REPORT

Sewer Strategic Infrastructure Plan

Agnes Water Sewerage Scheme

Prepared for Gladstone Regional Council

August 2014

QUALITY STATEMENT

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Executive Summary

Introduction

The Agnes Water Sewerage Scheme is a combination of gravity sewer and pump stations. The northern part of the catchment serves 1770. Flows from 1770 are then conveyed to Agnes Water. All the flows from 1770 and Agnes Water are then conveyed to Agnes Water Sewage Treatment Plant (STP).

The primary objective of the Sewer Strategic Infrastructure Plan was to identify the sewer infrastructure required to service the existing and future catchment demands in accordance with the Desired Standards of Service (DSS) in the Agnes Water Sewerage Scheme.

In order to achieve the purpose of this study the following key tasks were undertaken:

- Develop and update a hydraulic all pipe sewerage model in H20 MAP SWMM
- Within the same model, develop scenarios for planning horizons; 2012 (Current), 2016, 2021, 2026, 2031 and 2041 (Ultimate) models based on the latest GIS based demand model.
- Assess existing system capacity to deliver Peak Wet Weather Flow (PWWF) (5 times Average Dry Weather Flow (ADWF)) for all planning horizons
- Assess currently proposed strategies as provided by GRC
- Develop infrastructure or non-infrastructure solutions to ensure DSS requirements are achieved over all planning horizons
- Provide cost estimates for all solutions

Model update

A hydraulic model was received from GRC for use in Infowrks CS. The existing sewer GIS asset data was also supplied. The model was then reviewed against the asset data and updated.

Demands as contained within the concurrently developed GIS based demand model were allocated to hydraulic models for current (2014), 2016, 2021, 2026, 2031 and ultimate planning horizons for infrastructure assessment purposes.

System Performance Assessment

System Performance was assessed against three standards as shown in Table A.

Table A: System Performance Assessment Standards

Gravity Sewers	
Surcharge requirements	For existing sewer, surcharge of no more than 1m below the manhole surface level at PWWF
Storage	
Emergency Storage	Volume (kL) = 4 hours ADWF of the pump station's gravity catchment + 50% of any immediately upstream pump station emergency storage requirement
Pumping Stations	
Pump station Capacity	PWWF

Where failures of these standards were identified, upgrade and augmentations were proposed.

Infrastructure Schedules

New pump stations were identified in GRC's future servicing strategy these are shown in Table B Locations are shown in Figures A0 to A2 in Appendix A.

Table B: Summary of Pump Station Requirements

Pump Station ID	Upgrade ID	Planning Horizon	Flow (L/s)	Duty Head (m)	Location
SPS_A	SPS_AW_001	2016	157	45	Near Jarvey Drive
SPS_B	SPS_AW_002	Ultimate	4	9	Bicentennial Drive
SPS_C	SPS_AW_003	Ultimate	11	30	Round Hill Road
SPS_D	SPS_AW_004	2016	64	35	Near Captain Cook Drive
SPS_E	SPS_AW_005	2016	61	39	Springs Road

Where gravity sewer failures of the DSS are identified, the upgrade requirements are shown in Table 7-2 C. Locations are shown in Figures A0 to A2 in Appendix A. All augmentations of existing sewers consist of a duplication of the sewer along the existing route.

Table C: Summary of Gravity Sewer Mains Upgrades

Augmentation ID	Planning Horizon	Length (m)	Diameter (mm)	Location
SGM_AW_001	2016	269	225	Near Seaspray Drive
SGM_AW_002	2031	114	150	Marine Parade
SGM_AW_003	2016	1,198	225	Near Fitzroy Crescent/Captain Cook Drive
SGM_AW_004	2016	386	450	Near Fitzroy Crescent/Captain Cook Drive
SGM_AW_005	2016	280	375	Springs Road
SGM_AW_006	2016	1,804	450	Near Bicentennial Drive/Jarvey Drive/Watermark Avenue
SGM_AW_007	Ultimate	1,674	225	Bicentennial Drive

SGM_AW_003/004/005/006/007 are all required as part of GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme.

Based on GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1–1 the new pump stations shown in Table D are required. The locations of these pump station are shown in Figures A0, A1 and A2 shown in Appendix A. No augmentations to existing rising mains are proposed.

Table D: Summary of Rising Mains Upgrades

Augmentation ID*	SPS ID	Planning Horizon	Length (m)	Diameter (mm)	Location
SRM_AW_001	SPS_D	2016	1,505	250	Near Discovery Drive
SRM_AW_002	SPS_B	Ultimate	342	100	Bicentennial Drive
SRM_AW_003	SPS_A	2016	5,657	375	Anderson Way
SRM_AW_004	SPS_C	Ultimate	1,152	100	Round Hill Road

It should be noted that the redirection of PS02 as identified in the GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme is no longer proposed by this study.

Cost Estimation

The cost for the augmentations and upgrades are summarised in Table E.

Table E: Cost Estimates

	2014	2016	2021	2026	2031	Ultimate
Sewer Gravity Mains	$0	$2,421,965	$0	$0	$37,113	$607,519
Sewer Rising Mains	$0	$4,824,486	$0	$0	$0	$246,430
Sewage Pump Stations	$0	$1,622,820	$0	$0	$0	$248,740
Total	$0	$8,869,272	$0	$0	$37,113	$1,102,689

The cost estimation predicts that most investment is required in new infrastructure associated GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme. The cost of implementing this strategy is dominated by the cost of the proposed rising main from SPS A to Agnes Water Treatment Works.

Conclusions

The following conclusions can be made from this study:

- **Demands**

  The Demand Model estimates the total ET currently as 1,161 and ultimately as 4,623 within the Gladstone Sewerage Scheme.

  The demand model adopted for this assessment was based on the best available consumption and land use information for Agnes Water and is considered suitable for the purposes of this high level and strategic study. A number of assumptions were adopted in the development of this demand model and it is recommended that these assumptions be improved before adopting in future project phases (feasibility, design and delivery).

- **Pump Stations**

  Assessment of the capacity of existing pump station identified no upgrade requirements up to the Ultimate planning horizon, if GRC's future strategy is implemented.

  Overall, the proposed GRC strategy which includes the construction of SPS A, B, C, D and E and associated work resolves any capacity shortfall within pump stations in the Agnes Water Sewerage Scheme. No upgrades are anticipated.

- **Gravity Sewer Network**

  The assessment of the gravity network performance identified no surcharge within 1m of ground level due to lack of capacity within gravity sewer at the current planning horizon. Two future locations of surcharge at 2016 were identified: one is Seaspray Drive at the 2016 planning horizon and one in Marine Parade at the 2016 planning horizon.

  All other gravity sewers proposed in this study are associated with GRC's future servicing strategy.

- **Emergency Storage**

  No shortfalls in emergency storage were identified in this study, up to the Ultimate planning horizon.

- **Rising Main**

  All rising mains proposed in this study are associated with GRC's future servicing strategy. However, this study reviewed this strategy and concluded that the redirection of PS02 is not required.

- **Cost Estimation**

  The cost estimation predicts that most investment in assets is required at the 2016 planning horizon.

Recommendations

The following recommendations are made as a result of the findings of this study.

1. In order to increase confidence in the modelled predictions undertake the following:

    - Model pump run hours during ADWF should be compared against actual pump run hours based on SCADA data.
    - Records of observed controlled and uncontrolled overflows should be reviewed at locations of predicted DSS failures.

2. Demand allocation should be reviewed at locations where DSS failures on reticulation gravity sewers are predicted prior to implementing any augmentations. In particular this is required at the proposed augmentation in Seaspray Drive (SGM_AW_001).

3. At PS07 no demand is predicted upstream. In addition no pump curves or pump on/off levels were available to review the capacity. Upstream demands should be reviewed and pump curves obtained to check the capacity.

4. At PS03 no pump curves or pump on/off levels were available, therefore the pump discharge has been assumed based on the required PWWF. The pump curve should be obtained and the pump station capacity reviewed.

5. Pumps at PS05, PS71 and PS73 were modelled as fixed discharges. Pump curves should be obtained and the capacity of the pump stations reviewed.
6. No contour levels were available for use as part of this study. Therefore, at some locations of new infrastructure estimates of ground levels have been assumed or interpolated from available levels. Elevations should be confirmed at locations of new infrastructure and requirements of proposed infrastructure reviewed.

Gladstone Regional Council

Sewer Strategic Infrastructure Plan - Agnes Water Sewerage Scheme

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1 Introduction

MWH were engaged by Gladstone Regional Council in 2014 to develop water supply and sewerage strategic infrastructure plans for the Gladstone and Agnes Water networks. As part of this engagement 4 individual reports were produced as follows:

- Water Supply Strategic Infrastructure Plan – Gladstone Water Supply Scheme
- Water Supply Strategic Infrastructure Plan – Agnes Water Water Supply Scheme
- Sewerage Strategic Infrastructure Plan – Gladstone City Area
- Sewerage Strategic Infrastructure Plan – Agnes Water

The report represents the sewerage strategic infrastructure plan for the Agnes Water Sewage Treatment Plant (STP) catchment and documents the inputs, methodology, assumptions and approach adopted along with the water supply infrastructure outcomes.

All above listed reports have been prepared for the joint purpose of supporting Gladstone Regional Council's submission of the Local Government Infrastructure Plan (LGIP) for which updated water supply and sewerage infrastructure planning was required in the Gladstone City and Agnes Water networks.

1.1 Background

Gladstone Regional Council was formed in 2008 from the amalgamation of Calliope Shire Council, Gladstone City Council and Miriam Vale Shire Council. GRC is drafting a planning scheme for the whole of Gladstone Region, to replace the individual planning schemes for the three former shires. As part of GRC's submission of the draft planning scheme for its first State Interest Review in August 2014, one of the submission requirements is to prepare a Local Government Infrastructure Plan (LGIP), formerly known as a Priority Infrastructure Plan (PIP).

The LGIP outlines the necessary infrastructure required to service the next 10 to 15 years of growth outlined within the planning scheme. The LGIP outlines the local government's plans for providing trunk infrastructure to service urban development growth in a coordinated, efficient and orderly way. Trunk infrastructure is generally defined as 'higher order' infrastructure that is shared between developments, whereas non-trunk infrastructure is 'lower order' and is internal to developments which connects to 'higher order' trunk infrastructure.

To achieve this, the LGIP outlines the following infrastructure types:

- Water supply
- Sewerage
- Stormwater
- Transport
- Public parks and land for community facilities.

GRC engaged MWH to prepare a Sewer Strategic Infrastructure Plan for the Agnes Water Sewerage Scheme to enable the sewer component of the LGIP to be completed. The preparation of strategic infrastructure plans is in accordance with the *Sustainable Planning Act 2009,* Department of Local Government and Planning: Statutory Guideline 01/11 – Priority Infrastructure Plans, Queensland Planning Provisions (QPP) and the State Planning Regulatory Provision (SPRP).

This report documents the development of the plan to support the sewer component of the LGIP.

1.2 Terms of Reference

The Local Government Infrastructure Plan (LGIP) is structured as follows:

- *Planning Assumptions*, which clearly outlines the type, scale, location and timing of future development and growth and how these align with the local government's preferred land use pattern.
- *Priority Infrastructure Area* (PIA), which defines the parts of a local government area intended to accommodate the next 10-15 years growth for urban purposes.
- *Desired Standard of Service* (DSS), which details the applicable design and service standards to the respective trunk and non-trunk infrastructure networks.
- *Plans for Trunk Infrastructure* (PFTI), which identifies the existing and future trunk infrastructure to service urban development within the PIA.

The Sewer Strategic Infrastructure Plan supports the *Plans for Sewerage Infrastructure* component of the LGIP. The terms of reference to prepare the Sewer Strategic Infrastructure Plan requires the following tasks:

- Outline the development and growth factors affecting the need for additional sewer assets for the amalgamated GRC.
- Outline the desired sewer conditions to accommodate the region's needs.
- Identify sewer initiatives from previously prepared Priority Infrastructure Plans (PIPs).
- Provide a high level of assessment on the initiatives to determine their relative priority and year of implementation need.
- Deliver the sewer Strategic Infrastructure Plan to support the development of GRC's LGIP.

The terms of reference includes the following significant assumptions and limitations:

- The only initiatives to consider for inclusion in the LGIP were those from the previous three PIPs and other existing GRC documentation. Additional initiatives to resolve identified impacts during preparing the sewer Infrastructure Plan were excluded from the commission.
- Sewer modelling was excluded from the commission.
- Cost estimation was limited to GRC provided unit rates.

1.3 Project Scope

The primary objective of the Sewer Strategic Infrastructure Plan is to identify the sewer infrastructure required to service the existing and future catchment demands in accordance with the Desired Standards of Service (DSS).

In order to achieve the purpose of this study, the key tasks required are:

- Investigate the quality of data in GIS and extract data from GIS and other sources
- Define and confirm catchment boundaries and extents
- Develop and update a hydraulic all pipe infrastructure sewerage model in H20 MAP SWMM
- Within the same model, develop scenarios for planning horizons; 2012 (Current), 2016, 2021, 2026, 2031 and 2041 (Ultimate) models.
- Allocate loading in the model for all planning horizons based on the latest GIS based demand model
- Assess system capacity to deliver Peak Wet Weather Flow (PWWF) (5 times Average Dry Weather Flow (ADWF)) for the existing loads
- Assess existing system capacity to deliver PWWF for future loads
- Assess currently proposed strategies as provided by GRC
- Develop infrastructure or non-infrastructure solutions to ensure DSS requirements are achieved over all planning horizons
- Provide cost estimates for all solutions

- Prepare sewer infrastructure plans

1.4 Assessment Assumptions

MWH was supplied with the existing Agnes Water sewer hydraulic model in for use in InfoWorks CS and the existing GIS sewer asset data. A detailed review of the models was undertaken to identify any data quality issues and identify gaps in the data.

- The missing asset data not contained in the GIS data or the model, such as conduit invert levels and manhole chamber cover levels were interpolated appropriately from upstream and downstream data.
- Pump ON and OFF levels and pump curves provided in the model were assumed to be correct.
- No contour levels were available for use as part of this study. Therefore, at some locations of new infrastructure estimates of ground levels have been assumed or interpolated from available levels.

1.5 GRC's Proposed Future Strategy

GRC are in the process of implementing a strategy to manage sewage with the Agnes Water Sewerage Scheme. This is shown in Figure 1–1 and was reviewed and incorporated into the assessment undertaken in this study. Some of the infrastructure is currently being designed and constructed by GRC, however, the cost of all infrastructure was estimated by this study.

The strategy as proposed by GRC includes the following:

- Redirection of flows from 1770 and the north of Agnes Water to a new SPS D via a new gravity sewer.
- Redirection of flows from PS02 towards new SPS D.
- Redirection of flows from the upstream catchment of existing PS06 to new SPS D via a new gravity sewer.
- Decommissioning of existing booster pump station BSP01 and construction of a new pump station SPS E. This includes decommissioning sections of the existing rising main from existing pump stations PS01 and BSP01 and the construction of a new gravity sewer to convey flows from a new discharge point for PS01 to new SPS E
- New rising main from SPS D discharging to a new gravity sewer to convey flow to a new SPS A. The new gravity sewer also receives flow from SPS E and flows from PS08 catchment allowing PS08 to be decommissioned.
- New rising main from new SPS A to Agnes Water STP.
- New SPSs B and C and associated rising mains and downstream gravity sewer to convey flows towards new SPS A.

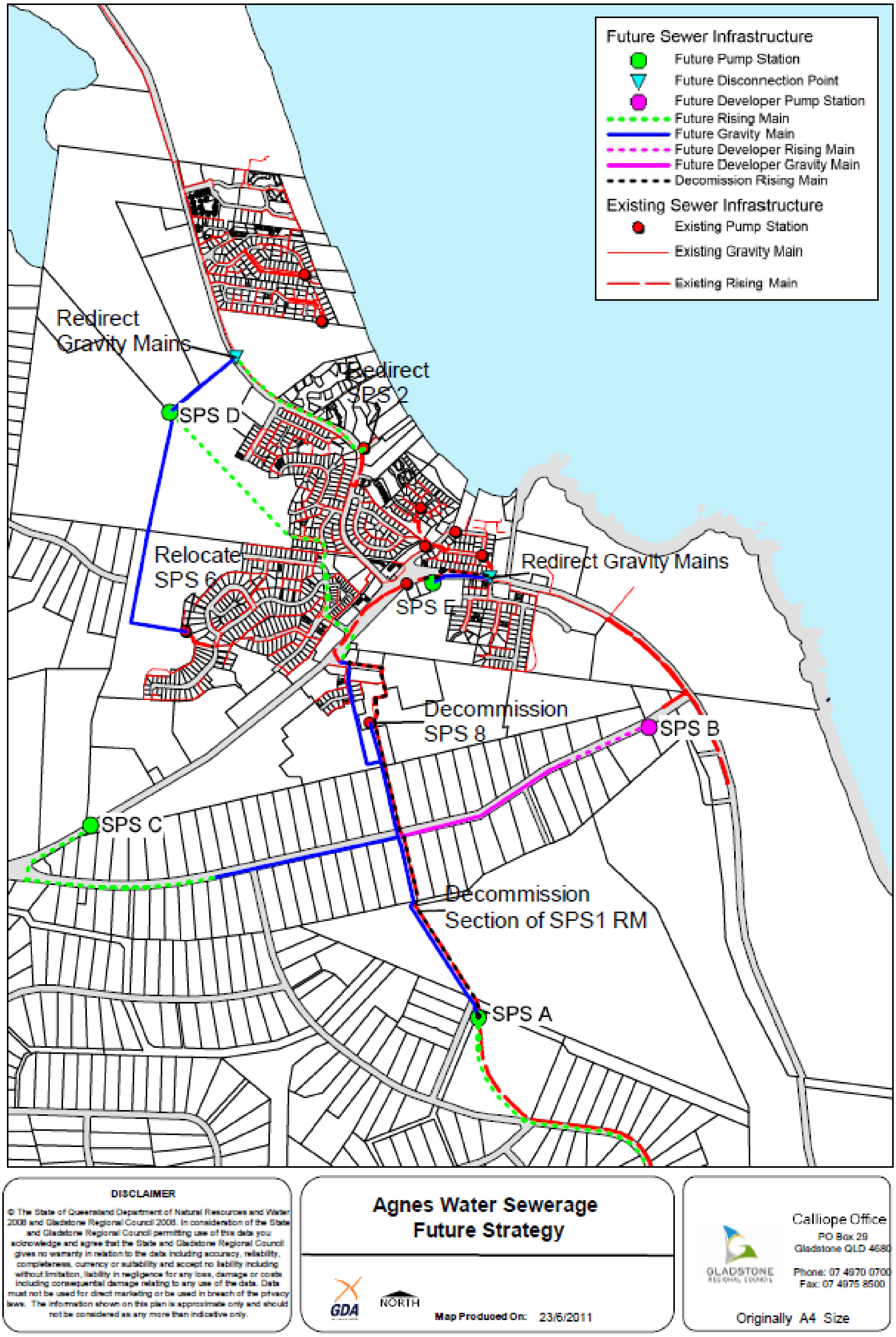


Figure 1-1: Agnes Water Sewerage Future Strategy

2 Desired Standards of Service

The Desired Standards of Service (DSS) have been based on GRC's 'Water and Wastewater Master Planning Guideline', version 0.1 January 2014. Service standards for wastewater have been decided by the Council taking into consideration of historical data and local conditions of the Agnes Water Sewerage Scheme. The DSS to be adopted for modelling are as detailed in **Error! Reference source not found.**.

Table 2-1: Design Standards of Service – Agnes Water Sewerage Scheme

Criteria	Value
Wastewater Demand	
Wastewater Demand	585 L/DAY
Average Dry Weather Flow (ADWF)	ADWF = 585 L/ET/DAY
Peak Wet Weather Flow (PWWF)	PWWF = 5 x ADWF
Gravity Mains	
Minimum Sewer Size	150 mm diameter for minimum ETs of 4
Surcharge requirements	For new sewers, gravity mains are to be no more than 100% full at PWWF For existing sewer, surcharge of no more than 1m below the manhole surface level at PWWF
Sewer Mains Capacity	Sized for PWWF
Friction losses	Head losses in gravity sewer mains are based on the Manning's formula $V = 1/N \times R^{0.67} \times S^{0.5}$ V = pipe velocity (m/s) N = Manning's roughness coefficient R = Hydraulic Radius (m) S = Pipe gradient (m/km)
Roughness Coefficients	N = 0.0130
Trunk Main	Classified as greater than 225NB or any main which is downstream of another trunk or any main which is downstream of a rising main
Branch Main	Classified as greater than 150NB and less than or equal to 225NB, downstream of a Branch main, downstream of a rising main
Rising Mains	
Maximum Velocity	1.5 m/s (at duty flow rate)
Friction losses	Head losses in rising mains are based on the Hazen-William formula $V= 0.3543 \times C \times S^{0.54} \times D^{0.63}$ V= Pipe velocity (m/s) C = Hazen-William roughness coefficient S = Pipe gradient (m/km) D = Pipe diameter (m)
Roughness Coefficient	C = 130
Storage	
Emergency Storage	Volume (kL) = 4 hours ADWF of the pump station's gravity catchment + 50% of any immediately upstream pump station emergency storage requirement
Pumping Stations	
Pump station Capacity	PWWF

Criteria	Value
Power	Power (kW) = ρgQH/1000 ρ - Fluid density = 1000 kg/m^3 g - Standard acceleration of gravity = 9.81 m/s Q - Duty flow rate (m^3/s) H - Total head (m)

3 Existing System Description

3.1 Background

The Agnes Water Sewerage Scheme is a combination of gravity and pumping system and contains 1770 and Agnes Water. The northern part of the catchment serves 1770. Flows from 1770 are then conveyed to Agnes Water. All the flows from 1770 and Agnes Water are then conveyed to Agnes Water STP.

The total drainage catchment covers an area of 1,096 ha and contains approximately 27 km of gravity sewers and 12 pumping stations including a booster pumping station.

The majority of the sewers are Plasticised Polyvinyl Chloride (PVC) pipes, with AC and DI pipes constituting the majority of the remaining pipelines.

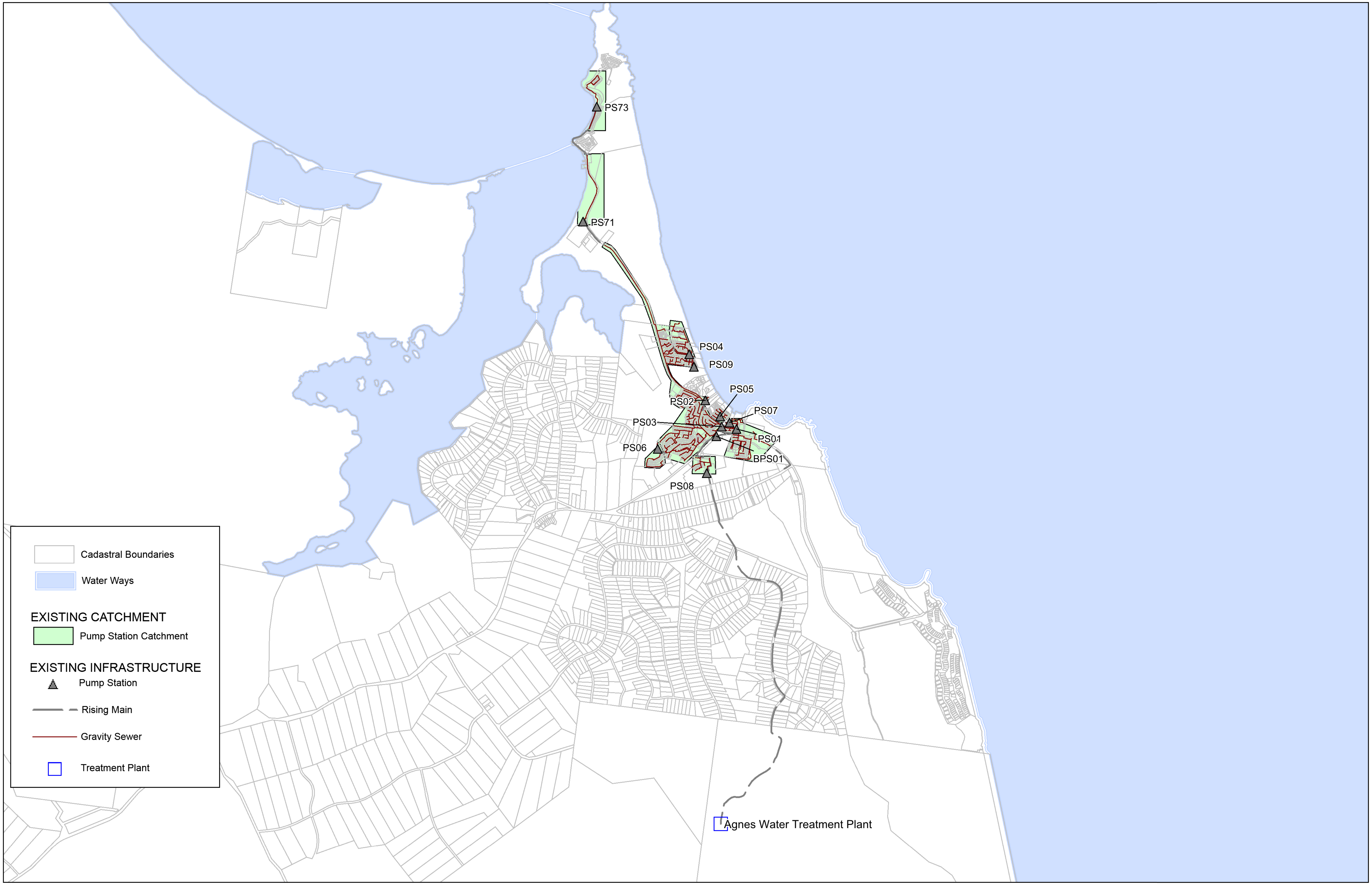
Table 3-1 summarises the details of existing sewerage system in Agnes Water.

Table 3-1: Existing Sewage Sewerage System Details of AW1770

Asset	Quantity
Sewage Treatment Plant (STP)	1
Sewage Pumping Station (SPS)	12*
Wet Wells at SPS	11
Emergency Overflows	None
All Manholes	707
All Pipes	686
Length of Gravity Mains (km)	27
Length of Rising Mains (km)	14

**Includes one Booster Pumping Station*

Figure 3-1 shows the AW1770 Sewerage Scheme and Figure 3-2 shows a schematic of the sewerage system.



GLADSTONE REGIONAL COUNCIL

SEWER INFRASTRUCTURE PLAN

MWH Global Pty Ltd can not be held responsible for any damages due to errors or omissions in this product.

Map Created:

Coordinate System: GDA 1994 MGA Zone 50

A4 Scale: 1:20,000

File Name: A3_Landscape

0 5 kilometres

Agnes Water Sewerage Scheme - Existing Network

Figure 3-1

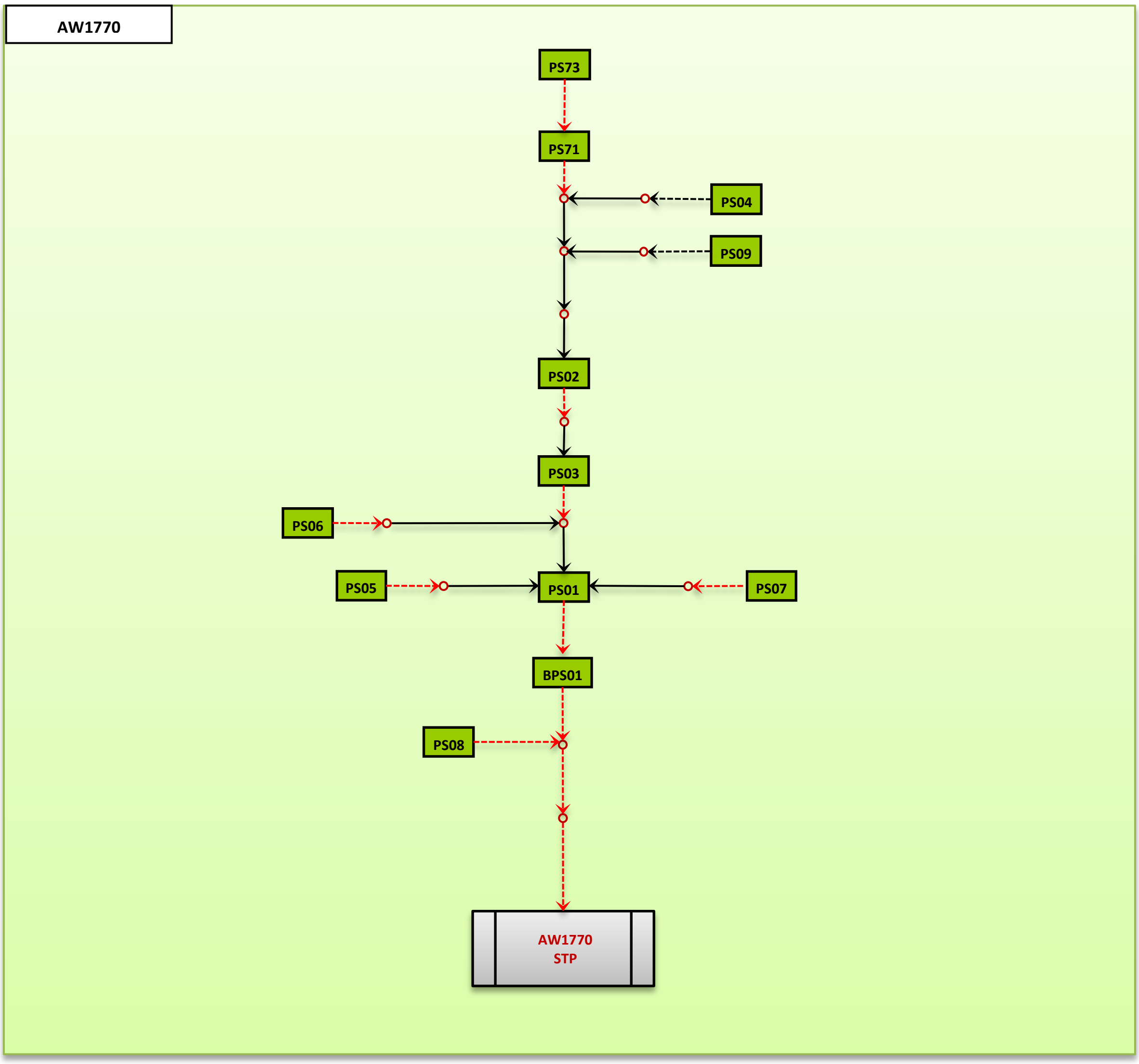


Figure 3-2: Schematic of Agnes Water Sewerage Scheme

3.2 Agnes Water Sewerage Catchment

The Agnes Water sewerage catchment covers the Agnes Water town area and 1770 located to the north of Agnes Water. The catchment has a total area of 1,096 ha. All flows are pumped to Agnes Water STP from pumping station PS01 through the booster pumping station BPS01. Agnes Water STP is located approximately 8km to the south of the Agnes Water catchment.

The network consists of approximately 27km of pipeline, ranging in diameter from 100mm to 300mm. There are 12 pumping stations and 11 wet wells within the network.

Table 3-2 summarises the details of existing Sewage Pumping Stations (SPS) and the available wet well storage at SPSs in AW1770 sewerage catchment A.

Table 3-2: Existing Sewage Pumping Station Details - Agnes Water/1770 Sewerage Catchment

Pump Station Name	Asset ID	Modelled Pump Station Capacity (L/s)	Existing Storage Volume (m^3)	Overflow Pipe Details (mm)
BPS01	BPS01-1	72	0	-
PS01	PS01-1	72	102	-
PS02	PS02-1	46	68	-
PS03	PS03*	-	14	-
PS04	PS04-1	17	63	-
PS05	PS05-1	-	29	-
PS06	PS06-1	0	12	-
PS07	PS07*	-	4	-
PS08	PS08-1	28	34	-
PS09	PS09-1	7	24	-
PS71	PS71-1	20	18	-
PS73	PS73-1	6	11	-

**Pump capacities are unknown as no information on the pump station was provided within the existing model*

4 Demand Development

The development of the GIS based demand model for the current and future demand horizons is described in detail in the 'Gladstone Regional Council Demand Model Development Technical Memo (MWH, July 2014)'. The methodology detailed within this report is summarised as follows:

1. The demand model was based on the future ultimate development GIS cadastre file supplied by GRC;

2. Each lot was designated a lot based land use as follows:
   a. The land uses were simplified and mapped to the model diurnal demand profile categories as shown in **Table 4-1** below;
   b. Any areas outside of the study area or not serviced by water or sewerage currently and into the future were designated with a RURAL land use type to indicate this;

Table 4-1: Land Use Code Mapping

GRC Land Use	Diurnal Pattern Profile
Single Family Residential	Residential
Multi-Family Residential	Residential
Commercial	Commercial
Mixed	Residential & Commercial
Industrial	Industrial
Community	Commercial
Public Open Space	Park
Schools	School

   c. The GRC existing customer accounts were used to identify whether an existing residential lot was single family residential (RES) or multi-family residential (RES-M);
   d. For multi-family residential and mixed use blocks, the GIS cadastre file contains a polygon for each individual residence and at least one for the lot area. To avoid over allocation of demand the lot polygons were designated a Land Use 'BLOCK';
   e. The land use for future development lots was determined from future development information supplied by GRC;

3. Existing (2014) Demand Development:
   a. For residential lots the following Equivalent Tenement (ET) ratios were adopted for existing lots in line with the GRC's Water and Wastewater Master Planning Guidelines;
      Single Family Residential = 1 ET/dwelling; and
      Multi-family Residential = 0.8125 ET/dwelling
      For the current horizon, demand was only allocated to lots with existing accounts.
   b. For existing non-residential lots ET was determined from the ET data provided by GRC. This ET had been determined from 2012/13 consumption data and ET derived using the average day water usage of 1,170 L/ET/day.

4. The demand model was extended to 2016, 2021, 2026, 2031, 2036 and Ultimate growth horizons.
   a. The future residential demand was grown in-line with the published Office of Economic and Statistical Research (OESR) population growth figures for the Agnes Water – Miriam Vale

SA2 area. It was assumed that 95% of the project growth within the Agnes Water – Miriam Vale SA2 area will occur within the Agnes Water study area.

b. The future non-residential demand was grown in line with the Gladstone Priority Infrastructure Plan (PIP) employment projections. Similar to residential demand development it was assumed that 95% of the project growth within the Agnes Water – Miriam Vale SA2 area will occur within the Agnes Water study area.

5. Information on all future identified development locations within Agnes Water was provided by GRC along with an order of expected development. ET demand was provided for a number of these parcels by GRC. For others ET was assigned based on an ET/ha development density derived with support of GRC and the standard demand ratios contained within the GRC Water and Wastewater Master Planning Guidelines. Developments were generally bought online in the demand model in priority order to match the demand growth profiles determined for the Agnes Water area.

4.1 Agnes Water Demand Outcomes

Table 4-2 provides a summary of the sewerage demand in ET developed for the Agnes Water sewerage network.

Table 4-2: Agnes Water ET Demand Summary (ET)

Zone	Current (2014)	2016	2021	2026	2031	2036	Ultimate
Agnes Water (excl. 1770)	1,092	1,303	1,560	1,807	2,070	2,365	4,549

Figure 4-1 provides the project Agnes Water sewage demands. Also plotted on Figure 4-1 are the OSER population projections adopted for this study. It should be noted that the demand unit ET does not apply to the population projections.

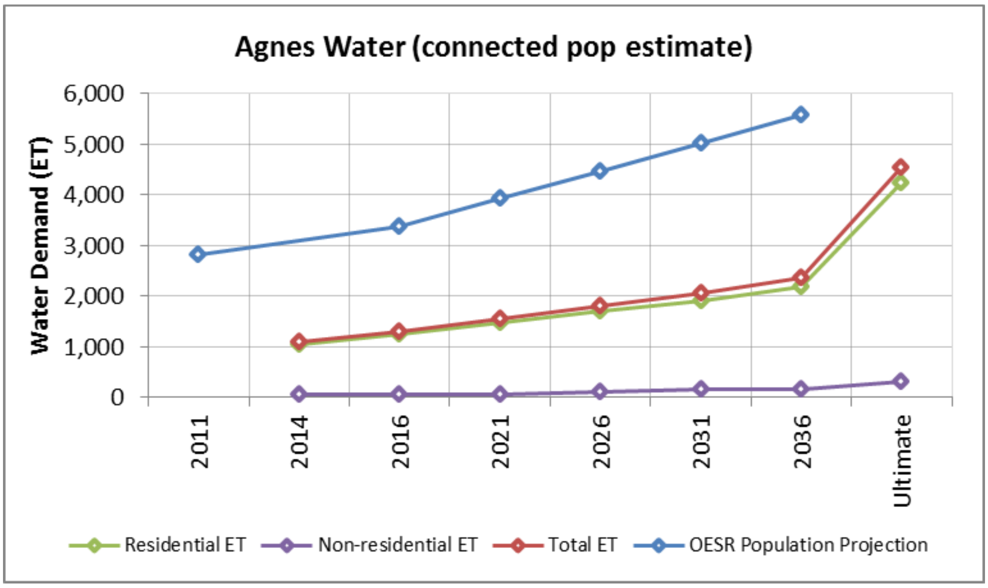


Figure 4-1: Agnes Water Sewage Demand (ET) and OSER Population Projections

5 Model Update

5.1 Previous Model

A model was received from GRC for the Agnes Water Sewerage Scheme, which was used as the basis for this study. The model was received for use in Infoworks CS. It was converted for use in H2OMAP SWMM.

The following assumptions were made in using the model as received from GRC:

- All connectivity was assumed to be correct.
- All pump curves within the model were assumed to be correct
- All pump on and off levels were assumed to be correct.

5.2 GIS Infrastructure Review

MWH was supplied with the existing GIS sewer asset data. A detailed review of the GIS data against the existing hydraulic models was undertaken to identify any data quality issues and identify gaps in the data.

The model received from GRC was then reviewed against the asset data. The models were updated to include any additional manholes and sewers contained within the GIS but not contained within the received model. The missing asset data such as conduit invert levels and sizes, manhole chamber cover levels and depths have been assumed wherever it is necessary in the models.

5.3 Scenario Setup

Three major scenarios have been considered in this study for the purpose of assessing system performance and identifying necessary infrastructure and trigger points.

CURRENT

The model *Current* represents the current scenario where demands are based on ETs at a theoretical usage of 585 L/ET/DAY.

The *Current* model is differentiated in to two scenarios; namely, Current Average Dry Weather Flow (ADWF) Scenario and Current Peak Wet Weather Flow (PWWF) Scenario.

INTERMEDIATE

The *Intermediate* model represents intermediate scenarios with four different demand sets for the years 2016, 2021, 2026 and 2031.

Each *intermediate* model is differentiated in to two scenarios; namely, Average Dry Weather Flow (ADWF) Scenario and Current Peak Wet Weather Flow (PWWF) Scenario. Different Facility Query sets have been created and utilised to account for any upgrades to hydraulic properties of the assets.

Different Facility Query sets have been created for the selected asset properties such as Conduits, Nodes, DWF Allocation, Pumps and Pump Curves. The Data Query sets have been named as 'ADWF_CatchmentName_IntermediateYear' (Example: ADWF_AS_2016) and 'PWWF_CatchmentName_IntermediateYear' (Example: PWWF_AS_2016).

ULTIMATE

The *Ultimate* model represents the Ultimate demand scenario and is based partly on PIA areas and partly on proposed developments.

The *Ultimate* model is differentiated into two scenarios; namely, Ultimate Average Dry Weather Flow (ADWF) Scenario and Ultimate Peak Wet Weather Flow (PWWF) Scenario.

Table 5-1 shows the details of the analysed scenarios and query sets for different planning horizons.

Table 5-1: Scenarios Analysed and Query Sets Used

Catchment	Scenario	Query set	Comment
CURRENT			
AW1770	CURRENT_AS_ADWF	ADWF_AS_CURRENT	Used to analyse the current scenario
AW1770	CURRENT_AS_PWWF	PWWF_AS_CURRENT	
INTERMEDIATE			
AW1770	2016_AS_ADWF	ADWF_AS_2016	Used to analyse 2016, 2021, 2026 and 2031 scenarios
AW1770	2016_AS_PWWF	PWWF_AS_2016	
AW1770	2021_AS_ADWF	ADWF_AS_2021	
AW1770	2021_AS_PWWF	PWWF_AS_2021	
AW1770	2026_AS_ADWF	ADWF_AS_2026	
AW1770	2026_AS_PWWF	PWWF_AS_2026	
AW1770	2031_AS_ADWF	ADWF_AS_2031	
AW1770	2031_AS_PWWF	PWWF_AS_2031	
ULTIMATE			
AW1770	ULT_AS_ADWF	ADWF_AS_ULT	Used to analyse Ultimate scenario
AW1770	ULT_AS_PWWF	PWWF_AS_ULT	

5.4 Demand Allocation

Dry weather flow (DWF) was distributed throughout the network using the automated routine ‘Demand Allocator’ within InfoSWMM Software. The routine was used to assign all lots/ETs to the nearest node on the sewer network. A sewer ET contribution of 585 L/ET/Day was applied to the model as a demand pattern. This demand pattern multiplied by the ET loaded to the node gives the ADWF loaded to that node. This process is liable to minor errors in the allocation of catchment to nodes but is the errors are considered insignificant for the planning process. The automated demand allocation was reviewed manually.

A summary of the Demand Allocation for different planning horizons derived for the purpose of sewer strategic plan development is shown in Table 5-2.

Table 5-2: Summary of Demand Allocation for Different Planning Horizons

Sewage Pumping Station	Existing and Projected Cumulative Equivalent Tenements					
	2014 (Current)	2016	2021	2026	2031	2041 (Ultimate)
BPS01	1,123	0	0	0	0	0
PS01	1,123	596	623	658	676	1,584
PS02	499	108	135	135	135	499
PS03	82	82	82	82	82	82
PS04	46	46	72	199	389	507
PS05	62	62	62	62	62	88
PS06	40	0	0	0	0	0
PS07	0	0	0	0	0	0
PS08	39	0	0	0	0	0
PS09	11	11	11	11	11	46
PS71	41	41	41	41	41	41
PS73	41	41	41	41	41	9
SPS A*	-	1,354	1,611	1,881	2,144	4,623
SPS B*	-	-	-	-	-	114
SPS C*	-	-	-	-	-	333
SPS D*	-	594	751	878	1,068	1,894
SPS E*	-	719	763	841	896	1,801

**Ages Water Future Sewage Pumping Stations*

6 System Performance Assessment

6.1 Assessment Methodology

A hydraulic analysis of the Agnes Water Sewerage Scheme was undertaken to identify potential hydraulic issues in the system as a result of predicted growth over the designated planning horizons. The performance of the existing sewer network was assessed against the flows generated from the demands predicted at the various planning horizons.

Performance of the following infrastructure was assessed against GRC's DSS:

- Pump Stations
- Emergency storage
- Gravity Sewers
- Rising Mains (where pump station upgrades are required)

6.1.1 Pump Capacity Assessment

A detailed assessment of pump station capacity was undertaken for all modelled pump stations. The assessment of pump station performance was undertaken in accordance with the DSS summarised in Section 2. The theoretical PWWF for each of the modelled pump stations and for each planning horizon are shown in Table 6-1, with its associated current modelled pump station capacity.

Table 6-1: Summary of Pump Station Capacity Requirements

Sewage Pumping Station	No. of Modelled Pumps	Type of Modelled Pump Curve	Existing Pump Station Capacity# (L/s)	Current and Projected Pump Capacity (L/s)					
				2014 (Current)	2016	2021	2026	2031	2041 (Ultimate)
BPS01	2	Modelled Pump Curve	34.2##	**38.0**	20.2	21.1	22.3	22.9	**53.6**
PS01	2	Modelled Pump Curve	34.2##						
PS02	2	Modelled Pump Curve	46.4	16.9	7.0	8.8	13.1	19.5	16.9
PS03**	2	Fixed	2.8	2.8	2.8	2.8	2.8	2.8	2.8
PS04	2	Modelled Pump Curve	17.2	1.6	1.6	2.4	6.7	13.2	17.2
PS05	2	Fixed	10.0	2.1	2.1	2.1	2.1	2.1	3.0
PS06	2	Modelled Pump Curve	3.2	1.4	-	-	-	-	-
PS07	1	Fixed	-	0.0	0.0	0.0	0.0	0.0	0.0
PS08	2	Modelled Pump Curve	20.0	1.3	0.0	0.0	0.0	0.0	0.0
PS09	2	Modelled Pump Curve	7.0	0.4	0.4	0.4	0.4	0.4	1.6
PS71	2	Fixed	10.0	1.4	1.4	1.4	1.4	1.4	1.4
PS73	2	Fixed	3.0	1.4	1.4	1.4	1.4	1.4	0.3
SPS A*	1	Fixed	-	0.0	45.8	54.5	63.7	72.6	156.5
SPS B*	1	Fixed	-	0.0	0.0	0.0	0.0	0.0	3.9
SPS C*	1	Fixed	-	0.0	0.0	0.0	0.0	0.0	11.3
SPS D*	1	Fixed	-	0.0	20.1	25.4	29.7	36.2	64.1
SPS E*	1	Fixed	-	0.0	24.3	25.8	28.5	30.3	61.0

*Note: The numbers in **BOLD** indicates that the pump capacities upgrade over the existing pump capacity for the respective planning horizons.*
**Agnes Water Future Sewage Pumping Stations*
***Pump included in original model received from GRC with no pump curves or on/off. Pump capacities and on/off level assumed.*
#Single pump capacity unless noted otherwise.
##Dual Pump operation during PWWF

Based on Table 6-1 the following should be noted:

- The capacity shortfall identified at PS01 is resolved by the construction of SPS E in 2016. This includes decommissioning of BSP01 and a significant section of rising main. The existing pumps are likely to run outside their normal operating range and a downgrade of pumps may be required. However, no assessment of the pump downgrade requirements at PS01 has been made by this study.

- At PS03 no pump curves or pump on/off were available, therefore the pump discharge has been assumed based on the required PWWF. It is recommended that the pump curve be obtained and the pump station capacity reviewed.
- PS06 is being relocated at 2016 and flows gravitated to SPS D.
- Pumps at PS05, PS71 and PS73 were modelled as fixed discharges. It is recommended that actual pump curves be obtained and the capacity of the pump stations reviewed.
- At PS07 no demand is predicted upstream. In addition no pump curves or pump on/off levels were available to review the capacity. It is recommend upstream demands reviewed and pump curves obtained to check the capacity.

Overall, the proposed GRC strategy which includes the construction of SPS A, B, C, D and E and associated work resolves any capacity shortfall within pump stations in the Agnes Water Sewerage Scheme. No further upgrade requirements are anticipated.

6.1.2 Storage Assessment

A detailed assessment of storage capacity was undertaken for all modelled wet wells in the catchment. The assessment of storage was undertaken in accordance with the DSS summarised in Section 2. The existing available emergency storage upstream of pump stations was assessed and compared against the required emergency storage for each planning horizon. This is shown in Table 6-2.

Table 6-2: Summary of Emergency Storage

Sewage Pumping Station	Existing Emergency Storage (m^3)	Current and Projected Wet Well Storage (m^3)					
		2014 (Current)	2016	2021	2026	2031	2041 (Ultimate)
BPS01	0	0	0	0	0	0	0
PS01	102	71	46	47	51	52	98
PS02	68	42	13	17	23	33	49
PS03	14	8	8	8	8	8	8
PS04	63	4	4	7	19	38	49
PS05	29	6	6	6	6	6	9
PS06	12	4	0	0	0	0	0
PS07	4	0	0	0	0	0	0
PS08	34	4	0	0	0	0	0
PS09	24	1	1	1	1	1	4
PS71	18	2	2	2	2	2	4
PS73	11	4	4	4	4	4	1

No shortfall in emergency storage is predicted within the Agnes Water Sewerage Scheme for any planning horizon.

6.1.3 Gravity Sewer Mains Assessment

A detailed assessment of gravity sewer main capacity was undertaken for all modelled sewers in the catchment. The assessment was undertaken in accordance with the DSS summarised in Section 2. The assessment was undertaken assuming that the new pump station (SPSs A, B, C, D and E) and associated work is constructed at the planning horizons as identified in Section 7.

No surcharge is predicted to with 1m of ground level due to lack of capacity within the gravity network at the current planning horizon. However, at two locations gravity sewers are predicted to have a lack of capacity when conveying PWWF demands resulting in predicted surcharge of less 1m below ground level, thus failing the DSS. These locations are shown Figure 6-1 and Figure 6-2.

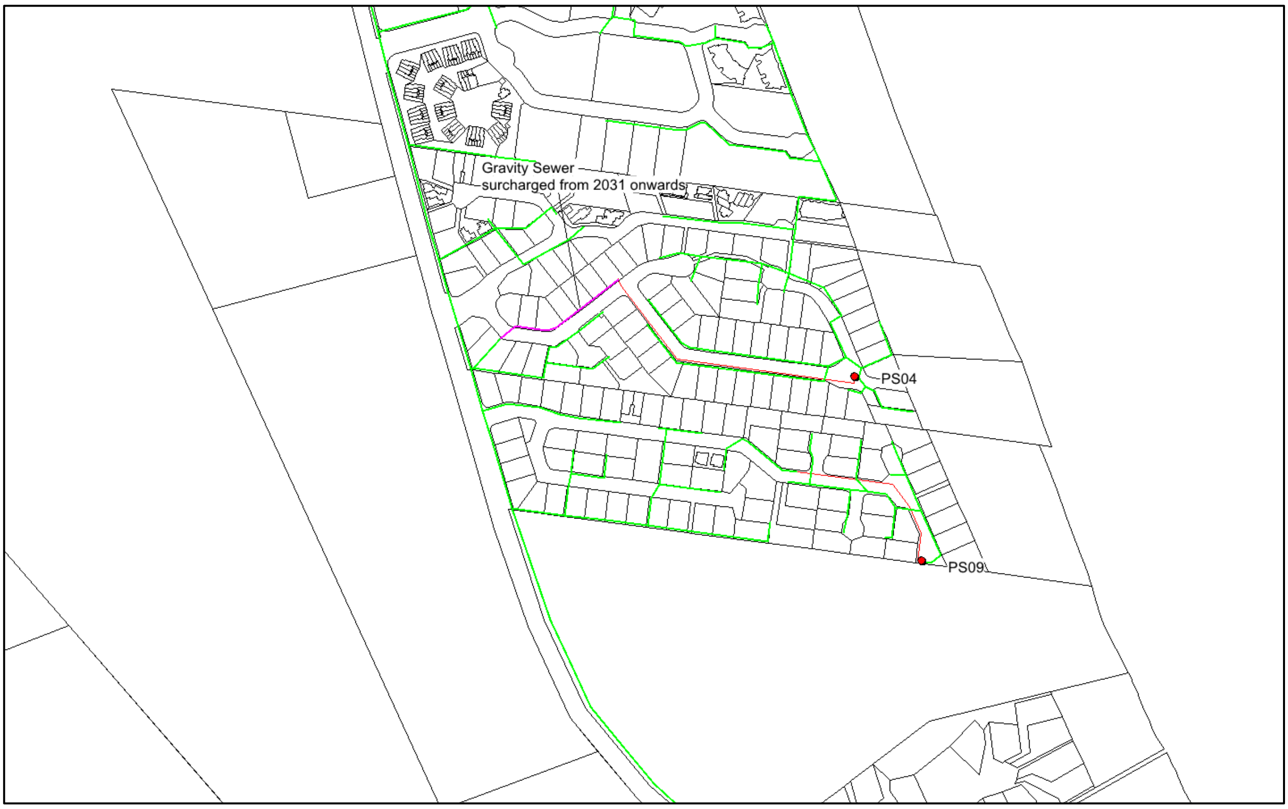


Figure 6-1: Surcharge Downstream of PS04 (2031)

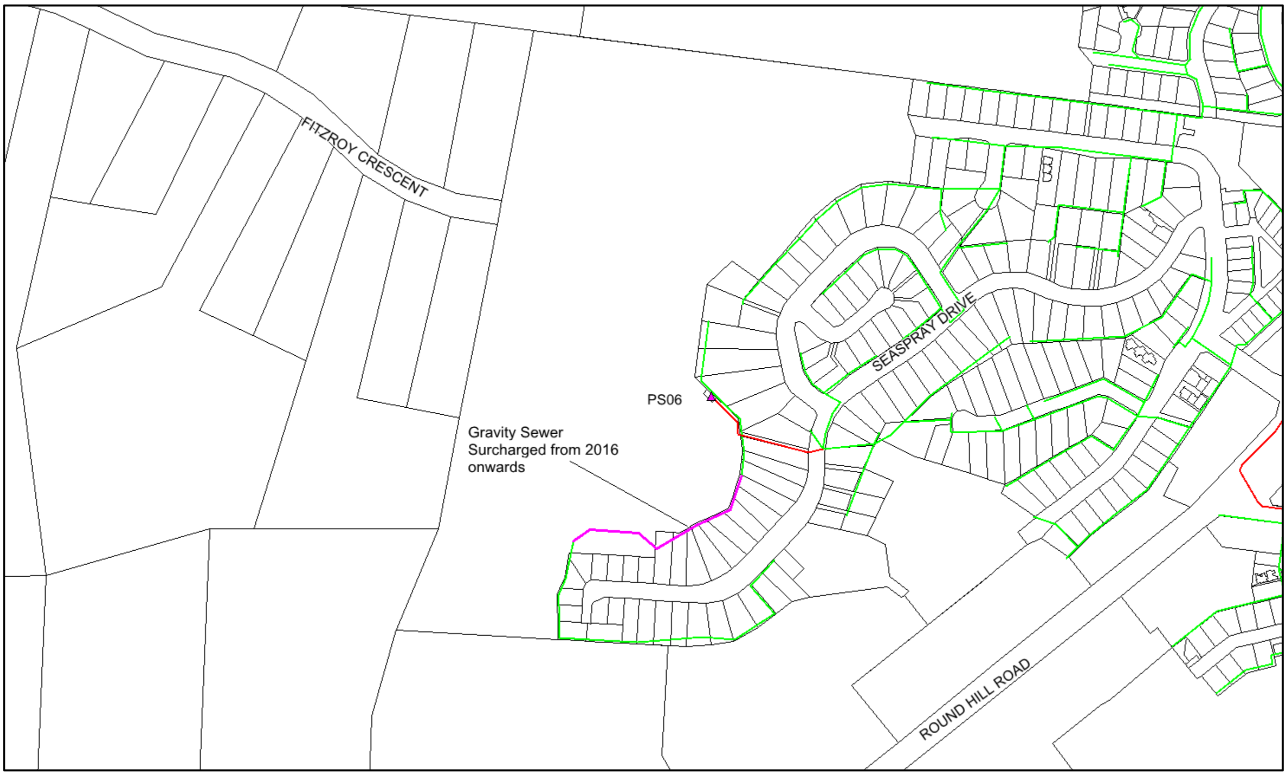


Figure 6-2: Surcharge Upstream of PS06 (2016)

6.1.4 Raising Mains Assessment

No pump station upgrade requirements were identified by this study, therefore future rising main performance has not been assessed and no augmentations or upgrades of existing rising mains are required.

7 Infrastructure Schedules

This section of the report outlines all the upgrade and augmentation requirements in the Agnes Water Sewerage Scheme based on the predicted DSS failures from the current to ultimate planning horizons.

7.1.1 Pump Station Upgrade

Based on GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1-1 the new pump stations shown in Table 7-1 are required. The locations of these pump station are shown in Figures A0, A1 and A2 shown in Appendix A.

Table 7-1: Summary of Sewage Pumping Stations Requirements

Pump Station ID	Upgrade ID	Planning Horizon	ET Trigger	Flow (L/s)	Duty Head (m)	Location
SPS_A	SPS_AW_001	2016	4,623	157	45	Near Jarvey Drive
SPS_B	SPS_AW_002	Ultimate	114	4	9	Bicentennial Drive
SPS_C	SPS_AW_003	Ultimate	333	11	30	Round Hill Road
SPS_D	SPS_AW_004	2016	1,894	64	35	Near Captain Cook Drive
SPS_E	SPS_AW_005	2016	1,801	61	39	Springs Road

7.1.2 Storage Upgrade

No emergency storage upgrades requirements have been identified in this study.

7.1.3 Gravity Sewer Mains Upgrade

Where gravity sewer failures of the DSS are identified, the upgrade requirements are shown in Table 7-2. Details of the upgrades are shown in Appendix B. Locations are shown in Figures A0 to A2 in Appendix A. No option or route assessment was undertaken. All augmentations of existing sewers consist of a duplication of the sewer along the existing route.

Table 7-2: Summary of Gravity Sewer Mains Upgrades

Augmentation ID	Planning Horizon	Length (m)	Diameter (mm)	Location
SGM_AW_001	2016	269	225	Near Seaspray Drive
SGM_AW_002	2031	114	150	Marine Parade
SGM_AW_003	2016	1,198	225	Near Fitzroy Crescent/Captain Cook Drive
SGM_AW_004	2016	386	450	Near Fitzroy Crescent/Captain Cook Drive
SGM_AW_005	2016	280	375	Springs Road
SGM_AW_006	2016	1,804	450	Near Bicentennial Drive/Jarvey Drive/Watermark Avenue
SGM_AW_007	Ultimate	1,674	225	Bicentennial Drive

SGM_AW_003/004/005/006/007 are all required as part of GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1-1.

Augmentation SGM_AW_001 is flagged as being required from the 2016 planning horizon onwards. Failure the gravity sewer is triggered by a large demand from a single lot (Lot Plan 213SP257657) highlighted in Figure 7-1.

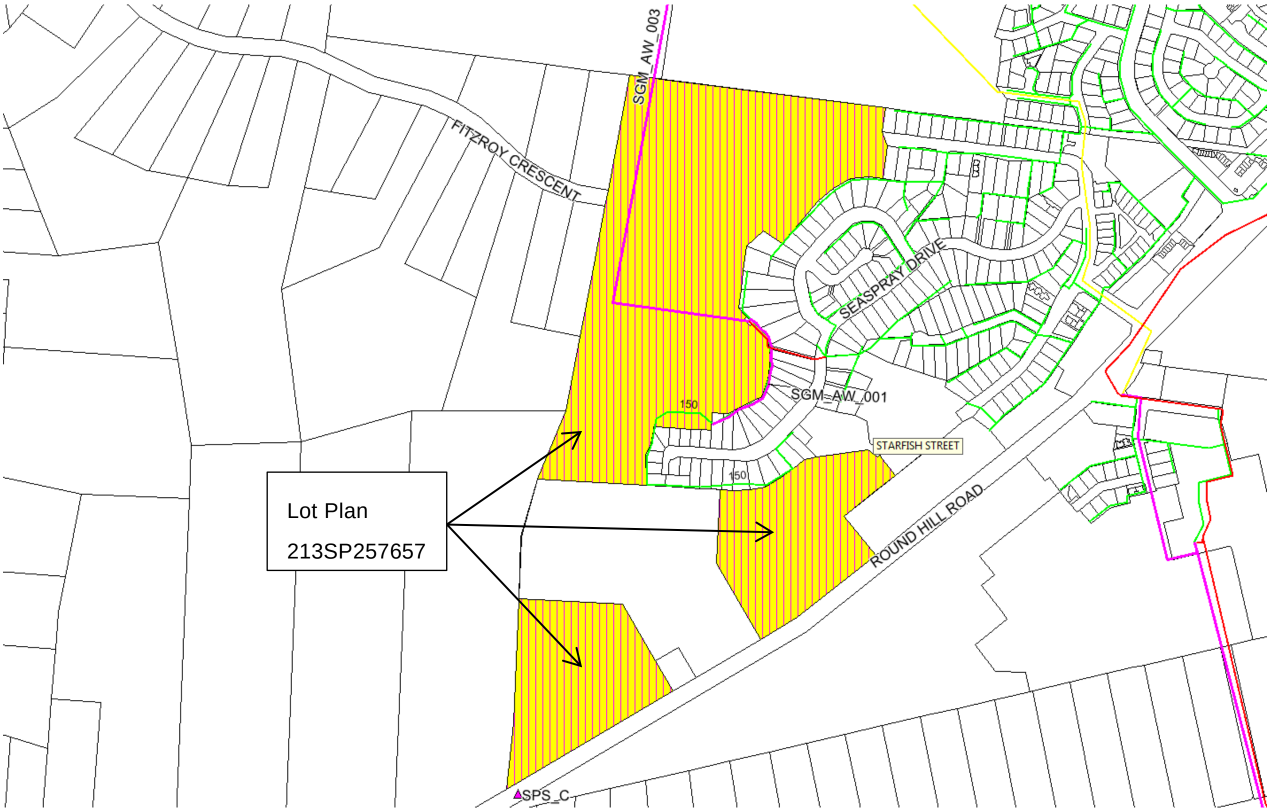


Figure 7-1: Augmentation SGM_AW_001

As this is demand is contained within the demand model as a single demand, it has not been possible to spilt the demand. Conservatively, the demand has been allocated to the 150mm diameter gravity sewer in Seaspray Street. Demands from this lot may, at least partially, be allocated directly to SGM_AW_003 which conveys flow to new SPS D.

It is recommended the demand and allocation for Lot Plan 213SP257657 be reviewed prior to implementing augmentation SGM_AW_001.

7.1.4 Raising Mains Assessment

Based on GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1–1 the new pump stations shown in Table 7-2 are required. The locations of these pump station are shown in Figures A0, A1 and A2 shown in Appendix A. No augmentations to existing rising mains are proposed.

Table 7-3: Summary of Rising Mains Upgrades

Augmentation ID*	SPS ID	Planning Horizon	Length (m)	Diameter (mm)	Location
SRM_AW_001	SPS_D	2016	1,505	250	Near Discovery Drive
SRM_AW_002	SPS_B	Ultimate	342	100	Bicentennial Drive
SRM_AW_003	SPS_A	2016	5,657	375	Anderson Way
SRM_AW_004	SPS_C	Ultimate	1,152	100	Round Hill Road

It should be noted that the redirection of PS02 as identified in the GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1-1 is no longer proposed by this study.

8 Cost Estimation

8.1 Cost Estimation Methodology

Cost estimates for all upgrades and augmentations were developed by this study based on the following assumptions:

- Unit rates were adopted from Harrison Grierson Unit Rates Report 2010. Rates were indexed to 2014 rates (11% increase)
- No geology assessment undertaken for soil factor multipliers. Harrison Grierson Unit Rates Report 2010 recommends the following multipliers based on soil type:

Hard Rock	1.36
Soft Rock	1.1
Clay	1
Sand	0.88

  No geology information was available for use in this study. A multiplier of 1 (clay) was assumed applied to unit rates at all locations.
- No contingency added to rates based on advice within Harrison Grierson Report.
- Cost Estimates for sewage pump station upgrades are developed using unit rates per kW. A pump efficiency of 70% is assumed to calculate the pump station power requirement.

8.2 Summary Cost Estimation Outcomes

The cost for the augmentations and upgrades described in section 7 Infrastructure Schedules are summarised in Table 8–1. Details of the cost of individual items are shown in Appendix C.

Table 8-1: Cost Estimate Summary

	2014	2016	2021	2026	2031	Ultimate
Sewer Gravity Mains	$0	$2,421,965	$0	$0	$37,113	$607,519
Sewer Rising Mains	$0	$4,824,486	$0	$0	$0	$246,430
Sewage Pump Stations	$0	$1,622,820	$0	$0	$0	$248,740
Total	$0	$8,869,272	$0	$0	$37,113	$1,102,689

The cost estimation predicts that most investment is required in new infrastructure associated GRC's proposed future servicing strategy in the Agnes Water Sewerage Scheme shown in Figure 1-1. The cost of implementing this strategy is dominated by the cost of the proposed rising main from SPS A to Agnes Water Treatment Works.

9 Discussion

9.1 Limitations

There are several limitations to the findings as presented in this study due to the data available, assumption made and type of modelling methodology used. These are described as follows:

1. **Demand Allocation** – Demands as contained within the GIS based demand model were distributed throughout the network using the automated routine 'Demand Allocator' within H2OMAP SWMM Software. Large demand allocations were checked manually. However, there may locations where small demands are allocated to the incorrect modelled node on the correct sewer. These will generally be minor in nature and the estimates of catchment loading and loading on trunk sewers. However, it is recommended that the demand allocation be reviewed in the future at locations where DSS failures on reticulation gravity sewers are predicted.

2. **PWWF** – It is common practise to use fixed demands to assess the capacity of a sewer network using 5 x ADWF. However, this does not represent the 'leakiness' of the sewer network during we weather events. Therefore it is important that any assessment of sewer networks using fixed demands be validated against observed data to increase confidence in the modelled results. This can be either SCADA data recorded at pump stations or customer records of overflow events. No data was available to undertake validation as part of this study. Validation is required in order to confirm the required upgrades and augmentations and to prioritise any future capital works.

3. **Pump Curves** – Pumps station PS03, PS05, PS07, PS71 and PS73 within the model were modelled with a 'fixed' discharge. At PS03 no information was available on the pump on/off level. As a result, the discharge has been assumed to be sufficient to convey PWWF at all planning horizon. At PS05, PS07, PS71 and PS73 this study has assumed this discharge as given in the model received from GRC to be correct, although it is unclear how the 'fixed' discharge was established (SCADA Data, pump draw down tests etc.). Using a 'fixed' discharge may be an oversimplification of pump performance in some locations, which could result in under prediction of flows during PWWF (i.e. a high water level in the wet well will generally result in greater pumped flows). This may result in possible surcharge in sewers downstream of the rising main discharge point not being identified.

4. **Solutions** – The solutions developed by this study include pump station upgrades and augmentation of gravity sewers with duplicate parallel sewers. No options analysis or risk assessment of routes has been undertaken. All augmentation of existing gravity sewers consist of duplications of the existing sewers along the same route.

5. **Elevations** – No contour information was available as part of this study. Assumptions have been made based on available levels from existing infrastructure where new infrastructure is proposed.

It is important that the risks associated with the limitations be mitigated prior to the design and implementation of any solutions identified in this study. Section 11 includes recommendations that should be undertaken in order to mitigate the risk associated with these limitations.

10 Conclusions

This study has provided a review of the performance of the Gladstone Sewerage Scheme using H2OMAP SWMM modelling software. A review of the sewer networks performance under PWWF was undertaken for planning horizons from Current (2014) through to Ultimate. A review of available and required emergency storage was also undertaken.

An existing model was received in Infoworks CS and updated based on GIS data. The data received was assumed to be correct although some discrepancies were identified. These have been described in section **Error! Reference source not found.**.

The following conclusions can be made from this study:

Demands

Contributing flows were loaded into the model from the GIS based ET Demand Model. The Demand Model estimates the total ET currently as 1,161 and ultimately as 4,623 within the Gladstone Sewerage Scheme. Hydraulic loads were added at 585 L/ET/Day and the sewer network assessed at PWWF (5 x ADWF).

The demand model adopted for this assessment was based on the best available consumption and land use information for Agnes Water and is considered suitable for the purposes of this high level and strategic study. A number of assumptions were adopted in the development of this demand model and it is recommended that these assumptions be improved before adopting in future project phases (feasibility, design and delivery).

Pump Stations

Assessment of the capacity of existing pump stations identified no upgrade requirements up to the Ultimate planning horizon, if GRC's future strategy is implemented.

Overall, the proposed GRC strategy which includes the construction of SPS A, B, C, D and E and associated work resolves any capacity shortfall within pump stations in the Agnes Water Sewerage Scheme. No upgrades are anticipated.

Gravity Sewer Network

The assessment of the gravity network performance identified no surcharge within 1m of ground level due to lack of capacity within gravity sewer at the current planning horizon. Two locations of future surcharge were identified: one is Seaspray Drive at the 2016 planning horizon and one in Marine Parade at the 2031 planning horizon.

No options analysis was undertaken on solutions to resolve predicted surcharge in the gravity sewer network. Solutions are proposed that involve the augmentation of existing gravity sewer with parallel duplicate sewers.

All other gravity sewer proposed in this study are associated with GRC's future servicing strategy as shown in Figure 1-1.

Emergency Storage

No shortfalls in emergency storage were identified in this study, up to the Ultimate planning horizon.

Rising Main

As part of the methodology of this study, if pump station upgrades or proposed the velocity in the rising main is reviewed. Where velocities exceed recommended levels, augmentations are proposed. However, within the Agnes Water Sewerage Scheme no upgrades of existing pump station are required and therefore no augmentation of existing rising mains required.

All rising mains proposed in this study are associated with GRC's future servicing strategy as shown in Figure 1-1. However, this study reviewed this strategy and concluded that the redirection of PS02 is no longer required.

Cost Estimation

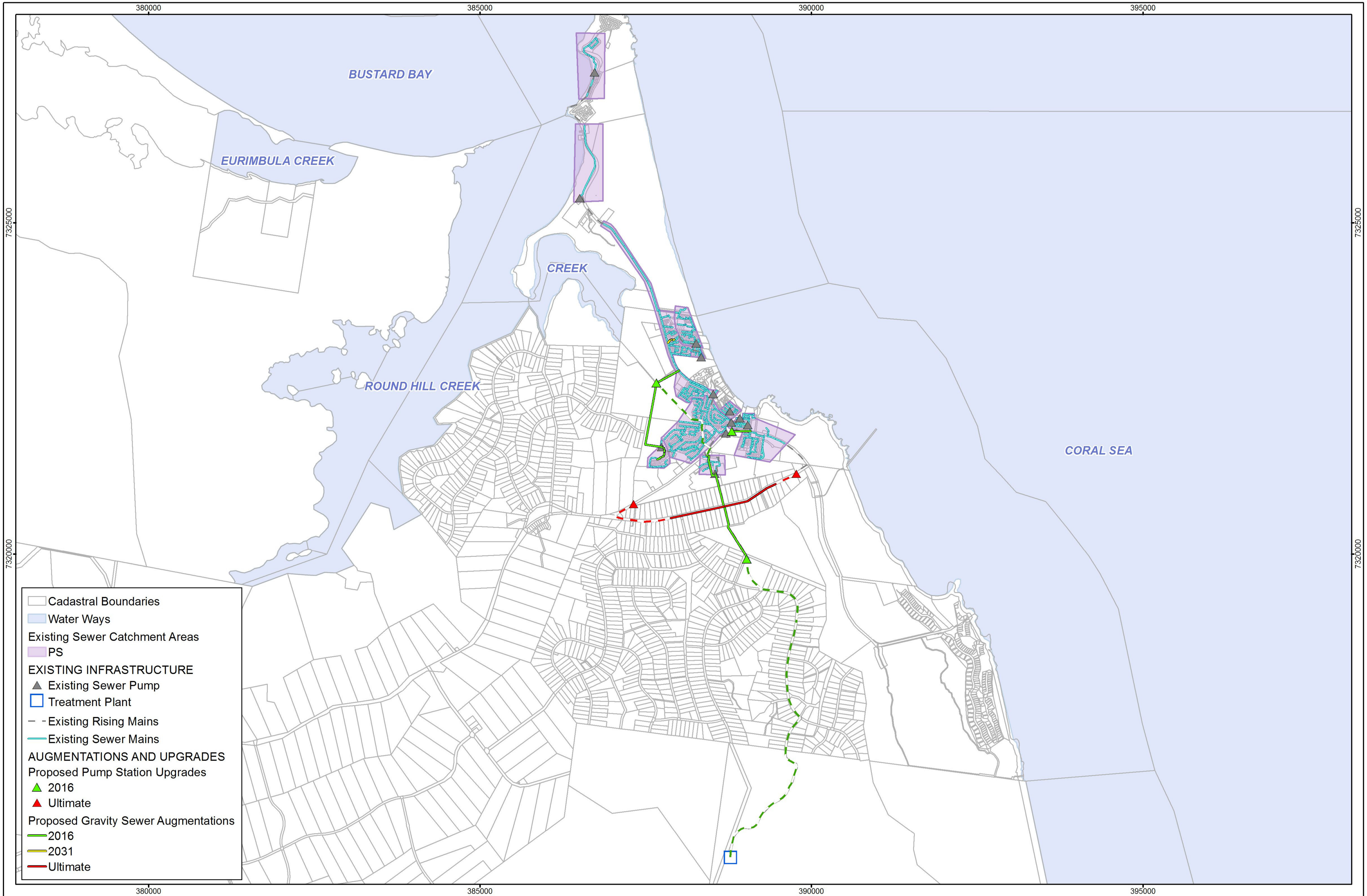
The cost estimation predicts that most investment in assets is required at the 2016 planning horizon.

11 Recommendations

The following recommendations are made as a result of the findings of this study.

1. In order to increase confidence in the modelled predictions undertake the following:
    - Model pump run hours during ADWF should be compared against actual pump run hours based on SCADA data.
    - Records of observed controlled and uncontrolled overflows should be reviewed at locations of predicted DSS failures.
2. Demand allocation should be reviewed at locations where DSS failures on reticulation gravity sewers are predicted prior to implementing any augmentations. In particular this is required at the proposed augmentation in Seaspray Drive (SGM_AW_001).
3. At PS07 no demand is predicted upstream. In addition no pump curves or pump on/off levels were available to review the capacity. Upstream demands should be reviewed and pump curves obtained to check the capacity.
4. At PS03 no pump curves or pump on/off levels were available, therefore the pump discharge has been assumed based on the required PWWF. The pump curve should be obtained and the pump station capacity reviewed.
5. Pumps at PS05, PS71 and PS73 were modelled as fixed discharges. Pump curves should be obtained and the capacity of the pump stations reviewed.
6. No contour levels were available for use as part of this study. Therefore, at some locations of new infrastructure estimates of ground levels have been assumed or interpolated from available levels. Elevations should be confirmed at locations of new infrastructure and requirements of proposed infrastructure reviewed.

Appendix A Proposed Infrastructure Maps



MWH

GLADSTONE REGIONAL COUNCIL

SEWER INFRASTRUCTURE PLAN

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Coordinate System: GDA 1994 MGA Zone 56

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GLADSTONE

Agnes Water - Gravity Sewer Scheme - Augmentation Plan

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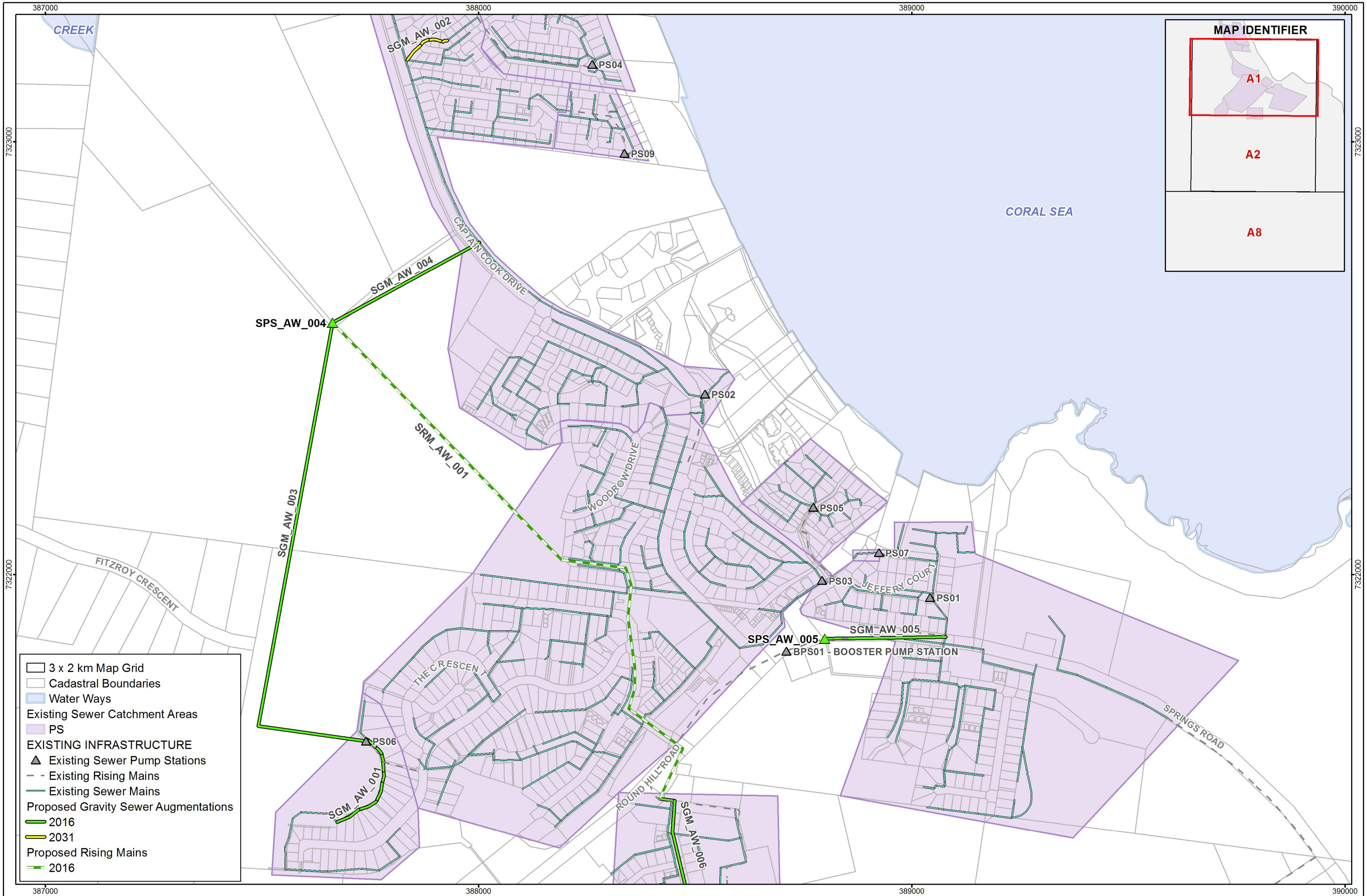
GLADSTONE REGIONAL COUNCIL

A0



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SEWER INFRASTRUCTURE PLAN

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Coordinate System: GDA 1994 MGA Zone 56

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GLADSTONE

Agnes Water - Gravity Sewer Scheme - Augmentation Plan

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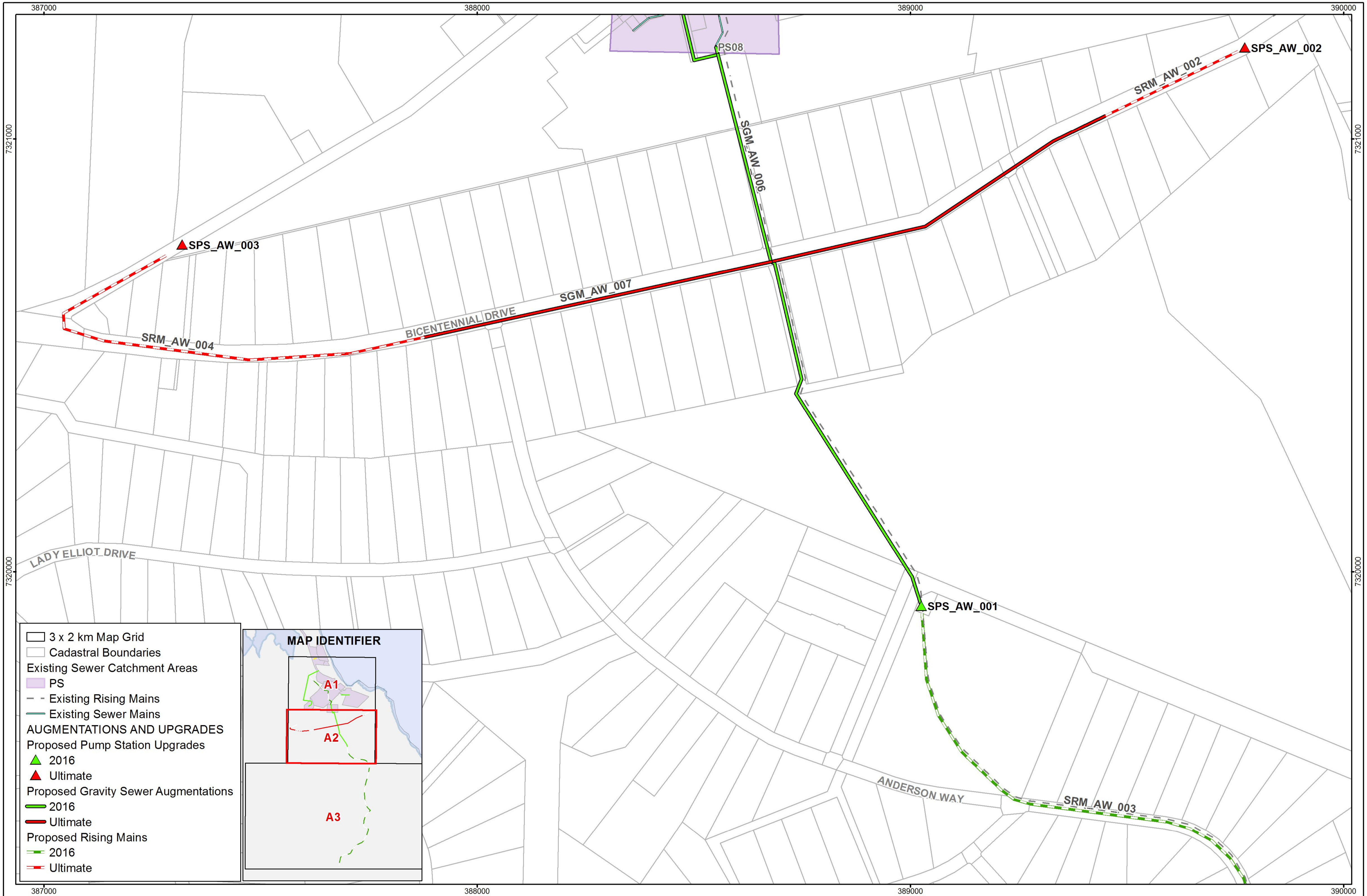
A1



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SEWER INFRASTRUCTURE PLAN

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Map Created: 19/08/2014 thatchc

Coordinate System: GDA 1994 MGA Zone 56

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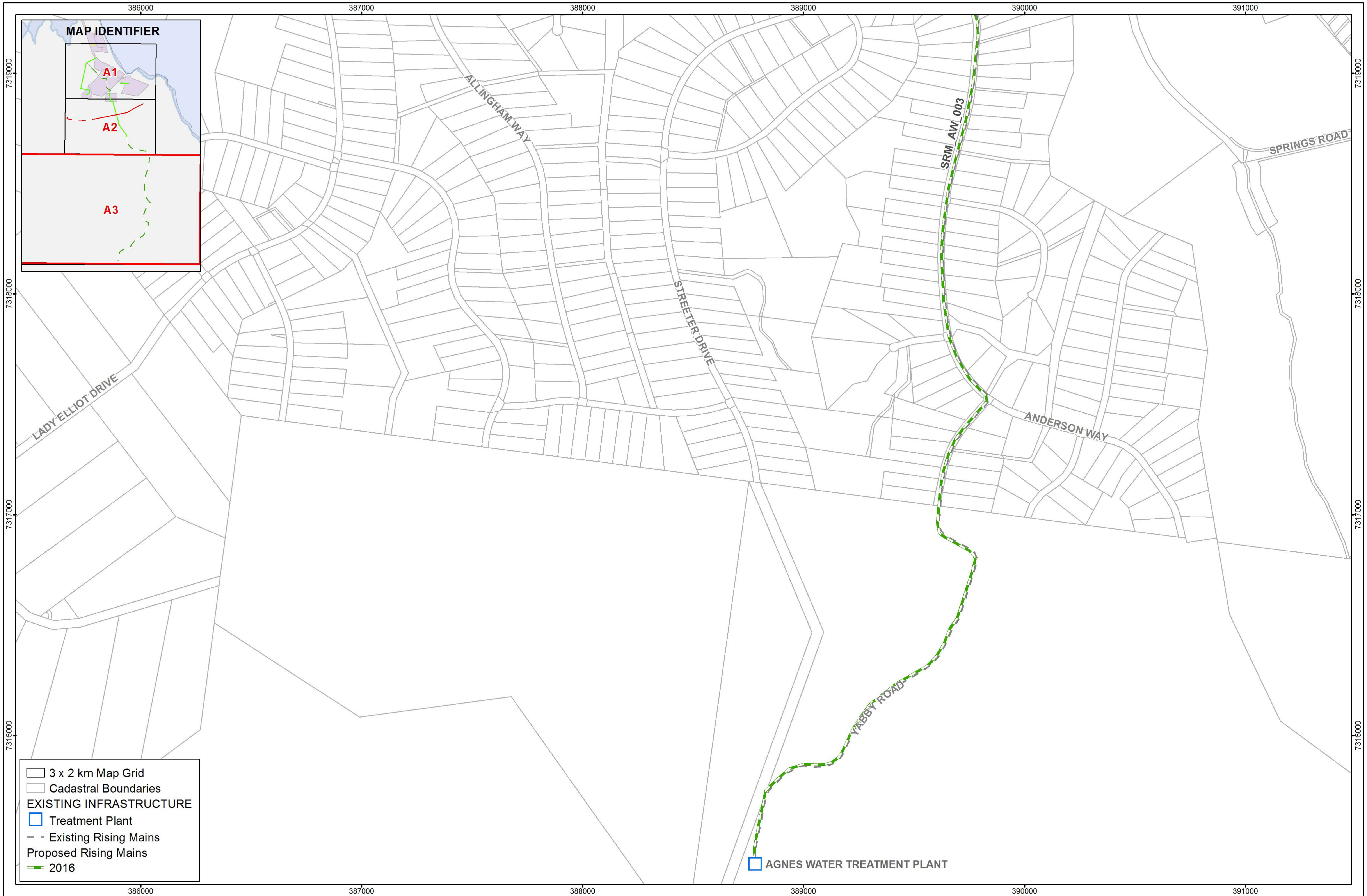
File Name: AGNW_AugmentationPlan_A2

Agnes Water - Gravity Sewer Scheme - Augmentation Plan

A2



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SEWER INFRASTRUCTURE PLAN

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File Name:
AGNW_AugmentationPlan_A3

Agnes Water - Gravity Sewer Scheme - Augmentation Plan

A3

Appendix B Infrastructure Schedules and Cost Estimates

SPS Upgrades

Upgrade ID	Pump Station ID	Planning Horizon	Sewerage Scheme	Sewerage Catchment	Upgrade Type	Duty Flow (L/s)	Duty Head (m)	Power (kW)	Address	Commentary	ET Trigger and Commentary	Item Cost Estimate ($)	Contingency ($)	Cost Estimate including contingency (%)
SPS_AW_001	SPS_A	2016	Agnes Water	Agnes Water	Trunk	157	45	99	Near Jarvey Drive	Proposed future servicing strategy	4623	$ 892,440	$ -	$ 892,440.00
SPS_AW_002	SPS_B	Ultimate	Agnes Water	Agnes Water	Trunk	4	9	0.5	Bicentennial Drive	Proposed future servicing strategy	114	$ 100,000	$ -	$ 100,000.00
SPS_AW_003	SPS_C	Ultimate	Agnes Water	Agnes Water	Trunk	11	30	5	Round Hill Road	Proposed future servicing strategy	333	$ 148,740	$ -	$ 148,740.00
SPS_AW_004	SPS_D	2016	Agnes Water	Agnes Water	Trunk	64	35	31	Near Captain Cook Drive	Proposed future servicing strategy	1894	$ 365,190	$ -	$ 365,190.00
SPS_AW_005	SPS_E	2016	Agnes Water	Agnes Water	Trunk	61	39	33	Springs Road	Proposed future servicing strategy	1801	$ 365,190	$ -	$ 365,190.00

Gravity Sewer Upgrade and Augmenations

Augmentation ID	Pipe ID	Upstream Manhole ID	Downstream Manhole ID	Planning Horizon	Sewerage Scheme	Sewerage Catchment	Upgrade Type	Diameter (mm)	Length (m)	Address	Commentary	Geology	Landuse (Rural/Urban)	Unit Rate ($/m)	Item Cost Estimate ($)	Contingency	Cost Estimate including contingency (%)
SGM_AW_001	a	29755	29828	2016	Agnes Water	Agnes Water	Trunk	225	30	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 10,736	0%	$ 10,736
SGM_AW_001	b	29828	29908	2016	Agnes Water	Agnes Water	Trunk	225	41	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 14,891	0%	$ 14,891
SGM_AW_001	c	29908	29909	2016	Agnes Water	Agnes Water	Trunk	225	21	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 7,649	0%	$ 7,649
SGM_AW_001	d	29909	29961	2016	Agnes Water	Agnes Water	Trunk	225	25	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 8,922	0%	$ 8,922
SGM_AW_001	e	29961	PS06	2016	Agnes Water	Agnes Water	Trunk	225	5	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 1,907	0%	$ 1,907
SGM_AW_001	f	29754	29755	2016	Agnes Water	Agnes Water	Trunk	225	44	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 16,141	0%	$ 16,141
SGM_AW_001	g	29753	29754	2016	Agnes Water	Agnes Water	Trunk	225	46	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 16,563	0%	$ 16,563
SGM_AW_001	h	29752	29753	2016	Agnes Water	Agnes Water	Trunk	225	58	Near Seaspray Drive	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Seaspray Drive	Clay	Greenfield	362.97	$ 20,872	0%	$ 20,872
SGM_AW_002	a	29689	29688	2031	Agnes Water	Agnes Water	Reticulation	150	36	Marine Parade	Augmentation required to resolve under capacity gravity sewer and resolve surcharging in Near Melaleuca Palace & Stoneybrook Drive	Clay	Urban	326.34	$ 11,635	0%	$ 11,635
SGM_AW_002	b	29688	29687	2031	Agnes Water	Agnes Water	Reticulation	150	22	Marine Parade	Augmentation required to resolve flooding and surcharging in Clarance Drive	Clay	Urban	326.34	$ 7,311	0%	$ 7,311
SGM_AW_002	c	29690	29689	2031	Agnes Water	Agnes Water	Reticulation	150	10	Marine Parade	Augmentation required to resolve flooding and surcharging in Marine Parade	Clay	Urban	326.34	$ 3,423	0%	$ 3,423
SGM_AW_002	d	29687	29612	2031	Agnes Water	Agnes Water	Reticulation	150	45	Marine Parade	Augmentation required to resolve flooding and surcharging in Marine Parade	Clay	Urban	326.34	$ 14,744	0%	$ 14,744
SGM_AW_003	a	PS06	SPS D	2016	Agnes Water	Agnes Water	Trunk	225	1198	Near Fitzroy Crescent/Captain Cook Drive	Augmentation required as per Agnes Water's Future Sewerage Strategy in Fitzroy Crescent	Clay	Greenfield	362.97	$ 435,008	0%	$ 435,008
SGM_AW_004	a	29463	SPS D	2016	Agnes Water	Agnes Water	Trunk	450	386	Near Fitzroy Crescent/Captain Cook Drive	Augmentation required as per Agnes Water's Future Sewerage Strategy in Captain Cook Drive	Clay	Greenfield	750.36	$ 289,545	0%	$ 289,545
SGM_AW_005	a	29856	SPS E	2016	Agnes Water	Agnes Water	Trunk	375	280	Springs Road	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Springs Road	Clay	Urban	714.84	$ 199,927	0%	$ 199,927
SGM_AW_006	a	E	New MH	2016	Agnes Water	Agnes Water	Trunk	450	35	Watermark Avenue	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Watermark Avenue	Clay	Urban	858.03	$ 30,420	0%	$ 30,420
SGM_AW_006	b	New MH	New MH	2016	Agnes Water	Agnes Water	Trunk	450	373	Watermark Avenue	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Watermark Avenue	Clay	Urban	858.03	$ 319,702	0%	$ 319,702
SGM_AW_006	c	PS08	New MH	2016	Agnes Water	Agnes Water	Trunk	450	18	Watermark Avenue	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Watermark Avenue	Clay	Urban	858.03	$ 15,396	0%	$ 15,396
SGM_AW_006	d	New MH	New MH	2016	Agnes Water	Agnes Water	Trunk	450	481	Near Bicentennial Drive/Jarvey Drive	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Near Bicentennial Drive/Jarvey Drive	Clay	Greenfield	750.36	$ 361,213	0%	$ 361,213
SGM_AW_006	e	New MH	SPS A	2016	Agnes Water	Agnes Water	Trunk	450	897	Near Bicentennial Drive/Jarvey Drive	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Near Bicentennial Drive/Jarvey Drive	Clay	Greenfield	750.36	$ 673,072	0%	$ 673,072
SGM_AW_007	a	B	New MH	Ultimate	Agnes Water	Agnes Water	Trunk	225	855	Bicentennial Drive	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Watermark Avenue	Clay	Greenfield	362.97	$ 310,416	0%	$ 310,416
SGM_AW_007	b	C	New MH	Ultimate	Agnes Water	Agnes Water	Trunk	225	819	Bicentennial Drive	Augmentation proposed as per Agnes Water's Future Sewerage Strategy in Watermark Avenue	Clay	Greenfield	362.97	$ 297,102	0%	$ 297,102

Rising Main Upgrades

ID	Pipe ID	Planning Horizon	Sewerage Scheme	Sewerage Catchment	Upgrade Type	Diameter (mm)	Length (m)	Address	Commentary	ET Trigger and Commentary	Geology	Landuse (Rural/Urban)	Unit Rate ($/m)	Item Cost Estimate ($)	Contingency	Cost Estimate including contingency (%)
SRM_AW_001	a	2016	Agnes Water	Agnes Water	Trunk	250	1505	Near Discovery Drive	Proposed future servicing strategy	2726	Clay	Greenfield	492	$ 740,217	0%	$ 740,217
SRM_AW_004	a	Ultimate	Agnes Water	Agnes Water	Trunk	100	1152	Round Hill Road	Proposed future servicing strategy	333	Clay	Greenfield	165	$ 190,004	0%	$ 190,004
SRM_AW_002	a	Ultimate	Agnes Water	Agnes Water	Trunk	100	342	Bicentennial Drive	Proposed future servicing strategy	114	Clay	Greenfield	165	$ 56,426	0%	$ 56,426
SRM_AW_003	a	2016	Agnes Water	Agnes Water	Trunk	375	1421	Anderson Way	Proposed future servicing strategy	4623	Clay	Greenfield	722	$ 1,025,843	0%	$ 1,025,843
SRM_AW_003	b	2016	Agnes Water	Agnes Water	Trunk	375	4236	Anderson Way	Proposed future servicing strategy	4623	Clay	Greenfield	722	$ 3,058,426	0%	$ 3,058,426