The land parcels that make up Caboolture West are owned by a large number of land holders. There are however some large parcels in the south which are owned by a number small number of large developers. It would appear that there is no obvious master developer. This may result in a number of issues for Unitywater.

9.2.1 Infrastructure Corridors and Resource Entitlements

An infrastructure master plan is critical for efficient delivery of water supply and sewerage services to the development. One of the benefits of a master plan, particularly for a development of this scale, is to identify trunk infrastructure items at the onset of the project so that appropriate sites and corridors can be assigned and acquired (through the infrastructure agreement process) to ensure that ultimate and staged infrastructure can be easily constructed and reasonably maintained without undue cost to access the infrastructure. Whilst for some linear items this may be in service corridors in the road reserve more significant items (e.g. sewerage pressure mains and critical water supply mains) easements or other resource entitlements may be required. Facility based infrastructure (e.g. pumps stations, treatment plants, reservoirs, and other structures) will also require designated freehold land sites including appropriate access to road networks.

In addition facilities such as sewerage pumping stations and more significantly sewage treatment plants would preferably be located in non-residential areas to minimise the impact of issues such as odour, noise, industrial traffic and poor visual amenity. To avoid these issues a buffer of at least 400 metres from the treatment plant boundary will be required. Prior to any final design modelling should be undertaken to ensure appropriate treatment of any odour is incorporated into final design solutions.

With such disaggregation in land ownership it is unclear how these sites, corridors and alignments will be determined, agreed and ultimately secured to allow Unitywater to most efficiently provide infrastructure and services. This issue could be further exacerbated should out of sequence development of this site occur.

9.2.2 Mechanisms for Provision of Infrastructure

This report is a technical document only and does not consider the mechanisms for funding the required infrastructure.

Traditionally there have been two ways for water service providers to manage infrastructure provision in new developments.

The first is the infrastructure charges or headworks model where the water authority develops plans for trunk infrastructure which identifies and estimates the cost of providing appropriate infrastructure to

support the standards of service. Then as development occurs each developer is charged the pre-determined cost (say per EP or per lot) to connect. Where the development is occurring sooner than anticipated and therefore the infrastructure does not yet exist the developer may be required to provide the infrastructure (as per the plans for trunk infrastructure). The cost of the infrastructure is offset against the infrastructure charge that the developer would have been required to pay. That is the charge to the developer would be the total EP multiplied by the charge per EP minus the cost of the trunk infrastructure provided by the developer.

The second is by the landholder/developer and the water authority collectively developing and infrastructure agreement, again based on an infrastructure master plan. The agreement describes the infrastructure and land requirements, triggers, parties responsible for construction, and financial contributions. The infrastructure agreement is negotiated and agreed prior to the development starting.

Both methods have their benefits and limitations. Some of these issues are potentially exacerbated due to the disaggregation of land ownership.

The infrastructure charges model issues include:

- It is unlikely that any of the small land holders will be able to fund trunk infrastructure as the cost of the infrastructure is likely to be significantly more than the value of their offsets.
- The more significant land holders own land parcels that are primarily in the southern pocket. This may result in bias toward development in the southern pocket which may not be consistent with preferred liveability outcomes and may not be in keeping with efficient delivery of water supply and sewerage services. For example the best place for a water supply reservoir may be in the north.
- Where Unitywater provide trunk infrastructure the timing for collection of infrastructure charges will be based on the rate of development therefore, Unitywater would potentially be taking on some aspects of development risks.

The infrastructure agreement model issues include:

- Consensus by all parties to the one agreement or individual agreements with each landholder.
- Management of either through the deliver phase (fifty years) will require significant processes, systems and maintenance.

Both methods will likely have an impact on Unitywater in terms of capital expenditure and /or development of systems and the allocation of human resources to support these systems. Unitywater should consider undertaking a financial assessment of both scenarios to understand both the quantum of investment and potential sensitivities.

9.3 Relevance for Seqwater

The Caboolture West development is located in the Caboolture River catchment. Traditionally water from this catchment has been extracted for treatment at the Caboolture Water Treatment Plant and distribution into the Caboolture water supply network. The Caboolture treatment plant is owned by Seqwater. Since the construction of the northern pipeline interconnector (NPI) the water supply to the Caboolture water network has been through the NPI as part of the overall water grid. The Caboolture WTP has only been use intermittently in recent years.

The Caboolture West development will potentially impact on both the operation of the SEQ water grid and the continued use of the Caboolture River and WTP as part of the Seqwater fleet. Further, development in this catchment may impact on its ability to be used as a water source in the future. These issues need to be formally raised with Seqwater as custodian for bulk water supply in South East Queensland.

10 Conclusions and Recommendations

10.1 Conclusions

From the development of water supply and sewerage infrastructure plans for Caboolture West the following is concluded:

1. Water supply and sewerage demands for Caboolture West have been developed based on population estimates and sequencing provided by MBRC. A total EP for the development of 76,565 was developed for both water supply and sewerage networks. A maximum day (MD) demand of 434 L/s was identified for the water supply network. A peak wet weather flow (PWWF) of 935 L/s was identified for the sewerage network
2. Infrastructure plans have been developed for Ultimate development to which timing in 5 year planning horizons has been applied. Interim servicing strategies have also been developed.
3. Infrastructure has been sized according to the standards of service contained within the SEQ Code planning guidelines for water supply and sewerage
4. Features of the ultimate proposed water supply network are as follows:
    a. The NPI has been assumed as the water supply source
    b. A reservoir site located toward the west of the site has a proposed ultimate volume of 38 ML and a TWL of 100 m AHD. There are options for staging of the reservoir capacity to a 20 ML reservoir by 2021 and 20 ML by 2031.
    c. Supply to the reservoir is delivered from the NPI via a pump supply main following Bellmere and Jackson Roads.
    d. A trunk distribution network has been developed to deliver supply to assumed neighbourhoods throughout Caboolture West. Indicative DMA inlet locations have been represented in mapping. Pressure management is proposed for DMA inlets servicing properties < 40 m AHD elevation
5. Features of the preferred interim water supply strategy is as follows:
    a. Supply of the first 2,200 EP from the Morayfield HLZ via a connection to the 375 mm diameter main in Tinney Road. An risk management plan and an asset maintenance plan will be required for the Morayfield HLZ pump station and the 375 mm diameter HLZ Supply main. An emergency connection to the low level zone is also required to mitigate the consequence of failure. Currently the Morayfield HLZ consists of approximately 6,800 EP fed directly from the Morayfield HLZ pump station. No emergency storage is available for these customers in the event of pump station failure.
    b. At 2,201 EP an interim reservoir of 5.5 ML is proposed to provide storage to Caboolture West. The reservoir is to be supplied from the NPI. All properties previously serviced from Morayfield HLZ are to be supplied from the proposed interim reservoir to facilitate reservoir turnover and release the 2,200 EP capacity back to the Morayfield HLZ.
    c. The interim reservoir can service up to 10,000 EP at which time a reservoir at the Ultimate location is required to service Caboolture West.
6. Features of the ultimate proposed sewerage network are as follows:
    a. The network has been developed based on the existing topology for the Caboolture West site.
    b. Gravity trunk mains are generally located to follow water courses to facilitate collection via gravity.
    c. Initial treatment of sewage at the South Caboolture STP has been assumed for Caboolture West with treatment of Ultimate flows at a new STP located at Redcliffe. The infrastructure and costing assessment undertaken within this report has limited

assessment to delivery of sewage as far as the existing Burpengary East STP from which flows are to be re-directed to the new Redcliffe STP in the future.

d. Five sewerage pump stations are proposed. This includes a terminal station, located at the south eastern corner of the Caboolture West site, for transfer of raw sewage via a rising main to the Burpengary East STP.

7. The external sewerage servicing strategy is summarised as follows:

   a. **Stage 1** – The existing 914 mm diameter trunk sewer to South Caboolture STP requires augmentation. The final size of the augmentation will be determined based on the needs of the full catchment. For the purposes of this study a 900 mm diameter duplication has been proposed.

   b. **Stage 2** – New short term pumping station and 900m of 150 mm diameter rising main delivering sewerage into the existing 375 mm sewer on Dobson Lane. This will provide between **1,200 and 2,000 EP** (up to 25 L/s) to start the Caboolture West development.

   c. **Stage 3** – Stop the diversion into Dobson Lane and start diverting flows 3.6km to Serenity Way, joining to the 610 mm diameter sewer. Sizing of this rising main will be dependent on the rate of growth in Caboolture West and the potential to temporarily not meet Unitywater design standards and ferric dose the sewage. From the assumptions adopted within this study a 375 mm diameter rising main is proposed. Additional discharge is proposed to be obtained for the purposes of reducing detention times obtained by reversing flows in the Stage 2 150 mm sewer in Dobson Lane such that the upstream catchment of the original discharge point is diverted to the Caboolture West pump station.

   d. **Stage 4** – The existing 610 mm and 762 mm diameter sewer could potentially allow up to **8,000 EP** from Caboolture West. However, the rate of development from other areas will require monitoring. South Caboolture STP capacity is likely to be exceeded by 2021. Therefore the diversion to the new Redcliffe STP will need to occur before 2021, before the South Caboolture STP reaches capacity or once 8,000 EP is exceeded

   e. **Stage 5** – Divert all flows to the new Redcliffe STP, initially via a single 750 mm main to the existing Burpengary STP site from which point further redirection of flow to Redcliffe with be required.

   f. **Stage 5b** – Divert additional flows from South Caboolture STP to the new Redcliffe STP via the rising main to Burpengary. This will supplement flows in the rising main until Caboolture West and Morayfield Burpengary produce enough flow to maintain healthy flows conditions.

   g. **Stage 6** – Duplicate the 375 mm diameter main from Caboolture west with a 525 mm diameter main to provide additional capacity from Caboolture West to the 750 mm diameter main.

   h. **Stage 7** - Replace the original 375 mm diameter main with a 525 mm diameter main providing two 525 mm diameter mains and the pumps require upsizing.

   i. **Stage 8** – Provide a second 750 mm diameter main to Burpengary East STP with associated pump upgrades, this is predicted to be after 2034

8. A significant number of assumptions have been made in regard to uplift factors and contingencies in the development of cost estimates for Caboolture West water supply and sewerage infrastructure. All costing assumptions are provided within **Section 2.3** of this report. **Section 5** of this report includes a discussion of some of the issues related to the assumptions used with the potential to impact both infrastructure plans and cost estimates developed in this report.

9. A summary of cost estimation outcomes is provided in Table 10-1**.**

Table 10-1: Caboolture West Infrastructure Cost Estimate Summary

Water Network Infrastructure	Cost	Cost / EP
Water Trunk Mains	$158,193,585	$2,066
Major Valves and Fittings	$7,414,915	$97

Water Pump Stations	$7,414,915	$97
Reservoirs	$28,836,122	$377
Other	$801,000	$10
Total Water Trunk Infrastructure	**$202,660,537**	**$2,647**
Donated/Reticulation Water Assets	**$149,118,092**	**$1,948**
Total Water Assets	**$351,778,629**	**$4,595**
Sewerage Infrastructure	**Cost**	**Cost / EP**
Gravity Trunk Mains	$57,251,953	$748
Rising Mains	$92,848,342	$1,213
Sewage Pump Stations	$52,113,227	$681
Sewage Treatment Plant Upgrades	$99,563,616	$1,300
Total Sewerage Trunk Infrastructure	**$301,777,138**	**$3,941**
Donated/Reticulation Sewerage Assets	**$192,041,907**	**$2,508**
Total Sewerage Assets	**$493,819,045**	**$6,450**
Total Infrastructure	**Cost**	**Cost / EP**
Total Trunk Infrastructure	**$504,437,675**	**$6,588**
Total Donated/Reticulation Assets	**$341,159,999**	**$4,456**
All Assets	**$845,597,674**	**$11,045**

10. A number of other considerations relating to the servicing of Caboolture West with water supply and sewerage infrastructure that are not specifically addressed within this technical report are discussed in **Section 9** of this report. Theses consideration are as follows:

    a. Alignment with strategic framework (including alignment with re-use and irrigation strategies and long term regional sewerage servicing strategy).
    b. Issues surrounding diverse land holding
    c. Infrastructure corridors and resource entitlements
    d. Mechanisms for provision of infrastructure
    e. Relevance for SEQWater.

10.2 Recommendations

Recommendations from this assessment are as follows:

1. The infrastructure plans contained within this report have been developed based on a number of assumptions. Changes to the base information adopted in this assessment are likely over the life of the Caboolture West development. Future changes have the potential to impact these infrastructure plans. It is recommended that this be understood and considered in using the infrastructure plans and/or costing contained within this report for decision making purposes. Future revisions of the infrastructure plans are also recommended as new and updated information becomes available.
2. A significant assumption in the development of the infrastructure plans is connection to the NPI as the water supply source. Discussion with LinkWater/Seqwater is recommended to secure approval for this connection.
3. The interim water supply strategy, which involves the provision of 2,200 EP from the Morayfield HLZ, increases the criticality of both the Morayfield HLZ pump station and the 375 mm diameter supply main in Tinney Road. As a result the criticality of these assets is increased during the period of interim supply. It is recommended asset maintenance plans for both assets are

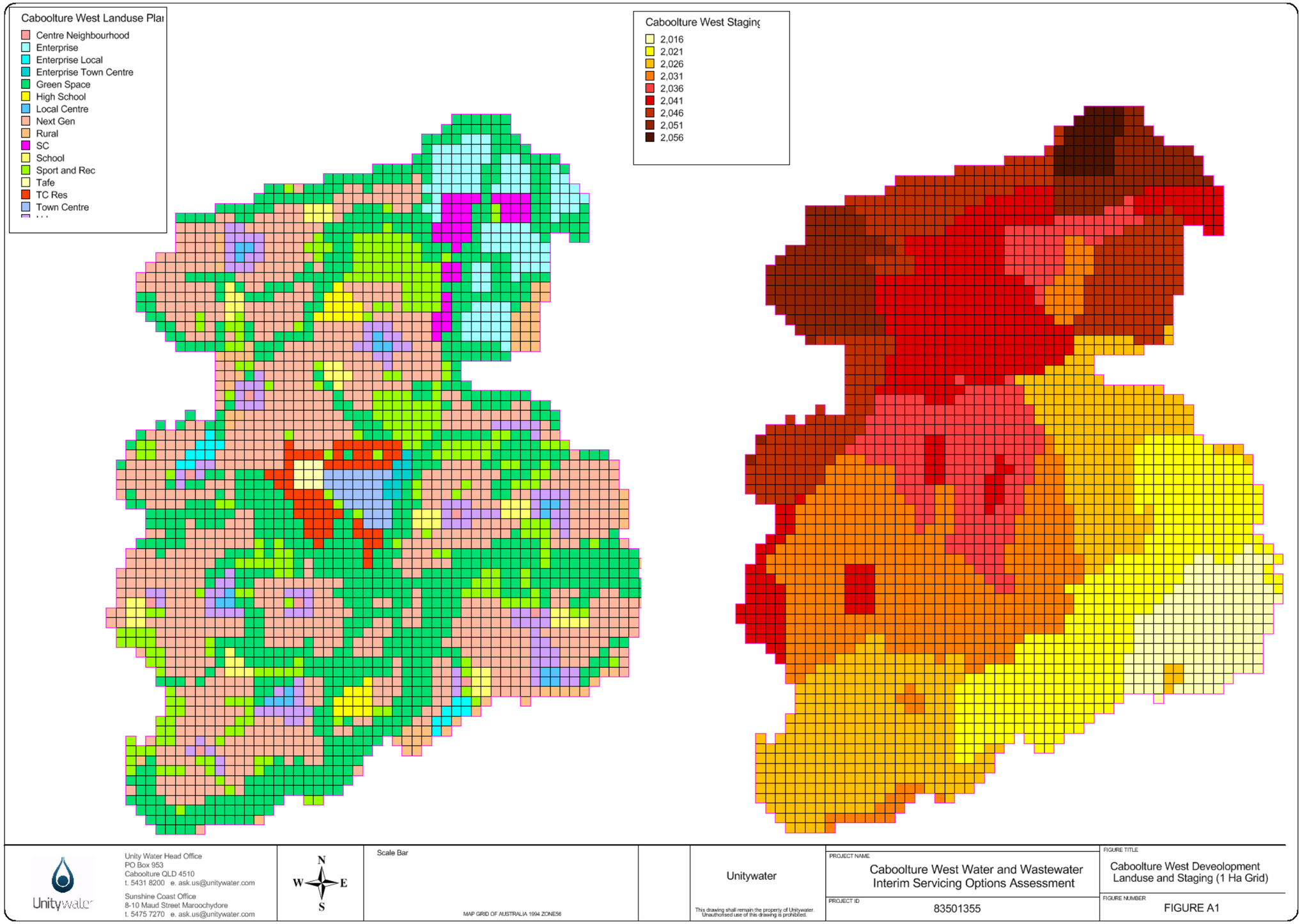
developed. It is recommended the asset maintenance plans ensure the 375 mm diameter main is accessible for regular inspection. It is also recommended that risk management plans are developed including the development of an operational contingency plan for implementation in the event of failure. Currently this option does not meet Unitywater standards of service due to insufficient storage.

4. As part of the interim supply solution, an emergency connection to the Morayfield LLZ via the Morayfield West reservoirs is recommended. The connection will only be required to provide supply under emergency conditions. Water quality may be a concern at this location due to the infrequency of use and it is recommended the setup of the connection be developed to minimise water quality concerns. Development of a plan to exercise this connection to ensure its operation when required is also recommended.
5. The alignment of the external rising mains used to convey sewage away from the Caboolture West development have been proposed to enable greatest interaction and use of interim capacity in the existing sewage collection network. The alignment also enables flexibility to temporarily take flows from the existing network to promote healthy flow conditions within the rising mains. The alignment will require the construction of two large pipes and may not be possible. Assessment into this alignment is recommended along with actions toward securing a proposed alignment. For the purposes of this study, the external rising main pipe alignments presented should be taken as indicative only for the purposes of establishing likely lengths and estimated costs.
6. This assessment assumes treatment of flows at a new Redcliffe STP will be required once capacity of the existing South Caboolture STP is reached. Within this study external infrastructure assessment has been limited to the delivery of sewage flows as far as the site of the existing Burpengary East STP. Sewage delivered to this point will require further redirection to the Redcliffe STP. The report proposes a rising main system for the transfer of sewage to the Burpengary East site. It is recommended that in future assessment, the vertical alignment of this main be assessed and options for full gravity transfer (deep sewers) or partial gravity transfer (with lift stations) be investigated due to the potential operational and operational cost advantages that maximising gravity transfer can provide. Should a rising main be implemented it is recommended that options for ensuring pipe full flow be identified. One such option may be the installation of a barometric loop at the Redcliffe STP and/or the Burpengary East transfer site.
7. This assessment assumes transfer of Ultimate sewage to the Redcliffe STP in line with the Unitywater TSS. It is recommended that as regional planning is undertaken and a preferred option and strategy for the transfer of flows from Burpengary East STP and or South Caboolture STP is identified, the outcomes of this report are revisited.
8. The infrastructure and costs associated with the ongoing transfer of sewage from the Burpengary East site to the new Redcliffe STP do not form part of this study. It is recommended that the infrastructure costs associated with this ongoing transfer are developed by Unitywater and their impacts on Caboolture West be understood and incorporated into the outcomes of this study. Significant technical assessments are likely required in identifying a preferred transfer strategy and associated infrastructure sizes and costs.
9. Transfer of sewage for treatment to the Redcliffe STP may potentially involve construction of an ocean outfall. No allowance for ocean outfall costs and their potential impacts on Caboolture West have been made within this study. As any ocean outfall requirements are understood it is recommended that the outcomes of this report are revisited.
10. The rate of external developments such as Morayfield Burpengary LPA have the potential to impact the timing of external sewage infrastructure requirements. It is recommended that the outcomes of this report are revised if updated information regarding other external developments become available.
11. It is recommended that in progressing the water supply and sewerage infrastructure plans for Caboolture West the following issues (discussed in Chapter 9) are further considered:
    a. Alignment with strategic framework (including alignment with re-use and irrigation strategies and long term regional sewerage servicing strategy).
    b. Issues surrounding diverse land holding
    c. Infrastructure corridors and resource entitlements

d. Mechanisms for provision of infrastructure
e. Relevance for SEQWater.

Appendix A : Figures

Figure A1 – Caboolture West Landuse Plan and Staging (Data Supplied by MBRC)



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Unitywater

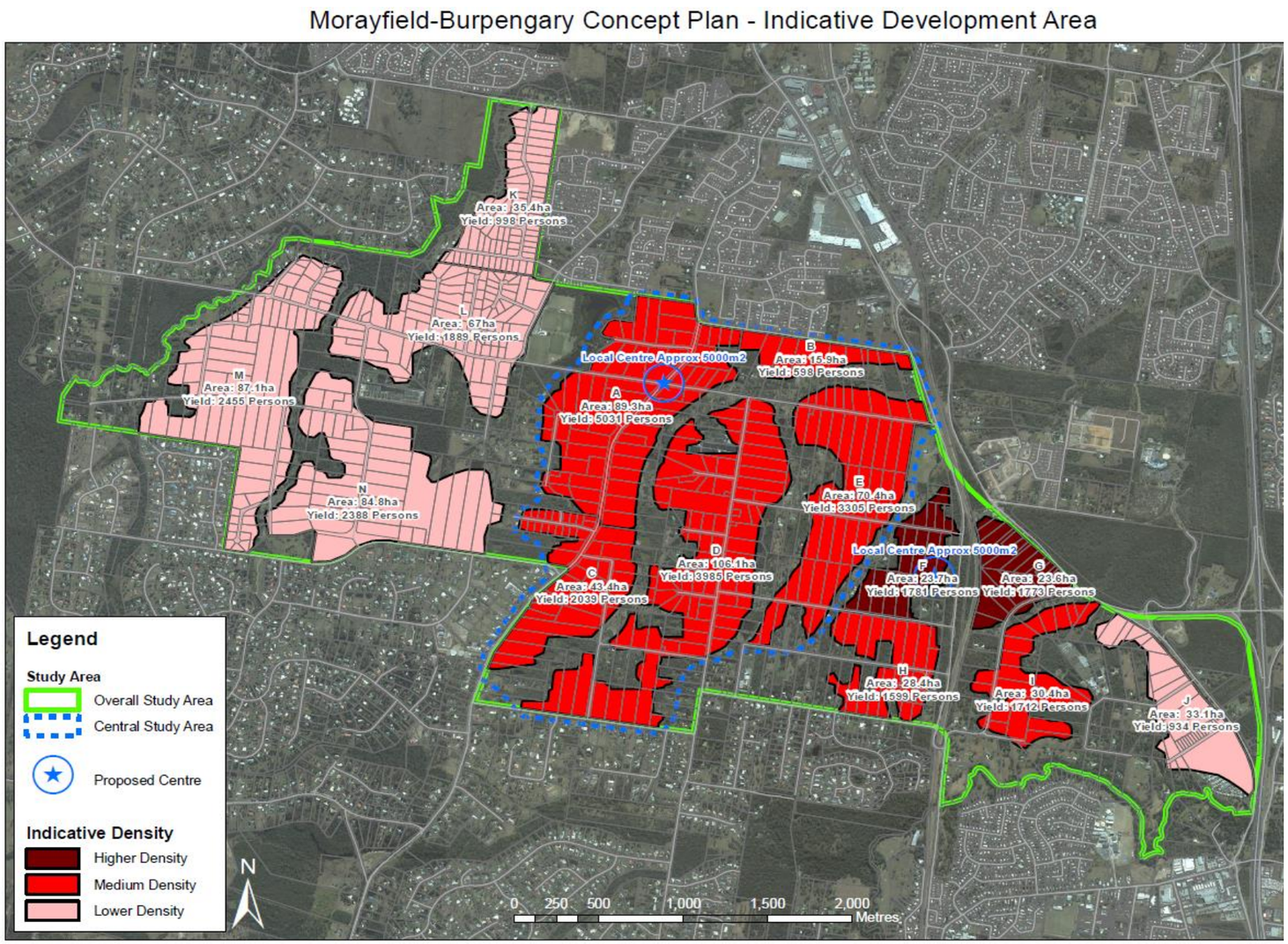
PROJECT NAME
Caboolture West Water and Wastewater Interim Servicing Options Assessment

PROJECT ID
83501355

FIGURE TITLE
Caboolture West Deveolopment Landuse and Staging (1 Ha Grid)

FIGURE NUMBER
FIGURE A1

Figure A2 – Morayfield Burpengary Concept Plan and Early Release Areas (Data Supplied by MBRC)



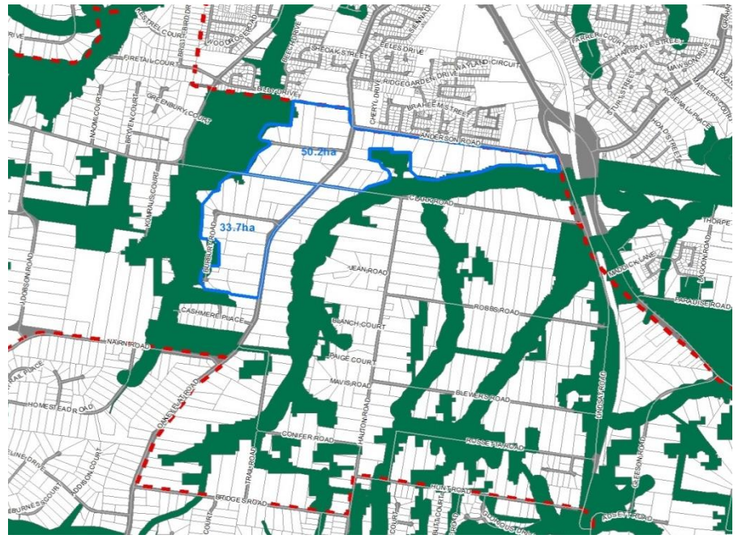
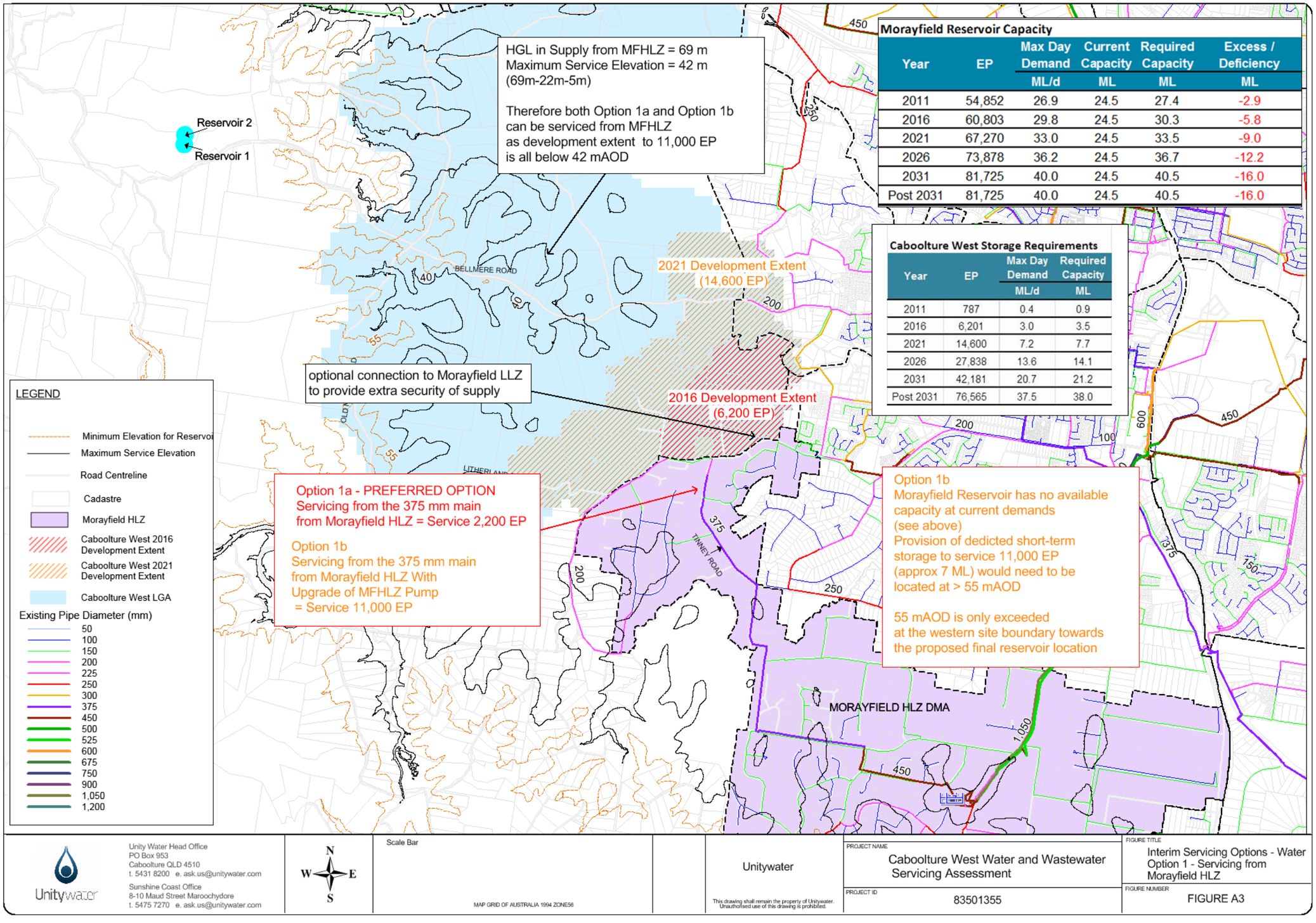


Figure A3 – Interim Water Supply – Option 1



Morayfield Reservoir Capacity

Year	EP	Max Day Demand	Current Capacity	Required Capacity	Excess / Deficiency
		ML/d	ML	ML	ML
2011	54,852	26.9	24.5	27.4	-2.9
2016	60,803	29.8	24.5	30.3	-5.8
2021	67,270	33.0	24.5	33.5	-9.0
2026	73,878	36.2	24.5	36.7	-12.2
2031	81,725	40.0	24.5	40.5	-16.0
Post 2031	81,725	40.0	24.5	40.5	-16.0

Caboolture West Storage Requirements

Year	EP	Max Day Demand	Required Capacity
		ML/d	ML
2011	787	0.4	0.9
2016	6,201	3.0	3.5
2021	14,600	7.2	7.7
2026	27,838	13.6	14.1
2031	42,181	20.7	21.2
Post 2031	76,565	37.5	38.0

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Unitywater

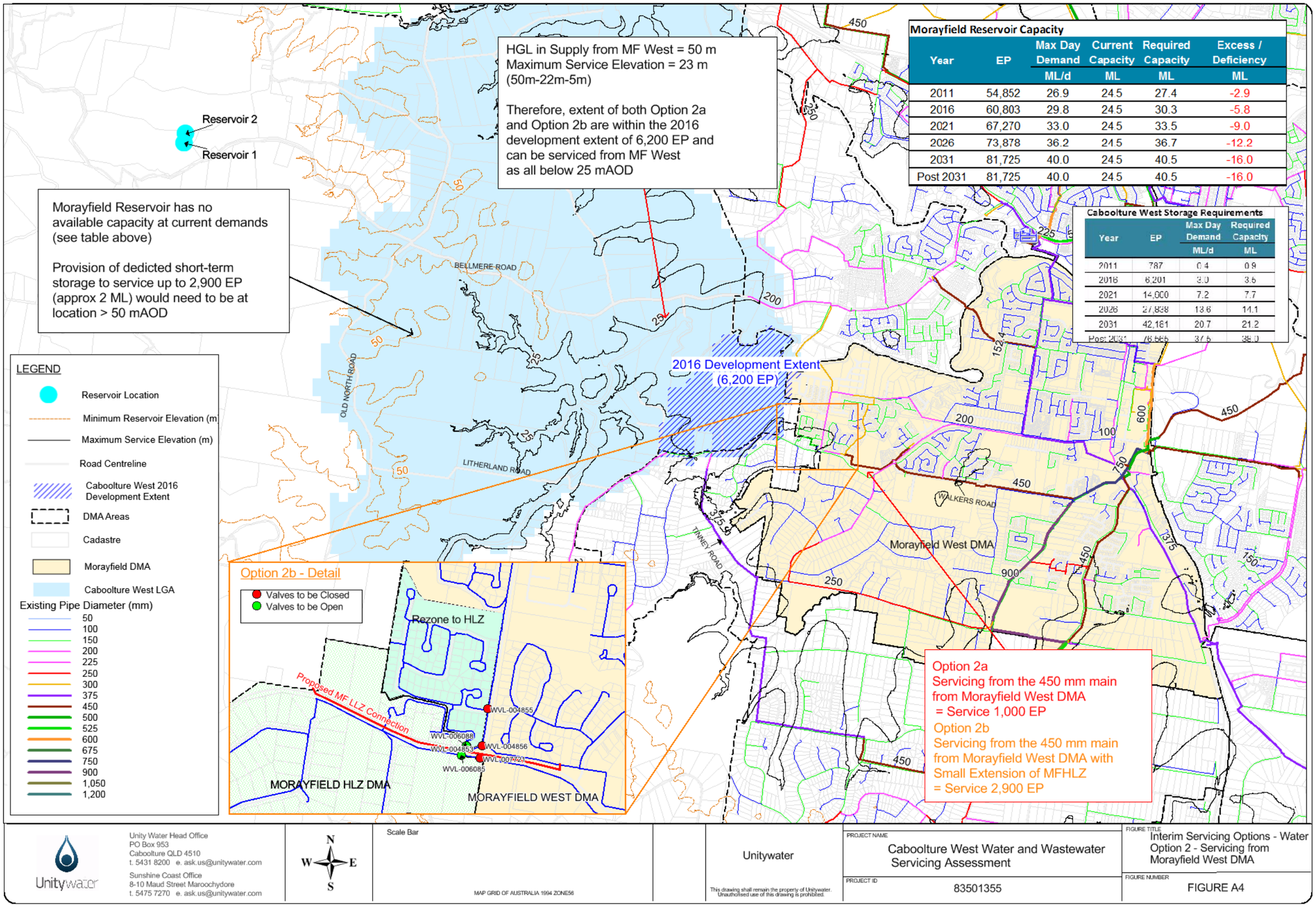
PROJECT NAME: Caboolture West Water and Wastewater Servicing Assessment

PROJECT ID: 83501355

FIGURE TITLE: Interim Servicing Options - Water Option 1 - Servicing from Morayfield HLZ

FIGURE NUMBER: FIGURE A3

Figure A4 – Interim Water Supply – Option 2



Morayfield Reservoir Capacity

Year	EP	Max Day Demand	Current Capacity	Required Capacity	Excess / Deficiency
		ML/d	ML	ML	ML
2011	54,852	26.9	24.5	27.4	-2.9
2016	60,803	29.8	24.5	30.3	-5.8
2021	67,270	33.0	24.5	33.5	-9.0
2026	73,878	36.2	24.5	36.7	-12.2
2031	81,725	40.0	24.5	40.5	-16.0
Post 2031	81,725	40.0	24.5	40.5	-16.0

Caboolture West Storage Requirements

Year	EP	Max Day Demand	Required Capacity
		ML/d	ML
2011	787	0.4	0.9
2016	6,201	3.0	3.6
2021	14,000	7.2	7.7
2026	27,838	13.6	14.1
2031	42,161	20.7	21.2
Post 2031	78,855	37.5	38.0

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Unitywater

PROJECT NAME: Caboolture West Water and Wastewater Servicing Assessment

PROJECT ID: 83501355

FIGURE TITLE: Interim Servicing Options - Water Option 2 - Servicing from Morayfield West DMA

FIGURE NUMBER: FIGURE A4

Figure A5 – Interim Water Supply – Option 3

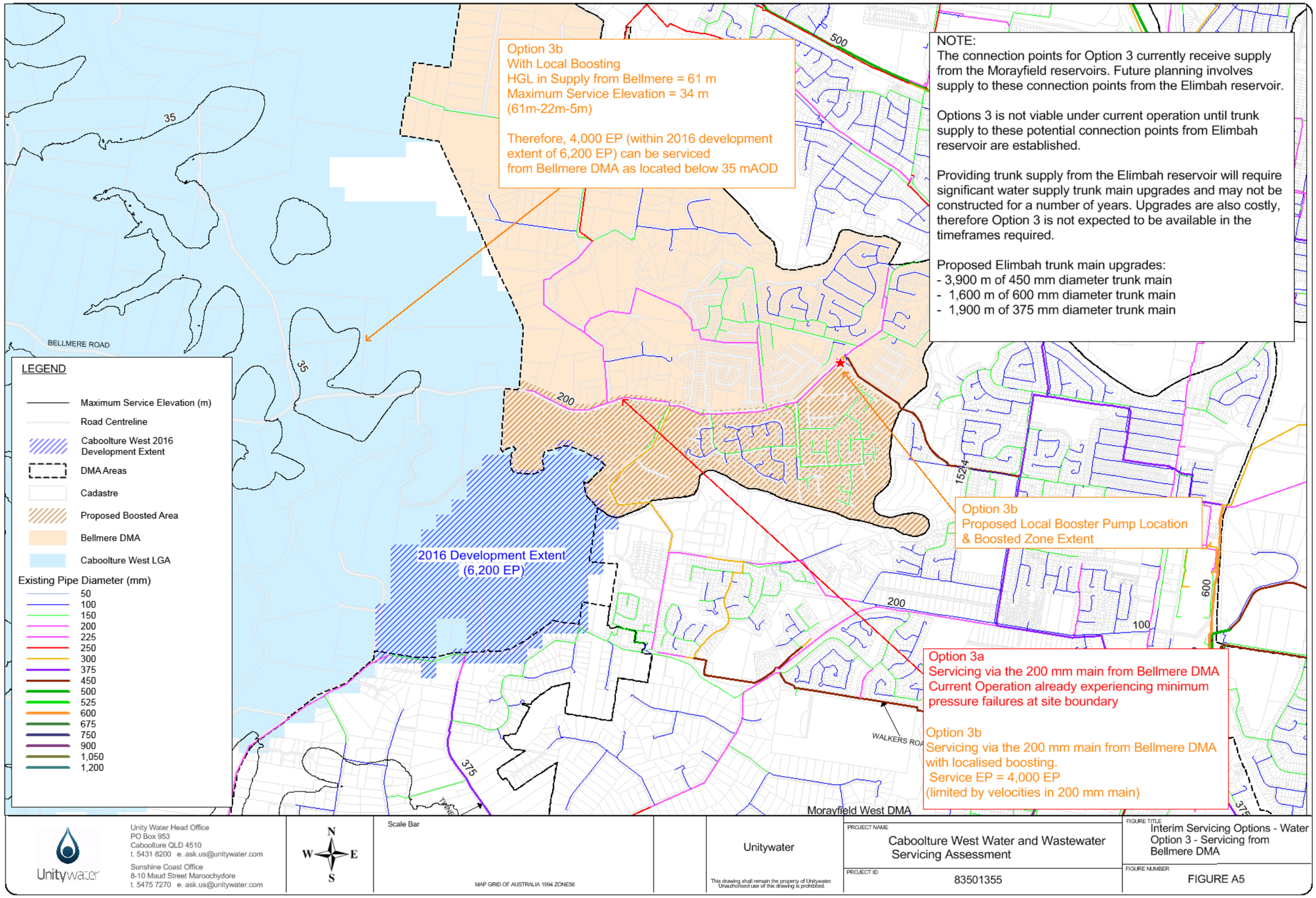


Figure A6 – Interim Water Supply – Option 4

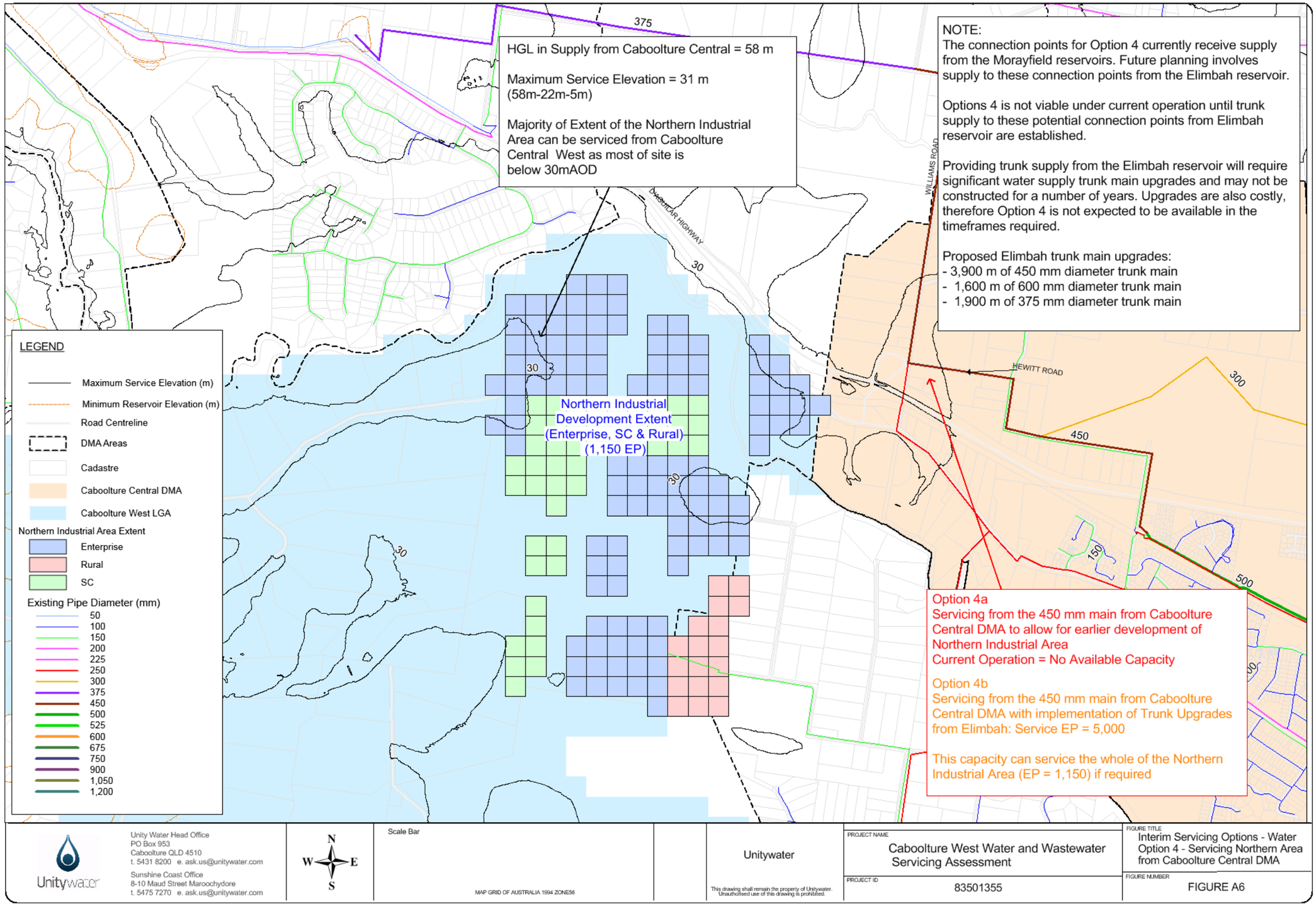


Figure A7 – Interim Water Supply – Option 5

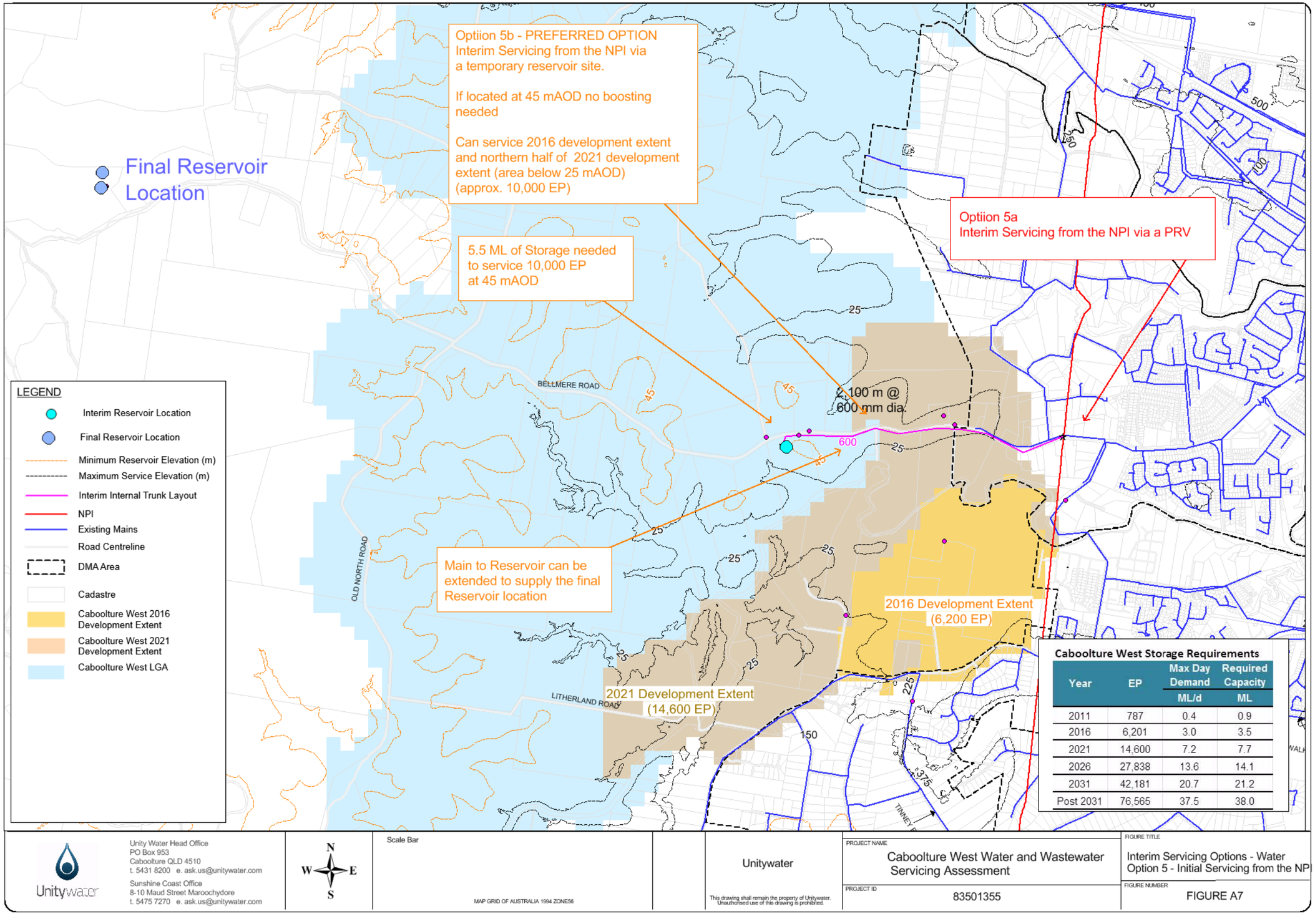
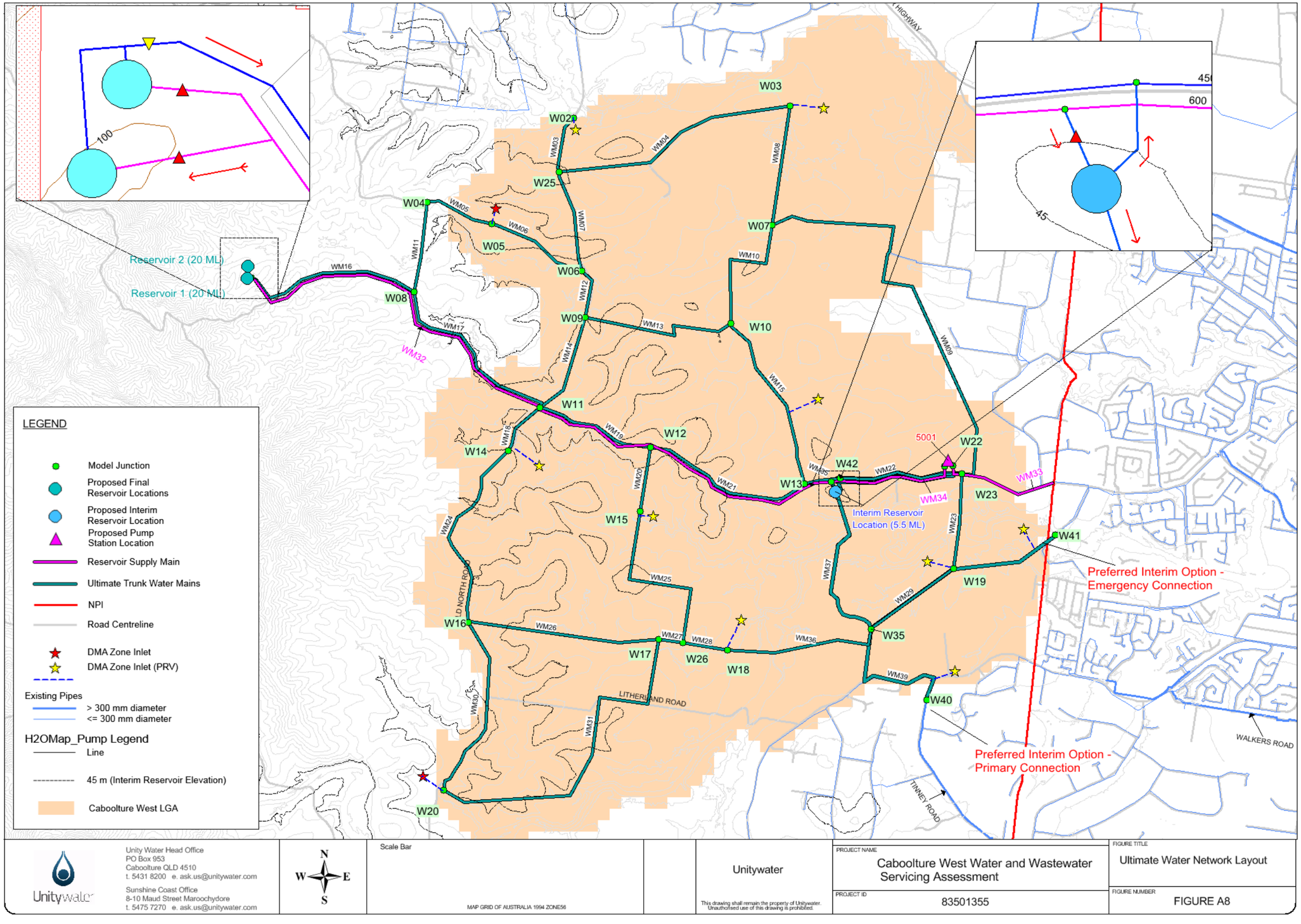


Figure A8 – Ultimate Water Supply Infrastructure



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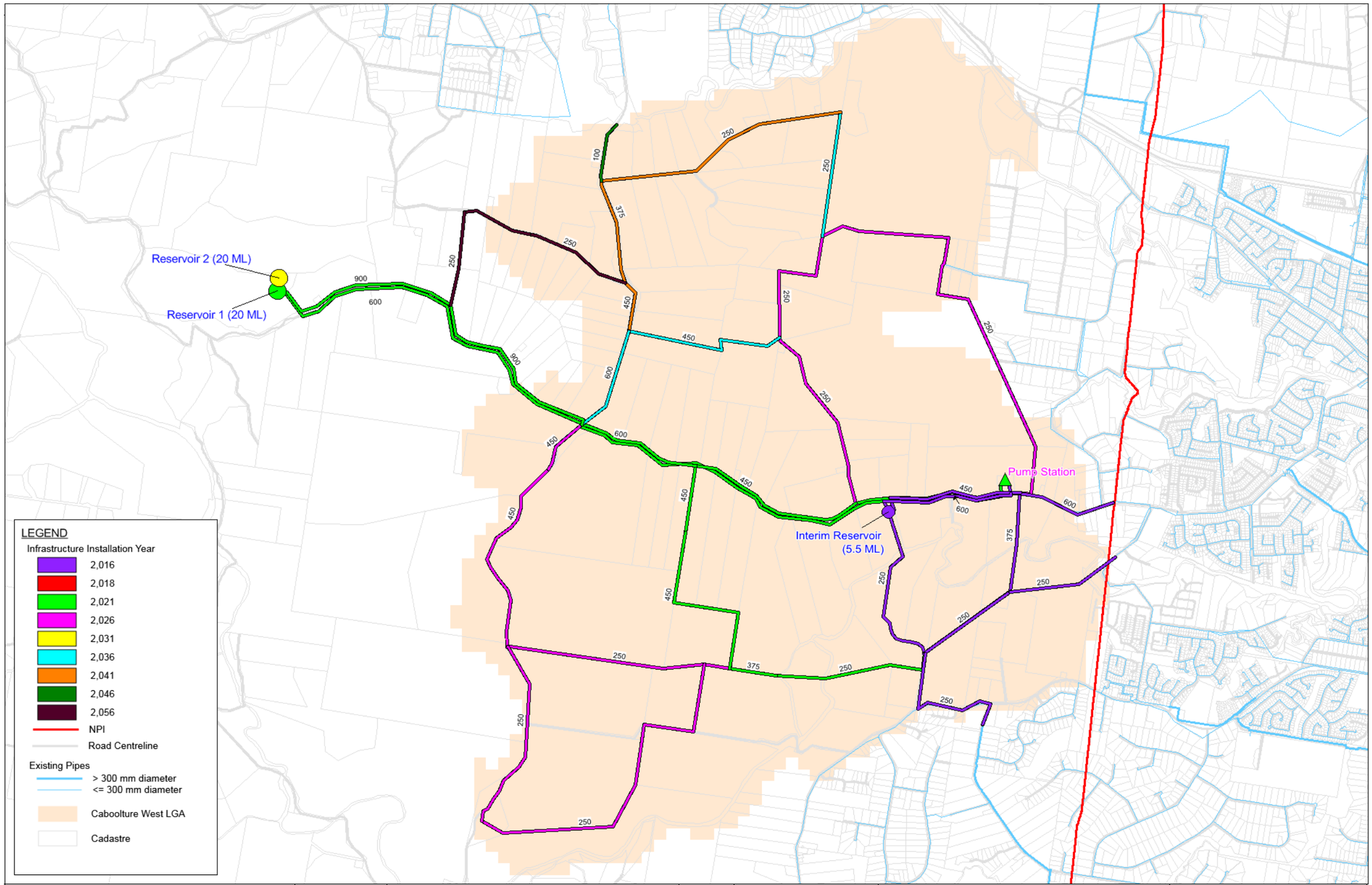
PROJECT NAME: Caboolture West Water and Wastewater Servicing Assessment

PROJECT ID: 83501355

FIGURE TITLE: Ultimate Water Network Layout

FIGURE NUMBER: FIGURE A8

Figure A9 – Ultimate Water Supply Infrastructure – Staging & Sizing



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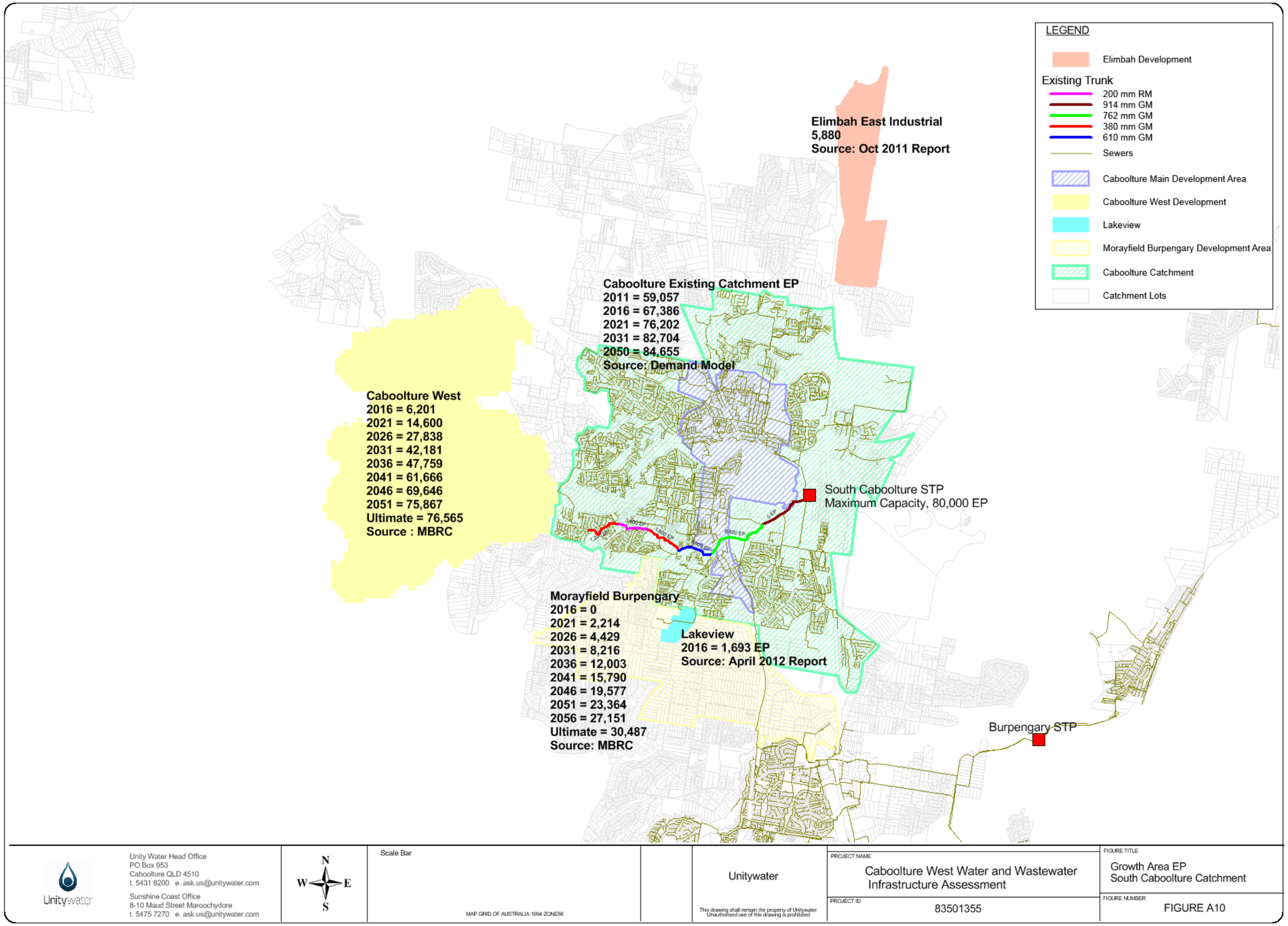
PROJECT NAME: Caboolture West Water and Wastewater Internal Infrastructure Assessment

PROJECT ID: 83501355

FIGURE TITLE: Water Infrastructure Staging and Sizing

FIGURE NUMBER: FIGURE A9

Figure A10 – Future Sewer Loading EP – South Caboolture Catchment



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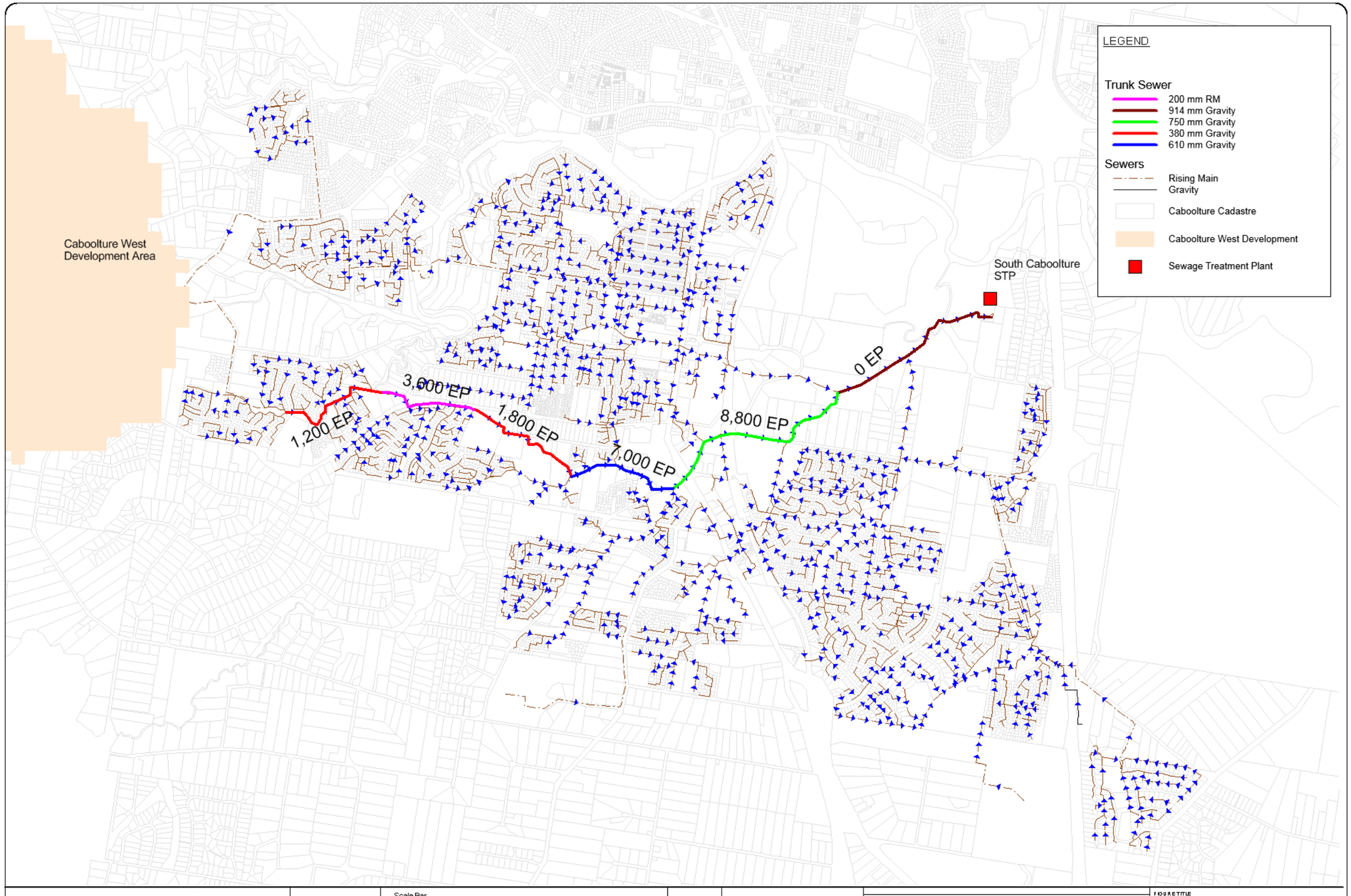
PROJECT NAME: Caboolture West Water and Wastewater Infrastructure Assessment

PROJECT ID: 83501355

FIGURE TITLE: Growth Area EP South Caboolture Catchment

FIGURE NUMBER: FIGURE A10

Figure A11 – Current Sewer Capacity



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PROJECT NAME
Caboolture West Water and Wastewater Infrastructure Assessment

PROJECT ID
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FIGURE TITLE
Existing Infrastructure with Spare Capacity

FIGURE NUMBER
FIGURE A11

Figure A12 – Ultimate Sewer Infrastructure and Catchments

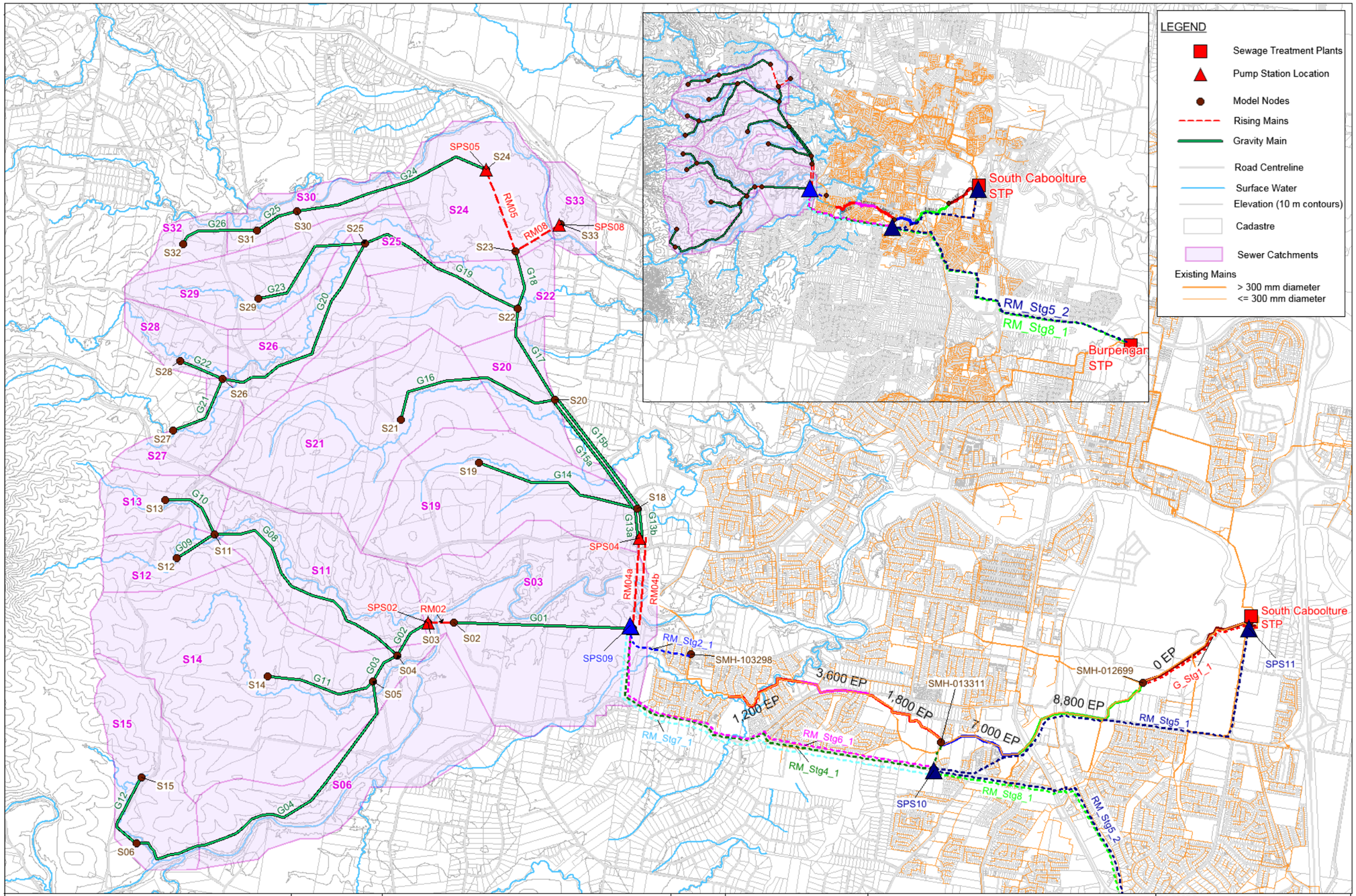
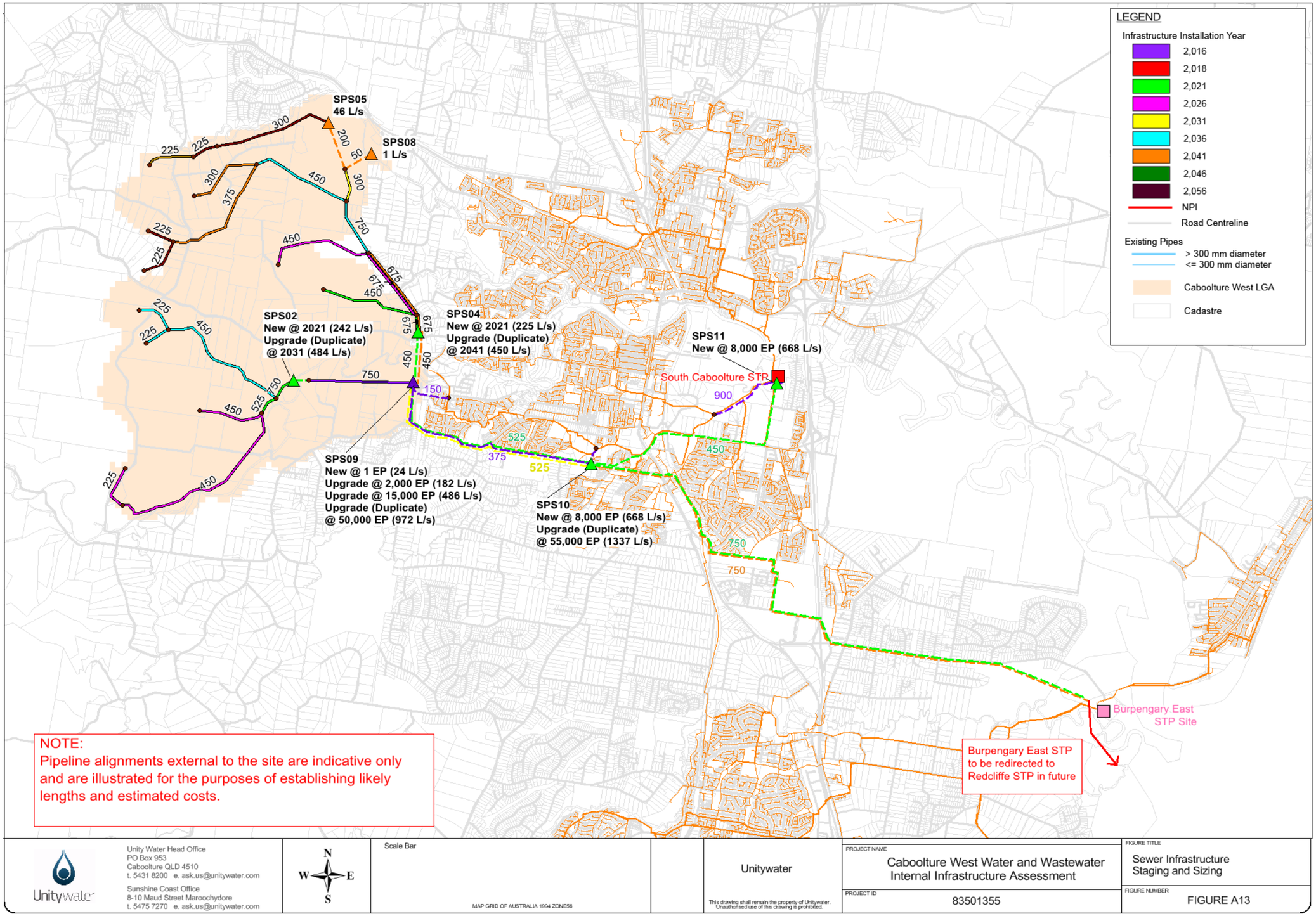


Figure A13 – Ultimate Sewer Infrastructure Staging and Sizing



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PROJECT NAME: Caboolture West Water and Wastewater Internal Infrastructure Assessment

PROJECT ID: 83501355

FIGURE TITLE: Sewer Infrastructure Staging and Sizing

FIGURE NUMBER: FIGURE A13

Appendix B : Infrastructure Tables

Table B1: Ultimate Water Network Infrastructure

Asset ID	Asset Type	EP Trigger (N/A to all infrastructure)	Estimate Planning Horizon	Length (m)	Diameter (m)	Material	Start Node	End Node	Base Infrastructure Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Water Trunk Mains													
WM01	Water Main		2026	9	750	DICL	W02	W01	$88,006	$35,202	$24,642	$59,140	$206,990
WM02	Water Main		2026	10	900	DICL	W04	W02	$92,251	$36,900	$25,830	$61,993	$216,975
WM03	Water Main		2046	509	100	PVC	W02	W25	$115,077	$46,031	$32,222	$77,332	$270,661
WM04	Water Main		2041	2,152	200	PVC	W25	W03	$432,835	$173,134	$121,194	$290,865	$1,018,027
WM05	Water Main		2056	609	250	PVC	W04	W05	$227,802	$91,121	$63,784	$153,083	$535,789
WM06	Water Main		2056	898	250	PVC	W05	W06	$299,751	$119,900	$83,930	$201,433	$705,014
WM07	Water Main		2041	905	375	DICL	W06	W25	$525,951	$210,380	$147,266	$353,439	$1,237,036
WM08	Water Main		2036	1,067	100	PVC	W03	W07	$157,234	$62,894	$44,025	$105,661	$369,814
WM09	Water Main		2026	3,717	100	PVC	W07	W23	$357,783	$143,113	$100,179	$240,430	$841,506
WM10	Water Main		2026	1,221	250	PVC	W07	W10	$379,981	$151,992	$106,395	$255,347	$893,714
WM11	Water Main		2056	797	250	PVC	W08	W04	$274,579	$109,832	$76,882	$184,517	$645,810
WM12	Water Main		2041	453	450	DICL	W06	W09	$348,291	$139,316	$97,521	$234,051	$819,179
WM13	Water Main		2036	1,404	450	DICL	W09	W10	$918,689	$367,476	$257,233	$617,359	$2,160,756
WM14	Water Main		2036	920	600	DICL	W09	W11	$918,700	$367,480	$257,236	$617,366	$2,160,781
WM15	Water Main		2026	1,605	250	PVC	W10	W13	$475,288	$190,115	$133,081	$319,393	$1,117,876
WM16	Water Main		2026	1,588	900	DICL	W27	W08	$2,545,398	$1,018,159	$712,711	$1,710,507	$5,986,775
WM17	Water Main		2026	1,671	900	DICL	W08	W11	$2,673,944	$1,069,577	$748,704	$1,796,890	$6,289,115
WM18	Water Main		2026	491	450	DICL	W11	W14	$371,085	$148,434	$103,904	$249,369	$872,792
WM19	Water Main		2026	1,040	600	DICL	W11	W12	$1,028,102	$411,241	$287,868	$690,884	$2,418,095
WM20	Water Main		2026	569	450	DICL	W12	W15	$418,030	$167,212	$117,048	$280,916	$983,206
WM21	Water Main		2026	1,510	525	DICL	W12	W13	$1,170,342	$468,137	$327,696	$786,470	$2,752,644
WM22	Water Main		2016	1,387	450	DICL	W13	W23	$908,849	$363,539	$254,478	$610,746	$2,137,612
WM23	Water Main		2016	844	375	DICL	W23	W19	$495,826	$198,331	$138,831	$333,195	$1,166,183
WM24	Water Main		2026	1,776	450	DICL	W14	W16	$1,142,228	$456,891	$319,824	$767,577	$2,686,521
WM25	Water Main		2026	1,634	450	DICL	W15	W26	$1,056,721	$422,688	$295,882	$710,116	$2,485,408
WM26	Water Main		2026	1,658	250	PVC	W16	W17	$488,638	$195,455	$136,819	$328,365	$1,149,276
WM27	Water Main		2026	211	250	PVC	W26	W17	$129,092	$51,637	$36,146	$86,750	$303,626
WM28	Water Main		2026	394	375	DICL	W18	W26	$272,500	$109,000	$76,300	$183,120	$640,919
WM29	Water Main	1	2016	896	250	PVC	W19	W35	$299,149	$119,660	$83,762	$201,028	$703,600
WM30	Water Main		2026	1,496	250	PVC	W20	W16	$448,215	$179,286	$125,500	$301,200	$1,054,201
WM31	Water Main		2026	3,044	100	PVC	W17	W20	$306,824	$122,730	$85,911	$206,186	$721,649
WM32	Water Main		2026	7,181	600	DICL	W21	W24	$6,647,619	$2,659,048	$1,861,333	$4,467,200	$15,635,201
WM33	Water Main	2201	2016	986	600	DICL	W24	W22	$978,561	$391,425	$273,997	$657,593	$2,301,576
WM34	Water Main	2201	2016	2,144	600	DICL	W24	W36	$2,038,679	$815,472	$570,830	$1,369,993	$4,794,974
WM35	Water Main		2016	135	450	DICL	W36	W13	$157,536	$63,014	$44,110	$105,864	$370,524
WM36	Water Main		2021	1,370	250	PVC	W35	W18	$416,957	$166,783	$116,748	$280,195	$980,682
WM37	Water Main	2201	2016	1,562	250	PVC	W13	W35	$464,773	$185,909	$130,136	$312,327	$1,093,146
WM38_Interim	Water Main	1	2016	1,421	250	PVC	W35	W40	$429,671	$171,868	$120,308	$288,739	$1,010,585
WM39_Interim	Water Main	1	2016	992	250	PVC	W19	W41	$30,643,754	$12,257,502	$8,580,251	$20,592,603	$72,074,110
Total Trunk Water Mains									$61,144,707	$24,457,883	$17,120,518	$41,089,243	$143,812,350
Total Cost + 10% uplift for currently undefined trenchless construction of some assets									$67,259,177	$26,903,671	$18,832,570	$45,198,167	$158,193,585

Table B1: Ultimate Water Network Infrastructure - Continued

Asset ID	Asset Type	EP Trigger	Year	Length (m)	Diameter (m)	Material	Start Node	End Node	Base Infrastructure Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Major Valves and Fittings													
Flowmeter 1	Flowmeter		2021		250		W15		$54,043	$21,617	$15,132	$36,317	$127,110
Flowmeter 2	Flowmeter		2026		450		W20		$59,513	$23,805	$16,664	$39,993	$139,975
Flowmeter 3	Flowmeter		2021		375		W18		$58,419	$23,368	$16,357	$39,258	$137,402
Flowmeter 4	Flowmeter		2016		375		W19		$58,419	$23,368	$16,357	$39,258	$137,402
Flowmeter 5	Flowmeter		2026		375		W2		$58,419	$23,368	$16,357	$39,258	$137,402
Flowmeter 7	Flowmeter		2026		375		W5		$58,419	$23,368	$16,357	$39,258	$137,402
Flowmeter 8	Flowmeter		2056		450		W14		$59,513	$23,805	$16,664	$39,993	$139,975
Flowmeter 9	Flowmeter		2046		375		W29		$58,419	$23,368	$16,357	$39,258	$137,402
Flowmeter 11	Flowmeter		2036		250		W3		$54,043	$21,617	$15,132	$36,317	$127,110
PRV 1	PRV		2021		250		W15		$15,404	$6,162	$4,313	$10,352	$36,230
PRV 3	PRV		2021		375		W18		$25,716	$10,287	$7,201	$17,281	$60,485
PRV 4	PRV		2016		375		W19		$25,716	$10,287	$7,201	$17,281	$60,485
PRV 5	PRV		2026		375		W2		$25,716	$10,287	$7,201	$17,281	$60,485
PRV 7	PRV		2026		375		W30		$25,716	$10,287	$7,201	$17,281	$60,485
PRV 9	PRV		2046		375		W14		$25,716	$10,287	$7,201	$17,281	$60,485
PRV 11	PRV		2036		250		W3		$15,404	$6,162	$4,313	$10,352	$36,230
FM12 - MFHLZ	Flow meter	1	2016		250		W40		$54,043	$21,617	$15,132	$36,317	$127,110
FM13 - Emergency	Flow meter	1	2016		250		W41		$54,043	$21,617	$15,132	$36,317	$127,110
NPI Connection	NPI Connection	2,201	2016		600		NPI						$5,000,000
Total Major Valves and Fittings									$894,773	$357,909	$250,536	$601,288	$7,104,506

Asset ID	Asset Type	EP Trigger	Year	Flow (L/s)	Head (m)	Power (kW)	Node	Base Infrastructure Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Water Pump Stations												
Pump Station 1	Pump Station - Stage 1	10,001	2021	220	40.90	346	W42	$1,703,100	$681,240	$476,868.00	$1,144,483	$4,005,691
Pump Station 2	Pump Station upgrade to Ultimate size		2031	401	56.10	629	W42	$1,449,500	$579,800	$405,860.00	$974,064	$3,409,224
Total Pump Stations								$3,152,600	$1,261,040	$882,728	$2,118,547	$7,414,915

Asset ID	Asset Type	EP Trigger	Year	TWL (mAHD)	Ground Level (mAHD)	Volume (ML)	Node	Base Infrastructure Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Water Reservoirs												
Interim Reservoir	Reservoir	2,201	2016	50	45	5.5	W42	$2,721,488	$1,088,595	$762,017	$1,828,840	$6,400,939
Reservoir 1	Reservoir - Stage 1	10,001	2018	100	90	20	W27	$5,291,909	$2,116,764	$1,481,735	$3,556,163	$12,446,570
Reservoir 2	Reservoir - Stage 2		2031	100	90	20	W27	$4,246,859	$1,698,744	$1,189,121	$2,853,889	$9,988,613
Total Reservoirs								$12,260,256	$4,904,102	$3,432,872	$8,238,892	$28,836,122
Other												
SCADA Programming												$300,000
Water quality treatment / re-chlorination												$500,000
Total Other												$800,000
TOTAL COST of Water Supply Trunk Assets												**$202,349,128**

Table B2: Ultimate Sewer Network Infrastructure

Asset ID	Asset Type	EP Trigger	Year	Length (m)	Diameter (m)	Material	Start Node	End Node	Depth Range (m)	Base Infrastructure Cost ($)	Cost of Trunk Main Manholes ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Sewer Gravity Mains															
G1	Gravity Main		2016	1,757	750	DICL	S02	S01	2.36 - 1.5	$2,225,812	$64,570	$916,153	$545,111	$1,500,658	$5,252,302
G2	Gravity Main		2021	448	750	DICL	S04	S03	4.18 - 1.78	$609,464	$16,464	$250,371	$148,971	$410,108	$1,435,378
G3	Gravity Main		2021	371	525	DICL	S05	S04	2.72 - 1.78	$325,094	$13,634	$135,491	$80,617	$221,935	$776,771
G4	Gravity Main		2026	3,343	450	DICL	S06	S05	2.72 - 1.04	$2,062,105	$122,855	$873,984	$520,020	$1,431,586	$5,010,550
G8	Gravity Main		2031	2,342	450	DICL	S11	S04	1.51 - 1.29	$1,461,496	$86,069	$619,026	$368,320	$1,013,964	$3,548,875
G9	Gravity Main		2031	443	225	PE	S12	S11	2 - 1.51	$129,824	$13,822	$57,458	$34,188	$94,117	$329,408
G10	Gravity Main		2031	670	225	PE	S13	S11	2 - 1.09	$167,511	$20,904	$75,366	$44,843	$123,450	$432,074
G11	Gravity Main		2026	1,085	450	DICL	S14	S05	2 - 1.85	$707,285	$39,874	$298,863	$177,824	$489,538	$1,713,384
G12	Gravity Main		2026	800	225	PE	S15	S06	2 - 1.04	$189,094	$24,960	$85,622	$50,945	$140,248	$490,870
G13a	Gravity Main		2021	292	675	DICL	S18	S17	8.71 - 7.22	$342,344	$10,731	$141,230	$84,032	$231,335	$809,671
G13b	Gravity Main		2041	292	675	DICL	S18	S17	8.71 - 7.22	$342,344	$10,731	$141,230	$84,032	$231,335	$809,671
G14	Gravity Main		2021	1,450	450	DICL	S19	S18	2.63 - 2	$926,288	$53,288	$391,830	$233,139	$641,818	$2,246,363
G15a	Gravity Main		2026	1,333	675	DICL	S20	S18	7.22 - 5.55	$1,362,198	$48,988	$564,474	$335,862	$924,609	$3,236,130
G15b	Gravity Main		2041	1,333	675	DICL	S20	S18	7.22 - 5.55	$1,362,198	$48,988	$564,474	$335,862	$924,609	$3,236,130
G16	Gravity Main		2026	1,805	450	DICL	S21	S20	3.8 - 2	$1,139,291	$66,334	$482,250	$286,939	$789,925	$2,764,739
G17	Gravity Main		2031	999	750	DICL	S22	S20	5.55 - 1.72	$1,289,836	$36,713	$530,620	$315,719	$869,155	$3,042,044
G18	Gravity Main		2036	582	300	DICL	S23	S22	2 - 1.2	$255,147	$18,158	$109,322	$65,047	$179,070	$626,745
G19	Gravity Main		2031	1,655	450	DICL	S25	S22	1.72 - 1.53	$1,049,290	$60,821	$444,044	$264,206	$727,345	$2,545,707
G20	Gravity Main		2041	2,155	375	DICL	S26	S25	1.55 - 1.53	$1,127,000	$67,236	$477,694	$284,228	$782,463	$2,738,622
G21	Gravity Main		2046	812	225	PE	S27	S26	2 - 1.55	$191,087	$25,334	$86,568	$51,508	$141,799	$496,297
G22	Gravity Main		2046	450	225	PE	S28	S26	2 - 1.42	$130,986	$14,040	$58,010	$34,516	$95,021	$332,574
G23	Gravity Main		2041	1,313	300	DICL	S29	S25	2 - 1.5	$504,933	$40,966	$218,360	$129,924	$357,673	$1,251,856
G24	Gravity Main		2046	1,979	300	DICL	S30	S24	3.43 - 2.78	$732,509	$61,745	$317,701	$189,032	$520,395	$1,821,382
G25	Gravity Main		2046	442	225	PE	S31	S30	2.78 - 1.01	$129,658	$13,790	$57,379	$34,141	$93,987	$328,956
G26	Gravity Main		2051	721	225	PE	S32	S31	2 - 1.01	$175,979	$22,495	$79,390	$47,237	$130,040	$455,140
G-Stg1_1	Gravity Main	1	2016	1,350	900	DICL	SMH-012699	SC_STP	2.78 - 1.01	$2,704,439	$49,613	$1,101,621	$655,464	$1,804,455	$6,315,591
Total Trunk Gravity Mains										$21,643,211	$1,053,122	$9,078,533	$5,401,727	$14,870,637	$52,047,230
Total Trunk Gravity Mains + 10% uplift for currently undefined trenchless construction of some assets										$23,807,532	$1,158,434	$9,986,386	$5,941,900	$16,357,701	$57,251,953

Asset ID	Asset Type	EP Trigger	Year	Length (m)	Diameter (m)	Material	Start Node	End Node	Note	Base Infrastructure Cost ($)		Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Sewage Rising Mains															
RM02	Rising Main		2031	250	500	DICL	S03	S02		$166,485		$66,594	$39,623	$109,081	$381,784
RM04a	Rising Main		2021	879	450	DICL	S17	S01		$527,408		$210,963	$125,523	$345,558	$1,209,451
RM04b	Rising Main		2041	879	450	DICL	S17	S01	Duplication	$527,408		$210,963	$125,523	$345,558	$1,209,451
RM05	Rising Main		2041	845	200	DICL	S24	S23		$181,709		$72,683	$43,247	$119,055	$416,694
RM08	Rising Main		2041	500	50	PE	S33	S23		$21,734		$8,693	$5,173	$14,240	$49,839
RM_Stg2_1	Rising Main	1	2016	900	150	DICL	SPS-09	SMH-103298		$145,430		$58,172	$34,612	$95,286	$333,501
RM_Stg4_1	Rising Main	2,000	2016	3,600	375	DICL	SPS-09	SMH-013311		$1,788,681		$715,472	$425,706	$1,171,944	$4,101,804
RM_Stg5_1	Rising Main	8,000	2021	4000	450	DICL	SPS-011	SPS-010		$2,400,035		$960,014	$571,208	$1,572,503	$5,503,760
RM_Stg5_2	Rising Main	8,000	2021	10,460	750	DICL	SPS-010	BE_STP		$12,915,963		$5,166,385	$3,073,999	$8,462,539	$29,618,887
RM_Stg6_1	Rising Main	15,000	2021	3,600	525	DICL	SPS-09	SPS-010	Duplication	$2,608,478		$1,043,391	$620,818	$1,709,075	$5,981,763
RM_Stg7_1	Rising Main	50,000	2031	3,600	525	DICL	SPS-09	SPS-010	Replacement	$2,608,478		$1,043,391	$620,818	$1,709,075	$5,981,763
RM_Stg8_1	Rising Main	55,000	2041	10,460	750	DICL	SPS-010	BE_STP	Duplication	$12,915,963		$5,166,385	$3,073,999	$8,462,539	$29,618,887
Total Rising Mains										$36,807,772		$14,723,109	$8,760,250	$24,116,452	$84,407,584
Total Rising Mains + 10% uplift for currently undefined trenchless construction of some assets										$40,488,550		$16,195,420	$9,636,275	$26,528,098	$92,848,342

Table B2: Ultimate Sewer Network Infrastructure - continued

Asset ID	Asset Type	EP Trigger	Year	Flow (L/s)	Head Gain (m)	Power (kW)_pump	Node	New/Upgrade	Base infrastructure Cost ($)			On-Cost ($)	Contingency Cost ($)	Final Cost ($)
Sewage Pump Stations														
SPS02	SPS		2021	242	6.50	22	S03	New	$1,438,308			$244,512.29	$673,128	$2,355,948
SPS02_upgrade	SPS		2031	483	8.03	54	S03	Upgrade	$1,784,366			$303,342.23	$835,083	$2,922,792
SPS04a	SPS		2021	225	10.43	33	S17	New	$1,663,346			$282,768.89	$778,446	$2,724,561
SPS04_upgrade	SPS		2041	449	9.96	63	S17	Upgrade	$1,246,349			$211,879.28	$583,291	$2,041,519
SPS05	SPS		2041	46	14.79	10	S24	New	$701,888			$119,320.98	$328,484	$1,149,693
SPS08	SPS		2041	1	14.52	5	S33	New	$465,799			$79,185.83	$217,994	$762,979
SPS09	SPS	1	2016	24	21.80	8	SPS09	New	$669,061			$113,740.42	$313,121	$1,095,922
SPS09_upgrade	SPS	2,000	2016	182	42.69	117	SPS09	Upgrade	$2,203,077			$374,523.17	$1,031,040	$3,608,641
SPS10	SPS	8,000	2021	668	51.33	518	SPS10	New	$6,156,182			$1,046,551.02	$2,881,093	$10,083,827
SPS11	SPS	8,000	2021	255	33.77	130	SPS11	New	$2,300,874			$391,148.66	$1,076,809	$3,768,832
SPS09_upgrade_2	SPS	15,000	2021	486	46.45	341	SPS09	Upgrade	$3,936,927			$669,277.63	$1,842,482	$6,448,687
SPS09_upgrade_3	SPS	50,000	2031	486 (972 total)	46.45	341	SPS09	Upgrade (Duplicate)	$3,936,927			$669,277.63	$1,842,482	$6,448,687
SPS10_upgrade	SPS	55,000	2041	668 (1337 total)	51.33	518	SPS10	Upgrade (Duplicate)	$5,312,051			$903,048.65	$2,486,040	$8,701,139
Total Sewage Pump Stations									$31,815,157			$5,408,577	$14,889,493	$52,113,227
Asset ID	**Asset Type**			**Flow (ML/day)**			**Node**		**Base infrastructure Cost ($)**			**On-Cost ($)**	**Contingency Cost ($)**	**Final Cost ($)**
Sewage Treatment Plants														
Burpengary East	STP Upgrade			16			S38		$60,783,648			$10,333,220.21	$28,446,747	$99,563,616
TOTAL COST of Sewerage Trunk Assets														**$301,777,138**

Table B3: Donated Water Assets

Developable land (ha)	100-300mm water mains (m)	Water Hydrants (No.)	Water Valves (No.)	All Donated Water Mains ($)	Water Hydrants Cost ($)	Water Valves Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
1,546	355,524	4,423	2,370	$51,332,489	$7,422,003	$4,646,058	$25,360,220	$17,752,154	$42,605,169	$149,118,092

Table B4: Donated Sewer Assets

Developable land (ha)	150mm Gravity Pipe (m)	225mm Gravity Pipe (m)	Sewer Manholes (No.)	Donated 150mm Gravity Pipes ($)	Donated 225mm Gravity Pipes ($)	All Donated Sewer Mains ($)	Sewer Manholes Cost ($)	Soil Type Factor Cost ($)	On-Cost ($)	Contingency Cost ($)	Final Cost ($)
1,546	347,121	68,262	9,981	$49,193,647	$3,410,251	$52,603,898	$31,140,174	$33,497,629	$19,931,089	$54,869,116	$192,041,907